FASTER GENERALIZED MESSAGE PASSING WITH SKEW-AWARE PARALLELISM AND WORK PARTITIONING

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ABSTRACT

Graph neural networks (GNNs) are built from sparse operations that gather and aggregate features along the edges of a graph, and on GPUs their speed is limited by memory access and parallelism rather than by arithmetic. IO-aware kernels remove most of the data movement, yet still leave much of the GPU idle on real graphs and cover only a few fixed layers. We show that the remaining bottleneck is how work is partitioned: degree distributions are heavy-tailed, so a kernel that gives every node one unit of parallel work waits on its few highest-degree nodes while the rest of the device idles. We, therefore, make GNN kernels degree-aware. First, nodes are bucketed by degree, extending a technique of prior IO-aware kernels, then reordered within each bucket and processed concurrently, so that long jobs start first and short ones fill the idle capacity. Second, the heaviest neighborhoods are cut into fixed-size edge slices that are merged exactly, and per-edge computations are partitioned over edges entirely. Third, data is loaded asynchronously wherever there is computation to overlap it. We bring these techniques to the two generalized message-passing primitives, g-SPMM and g-SDDMM, and provide them as a portable library of 18 and 32 kernels with autograd, from which arbitrary GNN convolutions can be composed in pure PyTorch. Against DGL, a widely used and efficient graph learning library, we achieve $17\times$ speedup for GATv2, $2.1\times$ for g-SDDMM and $1.4\times$ for g-SPMM in the median over thousands of configurations, reaching $23\times$ on `web-fraud` for GATv2 and $3.7\times$ on `amazon-computers` for g-SDDMM. Our implementations are also $16\times$ faster than PyG and can process graphs which cause other libraries run out of memory. Against prior IO-aware kernels, they are $2.1\times$ faster in the median and $12.7\times$ on the most skewed graph.

1 INTRODUCTION

Graph neural networks (GNNs) have become a standard approach to learning from relational data, with applications ranging from weather forecasting (Lam et al., 2023) and physical simulation (Sanchez-Gonzalez et al., 2020; Pfaff et al., 2021) to protein design (Shi et al., 2023) and predictive modeling on relational databases (Fey et al., 2024). Many widely used message-passing GNN layers (Kipf & Welling, 2017; Veličković et al., 2018; Brody et al., 2022; Shi et al., 2021) can be expressed through two sparse primitives: generalized sparse matrix–dense matrix multiplication (g-SPMM), which computes and aggregates messages into destination nodes, and generalized sampled dense–dense matrix multiplication (g-SDDMM), which computes an output for each edge from its source, destination, and/or edge features. The two dominant frameworks expose these primitives at different levels of generality. Deep Graph Library (DGL) (Wang et al., 2019) provides fused implementations for a fixed set of message and aggregation functions, whereas PyTorch Geometric (PyG) (Fey & Lenssen, 2019; Fey et al., 2025) offers a fully programmable interface whose default execution path materializes one message per edge. The trade-off is therefore between a fused but finite set of operators and a general but memory-hungry one (Section 2.3). As graphs grow to hundreds of millions of edges, the memory and runtime costs of these primitives determine the size of a model that can be trained and how quickly it can be trained. These primitives have low arithmetic intensity, so their performance depends primarily on how efficiently data moves through the memory

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hierarchy and how well parallel work is distributed across the GPU, rather than on peak compute throughput (Williams et al., 2009; Zhang et al., 2022).

The same observation has transformed transformer attention, where IO-aware algorithms achieve substantial speedups by avoiding the materialization of large intermediate tensors (Dao et al., 2022; Dao, 2024; Shah et al., 2024; Ivanov et al., 2021). Fomina et al. (2026) brought this principle to GNNs with the TurboGNN kernels. Their fused kernels compute attention scores, normalize them with online softmax (Milakov & Gimelshein, 2018), and aggregate values in a single pass over each neighborhood, never materializing a tensor per edge. For Graph Attention Network v2 (GATv2)(Brody et al., 2022), this reduces peak memory by up to $76\times$ and yields up to an $8.5\times$ speedup over DGL.

However, two limitations remain. First, these kernels still leave much of the GPU's parallel capacity unused. As we show in Section 4.1, profiling these kernels with hardware counters reveals that most of the device sits idle on skewed graphs, and that across the 144 configurations we profile their median memory throughput reaches only 6% of what the GPU can deliver. This source of underutilization arises from the irregular structure of graphs: unlike full dense transformer attention, where each query attends to the same number of keys, each node's workload is proportional to its degree. Real degree distributions are heavy-tailed: in our benchmark suite the most connected node has up to 4.2×10^4 times the average degree. A kernel that gives every node its own unit of parallel work leaves the GPU waiting for its few heaviest nodes. Second, existing fused kernels cover only a small set of predefined layers; layers outside this set, including newly proposed ones, must fall back to the general-purpose operators of DGL or PyG. Those fallbacks carry their own costs: PyG materializes every message before aggregating it, and DGL's kernels, although fused, distribute work without regard to degree skew. DGL's prebuilt packages are also tied to older PyTorch and CUDA versions, which complicates adoption on current software stacks.

Building on this analysis, we develop kernels that partition work according to the degree structure of the graph and make them available to every message-passing layer. Our work contributes and synthesizes three ideas:

1. **Skew-aware scheduling of sparse GNN kernels** (Section 3). We generalize TurboGNN's degree-aware approach beyond fixed attention layers to a broad class of message-passing operations. Nodes are bucketed by degree, each bucket is processed longest-job-first so that the long jobs start while the device is full, and the two buckets run concurrently so that short jobs fill the capacity the long ones leave idle.
2. **Edge-parallel execution and kernel-level optimizations** (Section 3.1). Neighborhoods too large for a single unit of work are divided into fixed-size edge slices whose partial results are recombined without approximation, and g-SDDMM, which produces an independent value per edge, is partitioned over edges outright. We combine this with asynchronous staging of operands and with attention to how data is loaded and held on the device.
3. **A portable library of generalized message-passing kernels** (Section 3.3). We implement the fused operators of `dgl.ops`: every supported message function crossed with sum, max and min aggregation for g-SpMM, and every operator between source-, destination- and edge-side operands for g-SDDMM. All kernels support automatic differentiation along with fp16, bf16, and fp32 data types, and share the same skew-aware scheduling strategy. The library exposes a lightweight PyTorch interface and does not depend on any existing graph framework, allowing a broad range of message-passing layers to benefit from fused, skew-aware execution.

A measured speedup does not say where the time went, so we also build a lightweight simulator that locates the lost capacity from the degree distribution alone, as we show in Section 4.3.

We evaluate our kernels in Section 4 on graphs with 10^4 to 1.3×10^8 edges. For GATv2 they are $2.1\times$ faster than TurboGNN in the median and up to $12.7\times$ on the most skewed graph, $17\times$ faster than DGL and $16\times$ than PyG, and they run on the two largest graphs where both frameworks exhaust an 80 GB A100. Our g-SDDMM is $2.1\times$ faster than DGL in the median across $3{,}156$ configurations and 14–$24\times$ faster than PyG, our g-SpMM up to $2.4\times$ faster than DGL, and the simulator accounts for where the remaining capacity is lost. We will release the kernels as an open-source library with a lightweight DGL-compatible PyTorch interface, making them easy to adopt, study, and extend.

2 BACKGROUND

We describe the relevant performance characteristics of GPUs, the two generalized message-passing primitives, and the principles of IO-aware kernels.

2.1 HARDWARE CHARACTERISTICS

A GPU pairs many compute units with a memory hierarchy whose levels trade capacity for bandwidth (Dao, 2024; Shah et al., 2024): off-chip high bandwidth memory (HBM) of tens of gigabytes visible to the whole device, a transparent L2 cache of tens of megabytes, a small programmer-managed shared memory in each streaming multiprocessor (SM), and registers private to each thread. For instance, the NVIDIA A100-SXM4-80GB used in this work has 80 GB of HBM at about 2 TB/s, a 40 MB L2 cache, and 108 SMs with 164 KB of shared memory each. Computation is issued as *kernels*, functions launched on many threads at once that load their inputs from HBM, compute in registers and shared memory, and write their outputs back (NVIDIA Corporation, 2026a). Threads are grouped into warps of 32 that share instructions, warps into thread blocks that share memory, and blocks are scheduled onto SMs as slots become free. Two consequences matter throughout this paper. A block holds its slot until its slowest warp finishes, so an SM cannot take new work while one long warp is still running; and because the device drains a launch block by block, a few very long blocks keep the remaining SMs idle until they complete. An A100 SM holds at most 32 resident blocks but 64 warps, so a kernel whose blocks each carry a single warp fills only half the warp slots however many blocks it launches. How many warps a block carries is therefore itself a scheduling choice, and we return to it in Section 3.1.

Whether a kernel is limited by compute or by memory depends on its arithmetic intensity, the number of operations it performs per byte it loads (Williams et al., 2009). Dense matrix multiplication performs many operations per byte and is compute-bound; the sparse primitives of GNNs are the opposite extreme, since a sum aggregation adds each gathered element once and its loads follow the graph's edges to data-dependent addresses that limit locality (Zhang et al., 2022). Their speed is therefore set by memory bandwidth and by how well the kernel keeps the SMs busy while loads are outstanding, and the regime is widening: from the A100 to the H100, peak half-precision compute grows about $3\times$ against $1.7\times$ for HBM bandwidth (Dao, 2024; Shah et al., 2024).

2.2 GENERALIZED MESSAGE PASSING

Message passing. Many GNN layers follow the message passing neural network (MPNN) framework (Gilmer et al., 2017). Given node features x_v, edge features e_{uv}, and the incoming neighborhood $\mathcal{N}(v)$, a layer computes

$$m_{uv} = \mathrm{MSG}\big(x_u, x_v, e_{uv}\big), \quad x'_v = \mathrm{UPD}\Big(x_v, \mathrm{AGG}_{u\in\mathcal{N}(v)} m_{uv}\Big), \tag{1}$$

where MSG constructs edge messages, AGG is a permutation-invariant neighborhood reduction, and UPD updates the node state. The irregular computation arises from gathering operands along graph edges and reducing messages over neighborhoods. Dense feature transformations can be handled separately by matrix multiplication libraries.

Sparse primitives. Let $G = (V, E)$ have $N = |V|$ nodes and $M = |E|$ edges, with node and edge features stored in $U \in \mathbb{R}^{N\times d}$ and $W \in \mathbb{R}^{M\times d}$, whose rows are x_v and e_{uv}. g-SPMM combines supported message functions with neighborhood aggregation (Wang et al., 2019),

$$Y_v = \bigoplus_{u\in\mathcal{N}(v)} \phi\big(U_u, W_{uv}\big), \tag{2}$$

where ϕ either copies source-node features (`copy_u`) or edge features (`copy_e`), or combines them elementwise using $\{+, -, \times, \div\}$. The reductions considered here are $\{\texttt{sum}, \texttt{max}, \texttt{min}\}$; DGL (Wang et al., 2019) also provides `mean` through degree-normalized summation. g-SDDMM computes an output for each edge without neighborhood aggregation. Its operands are selected from source-node, destination-node, or edge features, and its operator is elementwise arithmetic or a dot product.

Graph convolution uses sparse weighted sums (Kipf & Welling, 2017), while the pooling variant of GraphSAGE uses max aggregation (Hamilton et al., 2017). Attention layers additionally compute

edge scores, normalize them over each neighborhood, and aggregate values weighted by the resulting coefficients (Brody et al., 2022; Shi et al., 2021). Appendix C defines the primitive variants considered in this work.

2.3 Frameworks and prior work on efficient execution

The two dominant frameworks realize Equation (1) differently. DGL (Wang et al., 2019) exposes a graph-centric interface, `update_all` and `apply_edges`, whose built-in message and aggregation functions map onto fused g-SpMM and g-SDDMM kernels; user-defined functions remain available but fall off that path. PyG (Fey & Lenssen, 2019; Fey et al., 2025) exposes the three functions directly through `MessagePassing`, and its default gather–scatter path builds an edge-indexed tensor of messages before reducing it, which costs $O(Md)$ memory traffic and storage. Neither, however, fuses *across* primitives: in DGL's GATv2, `u_add_v` forms edge vectors that are then activated, projected, softmaxed and aggregated, so an intermediate of $O(Mhd_h)$ values reaches HBM for h heads of width d_h.

A long line of work attacks these costs one operator or one layer at a time. cuSPARSE optimizes SpMM (NVIDIA Corporation, 2026b) but covers neither reductions nor attention; GE-SpMM adds coalesced row caching (Huang et al., 2020), adaptive sparse tiling improves reuse (Hong et al., 2019), and GNNAdvisor selects execution parameters from graph statistics (Wang et al., 2021). Others fuse fixed operator sequences: FusedMM unifies SDDMM and SpMM on CPUs (Rahman et al., 2021), fuseGNN fuses GNN training kernels on GPUs (Chen et al., 2020), Fused3S fuses the three products of sparse attention (Li & Chandramowlishwaran, 2025), and Zhang et al. (2022) reorganize operators and recompute intermediates. DF-GNN adapts fusion and thread scheduling per operation and treats high-degree super-nodes separately (Liu et al., 2025). A third group changes the data layout instead: TC-GNN and cuTeSpMM restructure sparse computation for Tensor Cores (Wang et al., 2023; Xiang et al., 2025), RT-GNN combines Tensor-Core and CUDA-core execution (Yan et al., 2025), MaxK-GNN co-designs a sparsifying nonlinearity with its kernels (Peng et al., 2024), and graph partitioning or reordering permutes node indices for locality (Karypis & Kumar, 1997; Merkel et al., 2024), with benefits that depend on the kernel mapping. These gains are real but narrow: they apply to the operator, layer or layout they were designed for.

The IO-aware line is closest to ours. FlashAttention avoids materializing the attention matrix of the transformer (Vaswani et al., 2017) through tiling and online normalization (Dao et al., 2022; Milakov & Gimelshein, 2018), FlashAttention-2 improves work partitioning (Dao, 2024), and FlashAttention-3 exploits asynchrony and low precision (Shah et al., 2024); the same view helps transformers beyond attention (Ivanov et al., 2021). Fomina et al. (2026) carry it to GNNs in the TurboGNN kernels, fusing GATv2 and Graph Transformer layers, applying degree-aware work partitioning and studying graph reordering. We take that work as our starting point and differ in two ways. We schedule by degree rather than assume uniform work, applying degree ordering and cutting heavy neighborhoods into edge slices so that no block inherits a node's full neighborhood, and we apply this to the generalized primitives themselves rather than to a fixed set of layers, so that any layer expressible with `dgl.ops` benefits from it.

Section 3 describes our execution strategies for the generalized primitives and the fused attention kernels.

3 Methodology

We first describe the scheduling techniques that apply to any sparse message-passing kernel, then the kernel-level optimizations they build on, and finally how both are applied to the generalized primitives and to the fused attention kernels. Full derivations and implementation details are given in Appendices D to G.

3.1 Degree bucketing and bucket launch

A small fraction of nodes takes far longer to process than the rest. We call these *heavy* nodes and the remainder *light*, and split the node set into two *buckets* at a degree quantile q, chosen by the autotuner. Separating the two lets each bucket be given resources that match its work, so that the heavy nodes no longer stall the whole launch. Degree-aware partitioning of this kind was introduced

for reduction-based aggregation kernels and reported as an extension for attention (Fomina et al., 2026); we generalize it to the full generalized message-passing surface and evaluate it across all operators and both passes.

Warps per bucket. Heavy nodes receive more warps per block than light ones. Thread blocks are an abstraction over the SM's physical resources: an A100 SM can host two blocks of 1,024 threads or sixteen of 128, so raising the warp count of the heavy blocks gives each of them more threads, while the light blocks stay small enough to pack densely.

Degree ordering. Within each bucket, thread blocks are issued in node order, so a long-running block may start late and keep the device occupied after every short block has retired. We instead apply *degree ordering*, walking each bucket in descending degree by the classical longest-processing-time-first rule (Graham, 1969): the long blocks start while all SMs are busy and the short ones backfill each SM as it frees. The same rule is used in dense attention when causal masks or variable sequence lengths make worktiles uneven (Zadouri et al., 2026); in graphs the imbalance is not a special case but the normal one, since the work of a node is its degree. This reorders the *processing order of blocks* and leaves the graph untouched, unlike *graph reordering*, which permutes node indices to improve locality and whose benefit for GNN kernels depends on the kernel mapping (Karypis & Kumar, 1997; Merkel et al., 2024; Fomina et al., 2026).

Concurrent launch. The two buckets are launched on separate CUDA streams, the heavy one first so that the longest work starts earliest. Overlapping them reduces wave quantization, which matters most for the light bucket, whose blocks carry nearly identical loads, and means that it is the union of the two buckets rather than either alone that fills the device.

Edge slicing of heavy nodes. More warps help the heavy bucket, but do not remove the tail: a single block still walks the whole neighborhood of the largest node, so the grid is small and its blocks differ in length by the entire degree spread. We therefore cut the edge list of every heavy node into fixed-size *edge slices* and give each slice its own block. A slice never spans two nodes, so a node of degree δ occupies $\lceil \delta / \text{slice} \rceil$ blocks whose partial results remain independently mergeable, and a small merge kernel combines them exactly and deterministically. We derive that merge, and show it is exact for any slice size, in Appendix D. The slice size is tuned per graph. Every block now covers the same number of edges, so the heavy bucket is balanced by construction and the grid grows with the work rather than with the node count.

3.2 Kernel-level optimizations

The remaining improvements are not specific to graphs, but decide how close each kernel runs to its memory limit.

Asynchronous staging. Profiling with Nsight Compute shows that the kernels spend most of their time waiting on loads. We therefore stage operands through shared memory with the asynchronous copy instructions available since compute capability 8.0, prefetching the data for the next iteration while the current one is computed, in a pipeline whose depth is tuned. The benefit is bounded by how much computation an edge performs, and staging is not free: it consumes shared memory and adds synchronization, which lowers block residency. It therefore pays in the attention kernels, whose per-edge work is a multi-step reduction, mostly on graphs whose operands exceed L2, whereas in the primitives an edge performs a single copy or addition and staging is disabled by default. We report the sweep behind that decision in Table 10.

Wide memory access, bank conflicts and register spills. Three further details matter. Global loads are issued as 128-bit transactions only when the compiler can prove the address is 16-byte aligned, so operand rows are laid out and indexed to make that provable. Shared memory is split into 32 banks, and concurrent accesses to different cells of one bank serialize, so the staging buffers avoid writing to the bank currently being read. Finally, a kernel that needs more registers than the file provides spills them to local memory; we keep live values few, replacing convenience variables with lambdas and `constexpr` helpers, which also lets more blocks remain resident. Appendix F gives the details. The split quantile, the warp counts, the slice size, the pipeline depth and the choice

of g-SDDMM mapping are autotuned per configuration (graph, precision and feature width) and cached.

3.3 Generalized primitives and attention kernels

We apply the techniques above to two targets. The first is the fused attention kernels of TurboGNN (Fomina et al., 2026), which we take as given and reschedule; Appendix G describes what changes inside them. The second, and the one that makes these techniques reusable, is the generalized message-passing surface itself: 18 g-SpMM kernels, six message operators crossed with three reducers, and 32 g-SDDMM kernels, every operator crossed with every choice of operand side. All are templated on feature width and precision (fp16, bf16, fp32), carry autograd, share the scheduling above, and depend on no graph framework, so a layer written against `dgl.ops` can use them without inheriting a pinned PyTorch and CUDA version. Appendix C defines the operators.

3.3.1 Primitive-specific kernels

A g-SDDMM operator writes one output row per edge and reduces nothing, so its work is embarrassingly parallel over edges and needs no atomics. We therefore add a kernel whose unit of work is a fixed number of edges rather than a vertex, which makes every block equal whatever the degree distribution. The node-parallel mapping is less balanced, since a block inherits its node's degree, but it loads the destination row once for a whole neighborhood, whereas the edge-parallel kernel re-reads endpoint rows with excess reads that grow with degree. Neither dominates, so we keep both and let the autotuner (Section 3.2) choose per graph, independently for each pass.

For g-SpMM the message function is chosen by the user rather than fixed at compile time, so one kernel family must cover six message operators, three reducers and three precisions, with autograd. Rather than writing the 18 kernels by hand, we describe each operator by a single structure: its value, its two gradients, and three compile-time traits, namely whether it reads node features, whether it reads edge data and whether its gradients need the operands. The compiler can then drop unused loads and allocations. The scheduling of Section 3.1 applies unchanged; the only g-SpMM-specific details are that slices carry the winning edge index for `min`/`max` and that the edge-slicing condition is evaluated separately in each direction. The backward pass avoids atomics and fp32 staging wherever the structure of the computation allows; we describe how in Appendix E.

4 Experiments

We benchmark the attention kernels against DGL, PyG and the fused kernels of TurboGNN, adding one technique at a time, and the generalized primitives against DGL and PyG. We then use a simulator to show where load imbalance costs capacity.

Setup. All measurements are on a single NVIDIA A100-SXM4-80GB in fp16. Baselines are DGL 2.4.0 and PyG 2.8, which require their own PyTorch 2.4 / CUDA 12.1 environment. PyG and DGL are timed together in one process so that their columns share a reference run, and we give those paired timings in Appendix K.1. The attention kernels use the configuration chosen by one cached sweep per graph, the g-SpMM kernels fixed parameters; neither baseline exposes such knobs. Every backend is timed at the same boundary: the aggregation kernel alone, without linear projections, on the same graph with a self-loop per node and the same operands. This boundary is narrower than the full layers timed by Fomina et al. (2026), so speedups over the frameworks are larger here. Graphs come from Planetoid (Yang et al., 2016), OGB (Hu et al., 2020), GraphLand (Bazhenov et al., 2025) and the standard node-classification benchmarks (Shchur et al., 2018; Bojchevski & Günnemann, 2018; Mernyei & Cangea, 2022; Hamilton et al., 2017; Zeng et al., 2020), and range from 10^4 to 1.3×10^8 edges. Appendix A describes every graph and Appendix B the timing protocol of each suite. Our measurements were collected on an Ampere GPU, but the observed imbalance stems from the scheduling strategy rather than the architecture itself. A thread block occupies its slot until its slowest warp completes, while the work assigned to each node scales with its degree. Hopper and subsequent architectures preserve this execution model and support the CUDA streams and asynchronous-copy mechanisms used by our kernels. Because they also provide more SMs, long-running blocks can leave an even larger fraction of the device underutilized. We therefore expect our scheduling results to generalize to these architectures.

Table 1: **GATv2 attention, ablation against DGL and PyG.** Forward pass, $h = 2$ heads of width $d_h = 64$, fp16, A100, aggregation kernels only (no projections). Entries are milliseconds (fastest in bold) with the speedup over DGL beside them. Each column adds one technique to the previous ones, starting from TurboGNN (Fomina et al., 2026). The columns are the techniques of Section 3: *bucketing* (Section 3.1), *ordering* (Section 3.1), *concurrent* (Section 3.1), *edge slicing* (Section 3.1) and *async* (Section 3.2). Graphs are listed alphabetically; OOM marks a baseline that exceeds the 80 GB of GPU Memory. We report every configuration in Table 7.

	baselines		fused attention kernel, one technique added per column					
graph	DGL	PyG	TurboGNN	+ bucketing	+ ordering	+ concurrent	+ edge slicing	+ async
artnet-exp	4.15	5.55 (0.75×)	0.451 (9.20×)	0.429 (9.66×)	0.340 (12.2×)	0.340 (12.2×)	0.340 (12.2×)	**0.338** (12.3×)
avazu-ctr	137	189 (0.73×)	26.5 (5.18×)	9.47 (14.5×)	9.17 (14.9×)	**7.16** (19.2×)	**7.16** (19.2×)	**7.16** (19.2×)
citeseer	1.72	0.678 (2.53×)	0.056 (30.5×)	0.033 (52.6×)	0.031 (56.3×)	0.031 (56.3×)	0.031 (56.3×)	**0.029** (59.6×)
city-reviews	17.3	18.2 (0.95×)	5.00 (3.46×)	1.83 (9.44×)	1.74 (9.92×)	1.30 (13.4×)	1.30 (13.4×)	**1.26** (13.8×)
city-roads-L	3.64	3.36 (1.08×)	0.469 (7.77×)	0.469 (7.77×)	0.450 (8.10×)	0.442 (8.25×)	0.438 (8.32×)	**0.418** (8.71×)
city-roads-M	2.33	1.57 (1.48×)	0.204 (11.4×)	0.204 (11.4×)	0.193 (12.1×)	0.193 (12.1×)	0.191 (12.2×)	**0.178** (13.1×)
cora	1.72	0.671 (2.56×)	0.082 (20.9×)	0.036 (47.7×)	0.035 (49.2×)	0.035 (49.2×)	0.035 (49.2×)	**0.031** (56.2×)
hm-categories	128	176 (0.73×)	16.2 (7.87×)	8.59 (14.9×)	7.92 (16.1×)	**7.42** (17.2×)	**7.42** (17.2×)	**7.42** (17.2×)
ogbn-arxiv	17.1	11.4 (1.49×)	6.86 (2.49×)	1.91 (8.94×)	1.84 (9.27×)	1.43 (11.9×)	0.956 (17.8×)	**0.873** (19.5×)
ogbn-products	OOM	OOM	81.5	78.4	65.5	65.5	65.5	**55.2**
ogbn-proteins	OOM	OOM	32.4	31.3	**30.0**	**30.0**	**30.0**	**30.0**
pokec-regions	184	OOM	20.9 (8.82×)	20.9 (8.82×)	19.9 (9.25×)	19.1 (9.65×)	19.1 (9.65×)	**15.6** (11.8×)
pubmed	1.96	1.04 (1.88×)	0.151 (13.0×)	0.118 (16.7×)	0.102 (19.2×)	0.092 (21.4×)	0.092 (21.4×)	**0.089** (22.0×)
tolokers-2	6.96	9.90 (0.70×)	1.17 (5.94×)	0.547 (12.7×)	0.413 (16.8×)	**0.401** (17.4×)	**0.401** (17.4×)	**0.401** (17.4×)
twitch-views	96.8	105 (0.92×)	20.5 (4.72×)	8.72 (11.1×)	7.59 (12.8×)	5.83 (16.6×)	5.83 (16.6×)	**5.75** (16.8×)
web-fraud	259	127 (2.04×)	143 (1.81×)	32.4 (7.99×)	32.4 (7.99×)	25.5 (10.2×)	11.8 (22.0×)	**11.3** (23.0×)

Table 2: **g-SpMM against DGL and PyG.** $d = 128$, fp16, every graph in the suite; `copy_u_sum` underlies GCN and GraphSAGE, `copy_u_max` GraphSAGE pooling. Entries are milliseconds, with the speedup over DGL in small type; the fastest time in each group is in bold. We report every configuration in Table 8.

	`copy_u_sum`, forward			`copy_u_sum`, backward			`copy_u_max`, forward		
graph	DGL	PyG	ours	DGL	PyG	ours	DGL	PyG	ours
artnet-exp	0.232	1.75 (0.13×)	**0.164** (1.41×)	0.296	2.01 (0.12×)	**0.266** (1.11×)	0.347	2.56 (0.14×)	**0.196** (1.77×)
avazu-ctr	15.3	135 (0.11×)	**7.20** (2.13×)	15.3	78.6 (0.19×)	**7.21** (2.12×)	12.3	91.0 (0.14×)	**5.20** (2.37×)
citeseer	0.087	**0.050** (1.65×)	0.079 (1.11×)	0.261	**0.110** (1.97×)	0.195 (1.34×)	0.135	0.137 (0.92×)	**0.085** (1.59×)
city-reviews	1.97	7.13 (0.28×)	**1.11** (1.77×)	1.97	8.08 (0.24×)	**1.12** (1.76×)	1.98	9.01 (0.22×)	**0.921** (2.15×)
city-roads-L	**0.355**	1.67 (0.21×)	0.398 (0.89×)	**0.357**	1.95 (0.18×)	0.401 (0.89×)	0.593	2.21 (0.27×)	**0.476** (1.25×)
city-roads-M	0.138	0.702 (0.20×)	**0.132** (1.05×)	0.238	0.813 (0.29×)	**0.224** (1.06×)	0.253	0.956 (0.26×)	**0.153** (1.65×)
cora	0.090	**0.050** (1.63×)	0.078 (1.15×)	0.277	**0.118** (1.79×)	0.224 (1.23×)	0.138	0.196 (0.66×)	**0.088** (1.56×)
hm-categories	6.79	67.2 (0.10×)	**4.16** (1.63×)	7.31	79.3 (0.09×)	**4.22** (1.73×)	6.19	80.9 (0.08×)	**3.64** (1.70×)
ogbn-arxiv	3.12	4.16 (0.75×)	**1.78** (1.75×)	0.665	4.71 (0.14×)	**0.490** (1.36×)	2.86	6.19 (0.46×)	**1.39** (2.05×)
ogbn-products	46.4	521 (0.09×)	**30.8** (1.50×)	46.4	548 (0.08×)	**30.9** (1.50×)	52.6	1550 (0.03×)	**31.6** (1.66×)
ogbn-proteins	16.4	383 (0.04×)	**9.59** (1.71×)	16.4	307 (0.05×)	**9.61** (1.71×)	17.3	1587 (0.01×)	**11.4** (1.51×)
pokec-regions	12.6	118 (0.11×)	**8.89** (1.42×)	12.6	128 (0.10×)	**8.77** (1.44×)	16.1	150 (0.11×)	**9.37** (1.72×)
pubmed	0.089	0.369 (0.22×)	**0.087** (1.02×)	0.274	0.423 (0.53×)	**0.249** (1.10×)	0.138	1.05 (0.12×)	**0.096** (1.44×)
tolokers-2	0.392	2.60 (0.15×)	**0.196** (2.00×)	0.397	3.08 (0.13×)	**0.240** (1.65×)	0.451	3.39 (0.13×)	**0.216** (2.08×)
twitch-views	9.78	37.6 (0.26×)	**5.76** (1.70×)	9.83	41.9 (0.23×)	**5.73** (1.72×)	8.80	46.3 (0.19×)	**4.44** (1.98×)
web-fraud	76.9	65.0 (1.19×)	**35.8** (2.15×)	290	**89.7** (3.22×)	150 (1.93×)	60.8	103 (0.59×)	**27.2** (2.24×)

4.1 Where each technique pays

Table 1 reports GATv2 on all 16 graphs, starting from TurboGNN and adding one technique per column. TurboGNN is already $8.3\times$ faster than DGL in the median; our kernels raise this to $17\times$ over DGL and $16\times$ over PyG, a median $2.1\times$ over TurboGNN, and they complete `ogbn-proteins` and `ogbn-products` in 30 and 55 ms where both baselines exhaust the card.

The columns follow the techniques of Section 3 in order: *bucketing* splits nodes into a light and a heavy bucket and gives the heavy one more warps (Section 3.1), *ordering* walks each bucket longest-first (Section 3.1), *concurrent* launches the two buckets on separate streams (Section 3.1), *edge slicing* cuts heavy neighborhoods into fixed-size pieces (Section 3.1), and *async* stages neighbor rows through shared memory (Section 3.2). Each acts where Section 3 predicts it should. Degree bucketing does the most on the most skewed graphs ($4.4\times$ on `web-fraud`); degree ordering and concurrent launch contribute as much as $1.32\times$ and $1.35\times$, on `tolokers-2` and `city-reviews`

Table 3: **g-SDDMM against DGL and PyG.** $d = 128$, fp16, forward, every graph. Entries are milliseconds, with the speedup over DGL in small type and the fastest time in bold; *node-par.* walks each destination's neighbourhood, *edge-par.* is the edge-parallel kernel of Section 3.3.1. We report every configuration in Table 9.

	u_dot_v (dot-product attention logits)				u_add_v (GATv2 logits)			
graph	DGL	PyG	node-par.	edge-par.	DGL	PyG	node-par.	edge-par.
amazon-computers	0.146	1.90 (0.08×)	0.120 (1.21×)	**0.080** (1.82×)	0.379	1.72 (0.22×)	0.162 (2.35×)	**0.104** (3.66×)
amazon-photo	0.075	0.931 (0.08×)	0.068 (1.11×)	**0.045** (1.65×)	0.197	0.841 (0.24×)	0.084 (2.34×)	**0.054** (3.65×)
artnet-exp	0.228	2.49 (0.09×)	0.162 (1.41×)	**0.106** (2.16×)	0.516	2.25 (0.23×)	0.193 (2.68×)	**0.157** (3.28×)
artnet-views	0.228	2.49 (0.09×)	0.163 (1.40×)	**0.107** (2.14×)	0.515	2.26 (0.23×)	0.201 (2.56×)	**0.158** (3.26×)
avazu-ctr	6.75	114 (0.06×)	3.15 (2.14×)	**3.11** (2.17×)	14.7	99.3 (0.15×)	4.79 (3.06×)	**4.31** (3.41×)
citeseer	0.064	0.068 (0.95×)	**0.045** (1.42×)	0.046 (1.38×)	0.061	**0.058** (1.07×)	0.062 (0.99×)	0.064 (0.96×)
city-reviews	0.941	10.1 (0.09×)	0.692 (1.36×)	**0.422** (2.23×)	1.95	9.08 (0.22×)	0.792 (2.46×)	**0.676** (2.89×)
city-roads-L	0.240	2.23 (0.10×)	0.308 (0.78×)	**0.092** (2.60×)	0.479	2.04 (0.24×)	0.345 (1.39×)	**0.163** (2.93×)
city-roads-M	0.102	0.968 (0.11×)	0.155 (0.66×)	**0.046** (2.21×)	0.221	0.884 (0.25×)	0.175 (1.27×)	**0.069** (3.19×)
coauthor-cs	0.065	0.753 (0.09×)	**0.046** (1.41×)	0.053 (1.22×)	0.168	0.684 (0.25×)	0.064 (2.60×)	**0.047** (3.57×)
coauthor-physics	0.187	2.12 (0.09×)	0.115 (1.63×)	**0.089** (2.11×)	0.443	1.92 (0.23×)	0.149 (2.98×)	**0.131** (3.38×)
cora	0.064	0.069 (1.10×)	**0.045** (1.42×)	0.046 (1.41×)	0.063	0.058 (1.10×)	**0.043** (1.47×)	0.043 (1.45×)
CoraFull	0.066	0.675 (0.10×)	0.046 (1.42×)	**0.045** (1.48×)	0.144	0.611 (0.26×)	0.066 (2.20×)	**0.047** (3.07×)
Flickr	0.402	4.12 (0.09×)	0.380 (1.06×)	**0.174** (2.32×)	0.843	3.75 (0.23×)	0.384 (2.20×)	**0.294** (2.87×)
hm-categories	6.58	110 (0.06×)	**2.74** (2.41×)	3.05 (2.15×)	13.9	95.8 (0.15×)	4.60 (3.02×)	**4.18** (3.32×)
hm-prices	6.58	110 (0.06×)	**2.73** (2.41×)	3.06 (2.15×)	13.9	96.2 (0.15×)	4.59 (3.03×)	**4.18** (3.32×)
ogbn-arxiv	0.564	5.73 (0.10×)	0.722 (0.78×)	**0.249** (2.27×)	1.16	5.22 (0.22×)	0.693 (1.67×)	**0.455** (2.55×)
ogbn-products	51.9	OOM	25.6 (2.03×)	**25.1** (2.07×)	96.3	OOM	**41.1** (2.34×)	43.7 (2.20×)
pokec-regions	13.4	184 (0.07×)	7.49 (1.79×)	**6.19** (2.17×)	25.3	162 (0.16×)	**10.8** (2.34×)	10.9 (2.32×)
pubmed	0.063	0.527 (0.12×)	0.045 (1.41×)	**0.044** (1.42×)	0.118	0.475 (0.27×)	0.060 (1.97×)	**0.044** (2.65×)
reddit	40.6	OOM	**16.6** (2.44×)	18.7 (2.17×)	82.4	OOM	**31.5** (2.62×)	32.9 (2.50×)
tolokers-2	0.331	3.78 (0.08×)	0.189 (1.75×)	**0.156** (2.13×)	0.718	3.41 (0.21×)	0.278 (2.58×)	**0.206** (3.48×)
twitch-views	4.83	56.7 (0.08×)	2.77 (1.74×)	**2.19** (2.21×)	9.84	47.5 (0.21×)	3.89 (2.53×)	**3.62** (2.72×)
web-topics	7.32	99.4 (0.07×)	12.6 (0.58×)	**2.89** (2.53×)	14.3	87.5 (0.16×)	10.7 (1.34×)	**5.02** (2.86×)
WikiCS	0.127	1.66 (0.08×)	0.115 (1.10×)	**0.070** (1.81×)	0.334	1.50 (0.22×)	0.151 (2.21×)	**0.091** (3.67×)

respectively; edge slicing, which removes the *critical path*, doubles the speed on web-fraud and adds 1.5× on ogbn-arxiv; and asynchronous staging pays on the graphs too large for L2. Near-regular road networks have little imbalance to remove: the autotuner leaves the heavy bucket empty there ($q = 1$), and the gain over TurboGNN is 12–15%.

Hardware counters confirm the mechanism. In the forward pass the share of warps active rises from 23% to 48% on ogbn-arxiv and to 47% on web-fraud, and bandwidth from 4% to 15% and from 1% to 8% of peak. Across the suite TurboGNN reaches a median of 6% of peak DRAM throughput and our kernels 15%, still under half on even the densest graph, so the remaining headroom is in partitioning rather than in further reducing data movement.

4.2 Generalized primitives outpace the frameworks

g-SpMM. Table 2 reports the two reductions behind graph convolution and GraphSAGE on every graph at $d = 128$. Our kernels are faster than DGL on all graphs for copy_u_max and on 15 of 16 for copy_u_sum, by up to 2.4×, with median speedups of 1.6× forward and 1.5× backward for the sum. PyG, which materializes every message before scattering it, is 5× slower than DGL in the median, so our kernels are 6.5 to 11× faster than PyG.

g-SDDMM. Table 3 reports the logits of dot-product attention and of GATv2. The edge-parallel kernel is the faster of our two mappings on 19 and 20 of the 25 graphs, and is 2.2× faster than DGL in the median for u_dot_v and 3.1× for u_add_v. It is 14 to 24× faster than PyG, which gathers both endpoint rows of every edge and runs out of memory on the two largest graphs. Across all 32 operators, four widths and 25 graphs, it is 2.1× faster than DGL in the median and faster in 3,121 of 3,156 configurations; the exceptions are sub-millisecond calls on graphs below 3M edges, mostly the copy operators, where a kernel launch costs as much as the work. We report every configuration in Table 9.

4.3 Where load imbalance costs capacity

A measured speedup says how much was saved, not where the time was lost, so we model the launch itself. Each node, or each edge slice of a heavy node, becomes a block; each SM holds a fixed number of resident blocks; and one cycle advances every resident block by one edge. A block covering the vertices V_j is charged $c_j = \sum_{v \in V_j} (\alpha + \beta \delta_v)$ cycles, where δ_v is the number

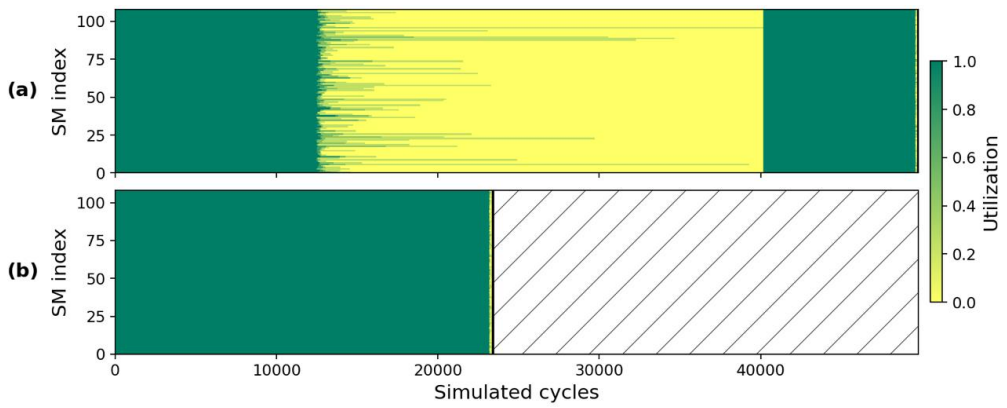

Figure 1: **Simulated scheduling on `twitch-views`.** Graph Transformer forward ($d = 256$, $q = 0.95$). (a) Top: degree bucketing with sequential launch, as in the implementation of TurboGNN. (b) Bottom: degree bucketing with concurrent launch and edge slicing, as in ours. Color denotes occupied block slots per SM; hatching marks time after completion.

of neighbors processed for v, β is the cost of one edge, and α is the work done once per block: the launch, the load of the destination row and the write of the result. We fit α and β to 168 measured kernel runtimes by non-negative least squares, so the costs come from the hardware. The model omits caches, warp divergence and the real dispatch order, and keeps only what degree skew controls, how unequal the blocks are.

Running it yields the makespan, the mean fraction of occupied block slots and the *drain tail*, the interval after 95% of the work has retired. It also identifies which resource binds, and only a *critical-path* bound can be removed by decomposing the work differently, which is what edge slicing does.

On `twitch-views`, the baseline schedule leaves a few long blocks holding their slots while the light bucket waits. Edge slicing shortens those blocks and concurrent launch fills the slots they release, which is what removes the low-utilization region in Figure 1: predicted slot utilization rises from 46.6% to 99.2% and the predicted runtime falls from 9.60 to 4.53 ms ($2.12\times$). Run over representative graphs[1], the same calculation says from the degree distribution alone which graphs have capacity to recover, and the hardware agrees: the two orderings have Spearman $\rho = 0.95$, with a Pearson correlation of 0.97 between log speedups. The simulator predicts little gain on the near-regular road graphs, where hardware gains are also small. Predicted speedups exceed measured ones by a median factor of 1.43; Table 5 specifies the simulated and hardware configurations used in this comparison. Appendix H gives the mechanics and Appendix K.6 the full

5 Discussion

Once IO-aware kernels remove edge-wise intermediates, what limits GNN layers is not data movement but how work is partitioned: on heavy-tailed degrees a few nodes hold their thread blocks while the rest of the device idles, leaving TurboGNN at a median of 6% of peak HBM bandwidth. We therefore made them degree-aware. Nodes are bucketed by degree, ordered longest-first and launched concurrently; heavy neighborhoods are cut into edge slices that merge exactly, and g-SDDMM is partitioned over edges outright. Both apply to the whole message-passing surface, 18 g-SpMM and 32 g-SDDMM kernels with autograd, a portable replacement for `dgl.ops`. On GATv2 this is a median $2.1\times$ over TurboGNN, $12.7\times$ on the most skewed graph and $17\times$ over DGL, on graphs where both frameworks exhaust an 80 GB card; our g-SDDMM is $2.1\times$ faster than DGL in the median over $3{,}156$ configurations.

A scheduling-only simulator says from the degree distribution alone which graphs have capacity to recover, of which our kernels realise a median 61%; running it at graph-load time would let a layer choose its partitioning without a sweep. Tuning the g-SpMM kernels per graph and fusing the `max` and `min` backward pass would close the two gaps we know of; hardware for asynchronous data movement (Shah et al., 2024) would shift the staging trade-off of Section 3.2, not the scheduling.

[1] `cora`, `citeseer` and `pubmed` are excluded as too small; see Table 5 for the full explanation.

USE OF LARGE LANGUAGE MODELS

LLM was used for text refinement. The authors take full responsibility for the content, including all claims and citations.

ETHICS STATEMENT

This work concerns the performance of numerical operations of GNNs. All graphs used are standard, publicly released benchmarks. The intended effect of the work is to reduce the GPU time and memory needed to train a given GNN, which reduces the energy cost of these workloads. We are not aware of a harmful application specific to this contribution beyond those already associated with GNNs generally.

REPRODUCIBILITY STATEMENT

Every table and figure is generated by a script from a measurement artifact, and the scripts are available at `https://anonymous.4open.science/r/skew-aware-parallelism`. Appendix B provides the hardware, library versions, measurement boundary, and timing protocol of each benchmark suite, and Appendix A describes the graphs metadata. The complete per-configuration results behind every table are disclosed in Appendix K.

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A DATASET CHARACTERISTICS

The graphs are drawn from the Planetoid citation networks (Yang et al., 2016), the Open Graph Benchmark (Hu et al., 2020), and GraphLand (Bazhenov et al., 2025), which contributes the industrial graphs with the most extreme degree skew. The remainder are standard node-classification benchmarks: the Amazon co-purchase and Coauthor graphs of Shchur et al. (2018), `CoraFull` (Bojchevski & Günnemann, 2018), `WikiCS` (Mernyei & Cangea, 2022), `reddit` (Hamilton et al., 2017) and `Flickr` (Zeng et al., 2020). Edge counts in Table 4 are as stored; every benchmark adds one self-loop per node. Three pairs of graphs share a topology and differ only in features or labels (for example `hm-categories` and `hm-prices`), so their near-identical timings are a consistency check.

Table 4: Complete metadata for all 27 graphs, computed by loading each graph and measuring it directly. *skew* is max in-degree over average degree; *top-1%* is the share of edges incident to the 1% highest in-degree nodes. E is as stored; $E{+}N$ is what the g-SPMM harness sees, which adds one self-loop per node.

graph	N	E	$E{+}N$	avg	med	p95	p99	max	skew	top-1%	self-loops	isolated
`amazon-computers`	13,752	505,474	519,226	36.76	23	102	245	2,993	81×	13.7%	13,752	0
`amazon-photo`	7,650	245,812	253,462	32.13	23	88	199	1,435	45×	10.9%	7,650	0
`artnet-exp`	50,405	611,101	661,506	12.12	3	59	136	199	16×	13.7%	50,405	0
`artnet-views`	50,405	611,101	661,506	12.12	3	59	136	199	16×	13.7%	50,405	0
`avazu-ctr`	76,269	22,044,423	22,120,692	289.04	72	1199	3915	42,032	145×	23.4%	76,269	0
`citeseer`	3,327	12,431	15,758	3.74	3	9	16	100	27×	6.5%	3,327	0
`city-reviews`	148,801	2,479,631	2,628,432	16.66	5	67	197	7,438	446×	19.8%	148,801	0
`city-roads-L`	142,257	421,318	563,575	2.96	3	4	5	10	3×	1.7%	142,257	0
`city-roads-M`	57,073	189,643	246,716	3.32	3	5	5	7	2×	1.5%	57,073	0
`coauthor-cs`	18,333	182,121	200,454	9.93	7	27	48	137	14×	6.3%	18,333	0
`coauthor-physics`	34,493	530,417	564,910	15.38	11	42	78	383	25×	7.1%	34,493	0
`cora`	2,708	13,264	15,972	4.90	4	10	20	169	35×	8.0%	2,708	0
`CoraFull`	19,793	146,635	166,428	7.41	5	20	40	298	40×	8.7%	19,793	0
`Flickr`	89,250	989,006	1,078,256	11.08	7	24	68	5,426	490×	16.3%	89,250	0
`hm-categories`	46,563	21,508,553	21,555,116	461.92	46	2329	6316	31,459	68×	22.0%	46,563	0
`hm-prices`	46,563	21,508,553	21,555,116	461.92	46	2329	6316	31,459	68×	22.0%	46,563	0
`ogbn-arxiv`	169,343	1,335,586	1,504,929	7.89	2	23	88	13,156	1668×	35.0%	169,343	0

. . . continued

graph	N	E	$E+N$	avg	med	p95	p99	max	skew	top-1%	self-loops	isolated
ogbn-products	2,449,029	126,167,309	128,616,338	51.52	27	164	379	17,482	339×	13.1%	2,449,285	0
ogbn-proteins	132,534	79,255,038	79,387,572	598.00	403	1936	2838	7,751	13×	5.7%	132,534	0
pokec-regions	1,632,803	32,255,367	33,888,170	19.75	9	74	134	13,734	695×	9.3%	1,632,803	0
pubmed	19,717	108,365	128,082	5.50	3	19	36	172	31×	9.3%	19,717	0
reddit	232,965	114,848,857	115,081,822	492.99	231	1775	3806	21,658	44×	11.5%	232,965	0
tolokers-2	11,758	1,049,758	1,061,516	89.28	31	383	827	2,139	24×	12.5%	11,758	0
twitch-views	168,114	13,763,228	13,931,342	81.87	33	265	742	35,280	431×	23.2%	168,114	0
web-fraud	2,890,331	15,785,700	18,676,031	5.46	2	13	45	228,991	41928×	34.1%	2,890,331	0
web-topics	2,890,331	15,785,700	18,676,031	5.46	2	13	45	228,991	41928×	34.1%	2,890,331	0
WikiCS	11,701	443,427	455,128	37.90	13	139	258	3,325	88×	11.6%	12,221	0

B MEASUREMENT PROTOCOL AND REPRODUCIBILITY

Hardware and software. All measurements are on one NVIDIA A100-SXM4-80GB (108 SMs, 2039 GB/s HBM2e, 40 MB L2). The machine is shared, and every run was launched on a GPU verified idle at launch. DGL 2.4.0+cu121 and PyG 2.8 run with PyTorch 2.4.0+cu121 on Python 3.11, the newest combination for which DGL publishes wheels; our kernels are built against that same PyTorch for these comparisons, and against the current toolkit (NVIDIA Corporation, 2026a) and PyTorch (Paszke et al., 2019) otherwise.

Measurement boundary. Every backend is timed at the aggregation kernel alone: for GATv2, the attention scores, their normalization and the value aggregation, with the linear projections replaced by the identity in DGL and PyG and absent from ours. Graphs carry one self-loop per node in every backend, and operands are materialized in the target precision.

Timing protocols. *Attention* (Table 1): 3 independent repeats of a 160-configuration sweep per graph, the median of the repeats taken per configuration; baselines timed by `triton.testing.do_bench` with a 20 ms warmup and 100 ms timed budget. *g-SpMM* (Table 2): 10 warmup calls, then 30 calls × 3 repeats, median of the repeat means; the backward pass is replayed with a retained graph so only backward kernels are timed. *g-SDDMM* (Table 3): every backend called directly on the same edge list, 5 warmup and 20 timed calls between CUDA events; DGL runs in its own environment and our kernels in theirs, with identical operands. *PyG columns of Tables 2 and 3*: PyG and DGL are timed in one process with the protocol of that table, and PyG's speedup is taken against that DGL run. Its DGL times agree with the DGL column of the table within 1% for SpMM forward and 0.3% in the median for SDDMM; we reproduce those paired timings in Appendix K.1. An earlier SDDMM sweep that timed every backend through a benchmarking wrapper added a per-call floor of about 0.15 ms, which inflated speedups on small graphs; no number in this paper comes from it.

Out-of-memory entries. Every OOM in the tables is a CUDA out-of-memory error recorded in the baseline's log on the 80 GB card; for GATv2 on `ogbn-products`, DGL attempts a single 60 GB allocation.

Tuning. In the attention kernels, the degree quantile of the light/heavy split and the enabled techniques are chosen per graph by minimum time over the sweep, as the kernels' autotuner does. g-SpMM kernels run at fixed launch parameters (8 warps per block, split at the 0.95 degree quantile), and the ablation of Table 1 pins the slice size to 1024 edges rather than tuning it per graph.

Hardware counters. The bandwidth and occupancy numbers we report in Section 4.1 are measured as `dram__bytes.sum` over `gpu__time_duration.sum` and `sm__warps_active` from Nsight Compute, over all launches of a configuration. Under profiling, kernels are serialized, so for concurrent launches this is per-kernel intensity rather than the combined rate of both streams.

Code. The kernels, the benchmark harnesses and the scripts that produce every table and figure in this paper are available at `https://anonymous.4open.science/r/skew-aware-parallelism`.

Generation. Every table and figure is emitted by `scripts/make_tables.py`, `make_figures.py` and `make_appendix.py` from the measurement artifacts, and the PyG arm by `bench/pyg_vs_dgl.py`.

C Operators in the generalized primitive surface

g-SpMM. For every node v, $Y_v = \bigoplus_{u \in \mathcal{N}(v)} \phi(U_u, W_{uv})$ with $\bigoplus \in \{\texttt{sum}, \texttt{max}, \texttt{min}\}$ and the message operators below, giving $6 \times 3 = 18$ kernels named `<message>_<aggregation>`, e.g. `u_mul_e_sum`. For `max` and `min` the kernels record the argmax position of every output element, which the backward pass scatters its gradient to.

message operator	$\phi(U_u, W_{uv})$
`copy_u`	U_u
`copy_e`	W_{uv}
`u_add_e`, `u_sub_e`, `u_mul_e`, `u_div_e`	$U_u \circ W_{uv}$, $\quad \circ \in \{+, -, \times, \div\}$ elementwise

g-SDDMM. For every edge (u, v), $S_{uv} = \psi(X, Y)$, where each operand is one of the source features U_u (`u`), the destination features U_v (`v`) or the edge features W_{uv} (`e`). The kernels are named `<lhs>_<op>_<rhs>`, giving $3 \times 2 \times 5 = 30$ binary kernels, plus `copy_u` and `copy_v`, which write the source or destination features onto every edge, for 32 in total. Copying edge features onto edges is a plain memory copy and has no kernel.

operator	$\psi(X, Y)$
`add`, `sub`, `mul`, `div`	$X \circ Y \in \mathbb{R}^d$, $\quad \circ \in \{+, -, \times, \div\}$ elementwise
`dot`	$\langle X, Y \rangle \in \mathbb{R}$
`copy_u`, `copy_v`	U_u, U_v

Both primitives are provided with a node-partitioned and, for g-SDDMM, an edge-parallel mapping (Section 3.3.1), in fp16, bf16 and fp32, with autograd.

D Exact merge of edge slices in the attention kernels

We cut each heavy neighborhood into edge slices of at most $S = 1024$ edges and launch every slice as a block of its own. For attention with logits z_j and values v_j, slice s computes the online-softmax state a warp would hold at its boundary: the maximum logit $m^{(s)}$, the scaled normalizer $Z^{(s)} = \sum_{j \in s} e^{z_j - m^{(s)}}$ and the scaled output $O^{(s)} = \sum_{j \in s} e^{z_j - m^{(s)}} v_j$. A merge kernel then combines the slices of each node,

$$m = \max_s m^{(s)}, \qquad Z = \textstyle\sum_s e^{\,m^{(s)} - m} Z^{(s)}, \qquad O = \frac{1}{Z} \sum_s e^{\,m^{(s)} - m} O^{(s)}, \tag{3}$$

and saves $m + \log Z$ for the backward pass. The result is exact for any S, and the merge visits slices in a fixed order, so it is deterministic.

E Avoiding atomics in the g-SpMM backward pass

The backward pass needs the most care, and we avoid atomics and fp32 staging wherever the structure of the computation allows. The node gradient of a sum reduction is the same g-SpMM over the transposed CSR rather than an atomic scatter; for four of the six operators the gradient does not read the operands and the pass reduces to copy-u, while for mul/div the edge operand is read in place through the graph's stored map from transposed to forward edge positions instead of an $O(MD)$ gather. The edge gradient writes every slot exactly once, so it goes directly into the operand dtype with no zero fill or staging buffer, walking the forward CSR with the same buckets and edge slicing as the forward pass. For min/max the gradient flows only through the selected edge; there are two formulations: a transposed-CSR traversal with a single owner per output slot, and an atomic scatter from destinations into an fp32 buffer. We choose the first when the operator reads an edge operand

and the mean degree is at most about ten. Arithmetic is performed in fp32 throughout; only the gradient buffers follow the operand dtype.

F Optimizing memory access inside a kernel

Three hardware mechanisms decide how much of a kernel's time is spent waiting on memory rather than computing, and all three are controlled by how the kernel is written rather than by how much data it moves. A load instruction transfers up to 128 bits at once, but only when the compiler can prove the address is aligned, so the same traffic can cost four times as many instructions. Shared memory is split into banks that serialize simultaneous accesses to different cells of one bank, so a staging buffer whose readers and writers collide pays for the collision on every iteration. And a kernel that needs more registers than the file holds spills the surplus to local memory, which is both slow and a reduction in how many blocks stay resident. We describe below how each is handled.

Wide loads. Accessing global memory is expensive, and NVIDIA GPUs can move 128 bits per instruction, but the compiler emits such an instruction only when it can prove the address is 16-byte aligned. We write the indexing so that this is both maintainable and provable, and the compiler then issues the widest available loads.

Bank conflicts. Shared memory shares its physical storage with the L1 cache and is divided into 32 banks whose cells are 32 or 64 bits wide. Concurrent accesses to different cells of the same bank are serialized unless every thread reads the same cell, so the staging buffers use access patterns that avoid writing into the bank currently being read.

Register spills. When a kernel needs more registers than the file provides, the surplus is spilled to local memory, which is far slower than a register and lowers the number of resident blocks. The easiest spills to avoid come from convenience variables that the compiler fails to inline into a recomputation, so we keep the number of live values small and express them as lambdas or `constexpr` helpers instead.

G Rescheduling the fused attention kernels

The fused GATv2 and Graph Transformer kernels of Fomina et al. (2026) compute a destination node's attention scores, normalize them with online softmax and aggregate the values in one pass over its neighborhood, so the per-edge weights never reach HBM. We keep that structure and change only how the work is scheduled: destination nodes are bucketed by degree, each bucket is given degree ordering and launched on its own stream, and the neighborhoods in the heavy bucket are cut into fixed-size edge slices whose partial softmax state is combined by the merge kernel of Appendix D. Neighbor rows are staged through shared memory as described in Appendix I; in these kernels each staged row feeds both the score computation and the weighted aggregation, in the forward pass and in the corresponding gradients.

H Utilization simulator: mechanics and cost model

Scheduling. The simulator takes the node degrees and a candidate assignment of vertices to thread blocks, with options for concurrent light/heavy bucket launch and edge slicing. At each simulation cycle, queued blocks are assigned to randomly selected SMs that have a free resident-block slot. Resident blocks then compete for the available memory bandwidth: at most b_{mem} blocks advance by one unit of work in a cycle. Finished blocks release their slots, allowing new blocks to be admitted. The simulation ends when all queues and all resident blocks are empty.

With concurrent launch, light and heavy blocks may reside on the GPU at the same time after the light kernel is released. Edge slicing divides a heavy neighborhood into fixed-size slices. Once all heavy slices have finished, a separate merge launch combines their partial results; thus, edge slicing adds work as well as parallelism. Appendix J defines the five configurations; the sweep records the slice size for each workload.

Block-cost model. For a block j assigned a set of vertices V_j, the simulated cost is

$$c_j = \sum_{v \in V_j} (\alpha + \beta d_v), \tag{4}$$

where d_v is the number of neighbors processed for vertex v, α represents fixed work, and β is the cost of processing one neighbor. We estimate α and β from measured kernel runtimes by non-negative least squares on 168 timings. The same model is applied to ordinary, sliced and merge blocks, so the extra work of edge slicing is included.

Utilization and bounds. Let T be the simulated makespan and U the mean fraction of occupied SM block slots. Slot utilization is distinct from hardware warp occupancy. The sweep also records the *drain-tail* duration in simulated cycles, defined as the interval between retirement of 95% of the total simulated work and completion of the final block. The lower bound used in the tables and figure captions is

$$T^* = \max\left(\underbrace{\frac{1}{S}\sum_j \frac{c_j}{B_j}}_{\text{slots}}, \underbrace{\frac{W}{b_{\text{mem}}}}_{\text{bandwidth}}, \underbrace{\max_j c_j}_{\textit{critical path}} \right), \tag{5}$$

where B_j is the resident-block capacity per SM of block j's kernel, S is the number of SMs, and $W = \sum_j c_j$ is the total work. The terms bound the time imposed by aggregate slot capacity, memory bandwidth and the longest block, respectively. The ratio $R = T/T^*$ measures the gap to this bound; $R = 1$ means that it is attained. The binding bound identifies which term is largest. When the *critical-path* term binds, shortening execution requires changing the work decomposition, as edge slicing does.

Time conversion. The predicted time is

$$t_{\text{pred}} = t_{\text{launch}} + 10^{-6} T s, \tag{6}$$

where s is the recorded time scale in ns per cycle and t_{launch} is the recorded overhead in ms. Both terms are retained in the reported predictions and their ratios. The source also provides the cost coefficients α and β and the cost-model median relative error. These parameters are read from the sweep. Table 5 places the predicted gains beside the measured ablation, which is the check on the model.

Sweep coverage. The sweep is run on a representative subset of the benchmark suite, chosen to span the degree-skew range rather than to cover every graph; the two largest, `ogbn-proteins` and `ogbn-products`, are left out. It covers 14 graphs, GATv2 forward, Graph Transformer forward and backward, and min-aggregation forward and backward, at $d \in \{128, 256\}$ and $q \in \{0.95, 0.99\}$, totaling 1,400 configurations; Table 5 reports 11 of those graphs, omitting the three smallest. Table 5 summarizes the comparison between sequential bucketed execution without edge slicing (b) and concurrent execution with edge slicing (e) for GATv2 forward, at $d = 128$, $q = 0.99$. Table 11 in Appendix K.6 reports every configuration in the sweep.

I ASYNCHRONOUS STAGING

Section 3.2 keeps `cp.async` staging off in the generalized primitives. Table 10 is the measurement behind that choice. For g-SpMM we compare pipeline depths 1, 2 and 4 against depth 0 over both passes and four widths; for g-SDDMM, depths 2 and 3 at 1, 4 and 16 edges per warp. The geometric mean over cells is below 1.00 in every one of these 48 settings, between 0.58 and 0.97. The SDDMM sweep contains a control: with one edge per warp no prefetch is possible, so any change is pure overhead, and it measures 0.78–0.84.

We use `cuda::memcpy_async` and a thread-scoped `cuda::pipeline` to stage operands in shared memory. FlashAttention-3 similarly overlaps data movement with computation using asynchronous loads and warp specialization (Shah et al., 2024). The buffers form a ring of P stages: iteration t consumes slot $s = t \bmod P$, which is subsequently reused for iteration $t + P$.

Table 5: **Simulated schedules against measured runtimes.** Sequential bucketed execution without edge slicing (mode b) is compared with concurrent execution with edge slicing (mode e). Simulations use GATv2 forward at $d = 128$, $q = 0.99$. The three Planetoid graphs, `cora`, `citeseer` and `pubmed`, are omitted: each has fewer than 2×10^4 nodes, versus at least 5×10^4 here, and launch overhead dominates their predicted runtimes. They remain in Table 11. Times include the recorded launch overhead; gain is t_b/t_e. *Measured* is the ratio of the + *bucketing* and + *edge slicing* times in Table 7, at $h = 2$, $d_h = 64$. Hardware uses two 64-channel heads and a tuned quantile; its cumulative ablation also includes ordering. Across these 11 graphs, Spearman $\rho = 0.95$ and the Pearson correlation of log speedups is 0.97; predicted speedups exceed measured ones by a median factor of 1.43.

graph	U_b (%)	U_e (%)	t_b (ms)	t_e (ms)	gain	measured
`artnet-exp`	80.8	92.3	0.298	0.266	1.12×	1.26×
`avazu-ctr`	51.8	98.7	8.315	4.382	1.90×	1.32×
`city-reviews`	37.0	96.0	1.062	0.432	2.46×	1.41×
`city-roads-L`	98.6	99.6	0.289	0.289	1.00×	1.07×
`city-roads-M`	98.7	99.2	0.146	0.145	1.00×	1.07×
`hm-categories`	59.5	99.0	8.095	4.878	1.66×	1.16×
`ogbn-arxiv`	17.0	97.4	0.649	0.143	4.53×	1.99×
`pokec-regions`	87.1	100.0	13.177	11.492	1.15×	1.09×
`tolokers-2`	35.7	67.4	0.436	0.249	1.75×	1.36×
`twitch-views`	40.4	97.4	5.286	2.215	2.39×	1.50×
`web-fraud`	12.6	100.0	7.878	1.029	7.65×	2.75×

Algorithm 1 Pipeline stage reuse

Require: $P \geq 1$ stages $B[0], \ldots, B[P-1]$; T iterations
1: Prefetch the first $\min(P, T)$ operands
2: **for** $t = 0, \ldots, T-1$ **do**
3: $s \leftarrow t \bmod P$
4: WAITREADY($B[s]$)
5: PROCESSSTAGE($B[s], t + P$)

In Algorithm 1, T is the number of iterations assigned to a warp or thread. WAITREADY waits for copy completion and, for cooperative loads, synchronizes the warp. PROCESSSTAGE evaluates the kernel's per-neighbor operations and recycles the slot after all readers have finished: it releases the slot and issues the next asynchronous copy if $t+P < T$. The internal instruction order is specialized per kernel; slot reuse need not wait for arithmetic that uses only register-resident values.

Applicability and resource cost. Asynchronous staging can hide latency by overlapping transfers with independent arithmetic; longer scans amortize startup and drain costs. However, it adds shared-memory traffic and synchronization, and its buffer footprint can reduce block residency.

Pipelining in attention kernels. Each warp cooperatively loads complete neighbor operand rows in aligned 16-byte chunks. In both GATv2 and Graph Transformer, staged rows supply score computation and weighted aggregation in forward and the corresponding gradient computations in backward. Both operators perform $O(d_h)$ arithmetic per edge, where d_h is the head dimension.

Asynchronous loads in min/max aggregation. For min/max aggregation, each thread stages its own 16-byte piece of the feature row. After copy completion, it updates the extrema and source indices. This per-thread scheme is used in the light-node and packed-heavy forward kernels.

J SCHEDULING CONFIGURATIONS AND UTILIZATION PROFILES

These per-SM heatmaps visualize the numerical sweep in Appendix K.6. Their captions report the corresponding makespans and bounds from Table 11; Table 5 summarizes the comparison with hardware. Two additional synthetic workloads, which are not part of the numerical sweep, are included at the end.

Each figure compares five scheduling configurations, with fixed panel labels:

(a) one kernel over every node, no degree bucketing

(b) degree bucketing, the two buckets launched one after the other

(c) degree bucketing with edge slicing, launched one after the other

(d) degree bucketing with concurrent launch

(e) degree bucketing with concurrent launch and edge slicing

Colour shows the fraction of occupied SM block slots: the darkest shade means full utilization and the lightest means idle. All panels share the simulated-cycle axis; hatching marks the interval after a configuration has completed, and the solid rule marks its completion time. Appendix H defines the reported metrics, including T/T^* and the binding bound in each caption (Equation (5)). Because edge slicing changes the work decomposition, T^* depends on the configuration. Thus T/T^* measures the gap to a configuration's own bound; it does not rank configurations. Captions also report T and the cycle-based speedup T_a/T over mode (a). The time-based gains in Table 5 instead compare modes (b) and (e), including the recorded launch overhead.

Figure 1 in the main text selects modes (b) and (e) for `twitch-views`, relabeling them as (a) and (b). Figure 253 below shows all five modes for that workload.

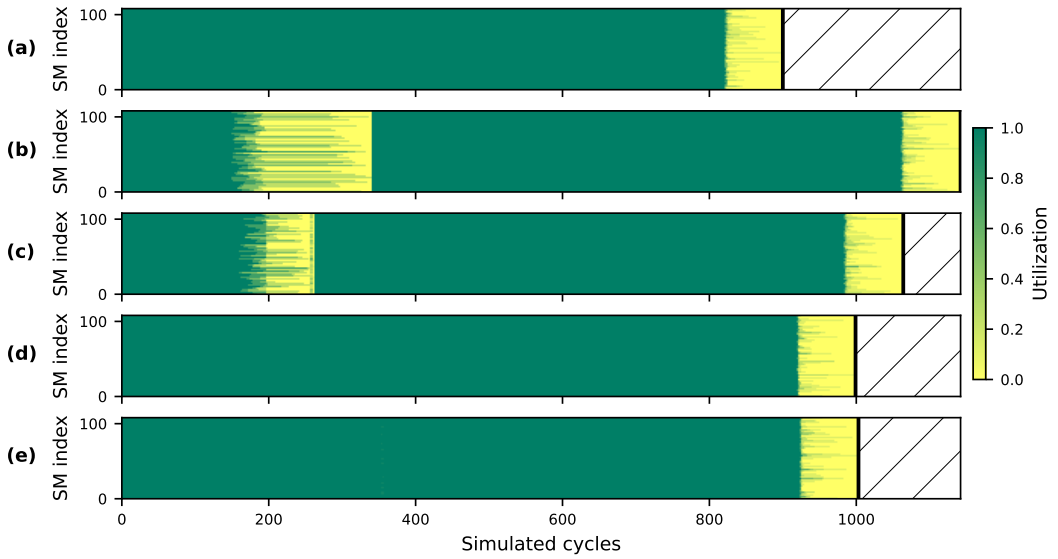

Figure 2: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 900$, $T/T^* = 1.092$ (slot), 1.00×; (b) $T = 1{,}142$, $T/T^* = 1.238$ (slot), 0.79×; (c) $T = 1{,}064$, $T/T^* = 1.149$ (slot), 0.85×; (d) $T = 999$, $T/T^* = 1.083$ (slot), 0.90×; (e) $T = 1{,}003$, $T/T^* = 1.083$ (slot), 0.90×.

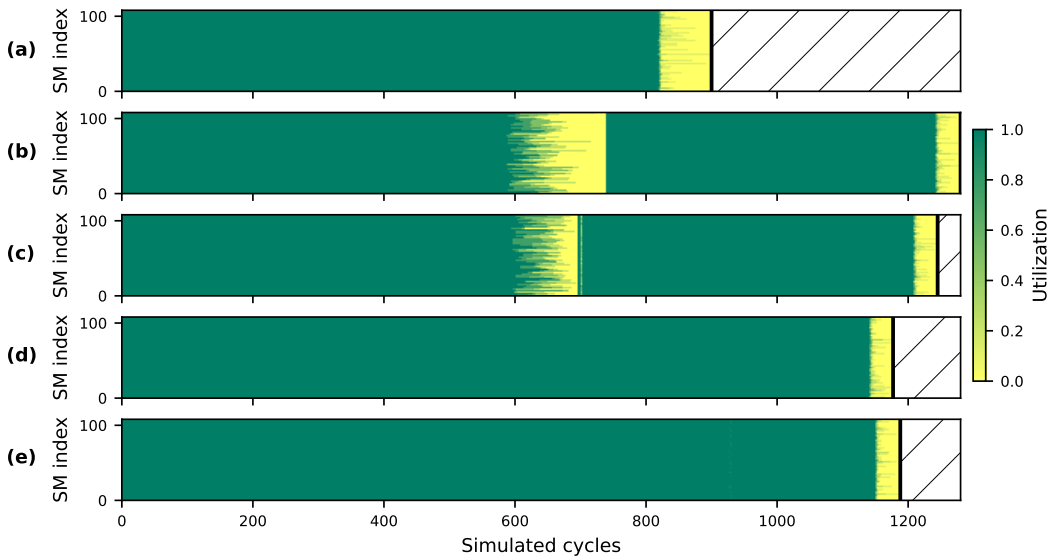

Figure 3: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 900$, $T/T^* = 1.092$ (slot), 1.00×; (b) $T = 1{,}280$, $T/T^* = 1.121$ (slot), 0.70×; (c) $T = 1{,}245$, $T/T^* = 1.081$ (slot), 0.72×; (d) $T = 1{,}177$, $T/T^* = 1.031$ (slot), 0.76×; (e) $T = 1{,}188$, $T/T^* = 1.031$ (slot), 0.76×.

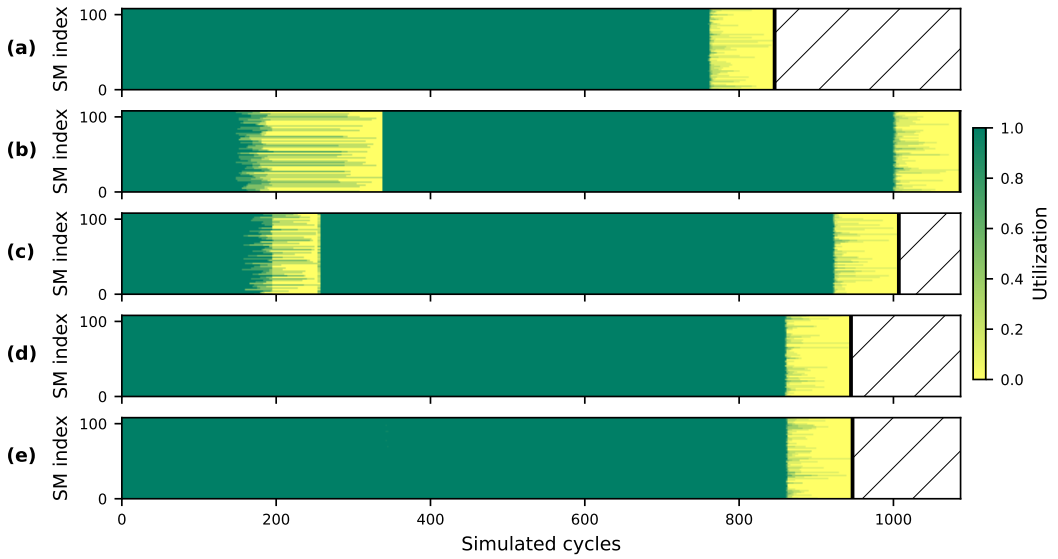

Figure 4: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 846$, $T/T^* = 1.105$ (slot), 1.00×; (b) $T = 1{,}087$, $T/T^* = 1.259$ (slot), 0.78×; (c) $T = 1{,}007$, $T/T^* = 1.163$ (slot), 0.84×; (d) $T = 945$, $T/T^* = 1.094$ (slot), 0.90×; (e) $T = 947$, $T/T^* = 1.094$ (slot), 0.89×.

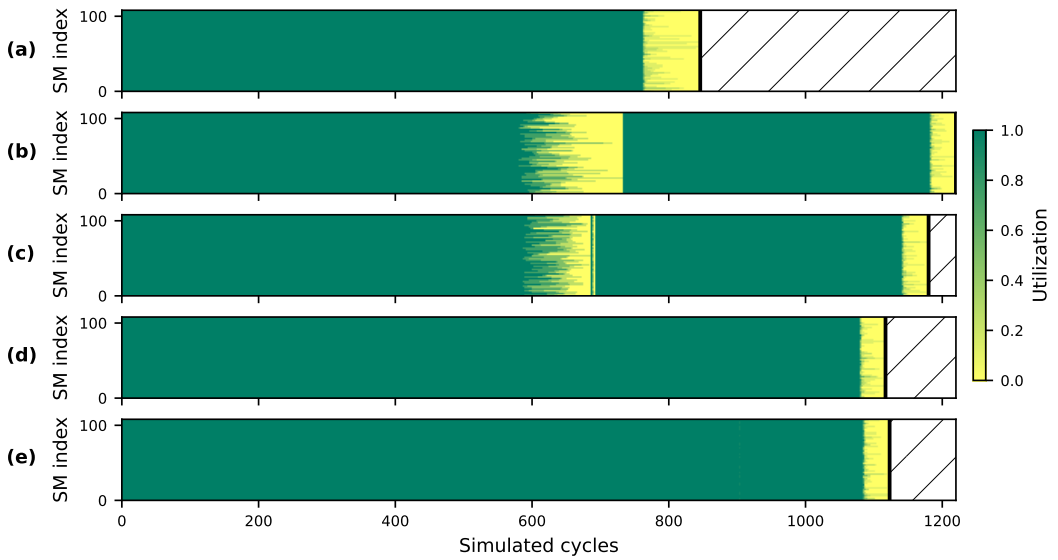

Figure 5: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 846$, $T/T^* = 1.105$ (slot), 1.00×; (b) $T = 1{,}220$, $T/T^* = 1.129$ (slot), 0.69×; (c) $T = 1{,}180$, $T/T^* = 1.086$ (slot), 0.72×; (d) $T = 1{,}117$, $T/T^* = 1.034$ (slot), 0.76×; (e) $T = 1{,}123$, $T/T^* = 1.033$ (slot), 0.75×.

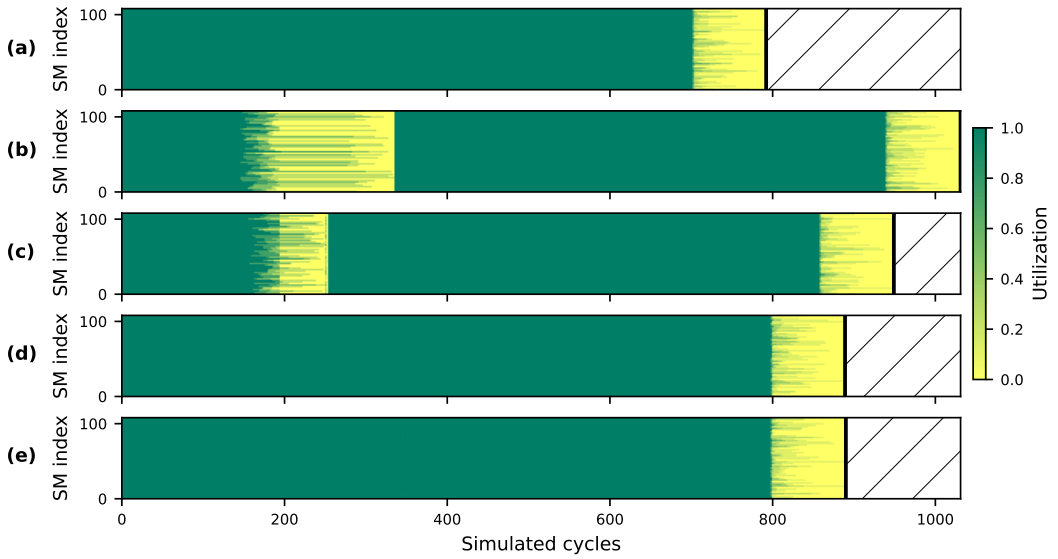

Figure 6: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 792$, $T/T^* = 1.120$ (slot), 1.00×; (b) $T = 1{,}031$, $T/T^* = 1.281$ (slot), 0.77×; (c) $T = 949$, $T/T^* = 1.178$ (slot), 0.83×; (d) $T = 889$, $T/T^* = 1.105$ (slot), 0.89×; (e) $T = 890$, $T/T^* = 1.105$ (slot), 0.89×.

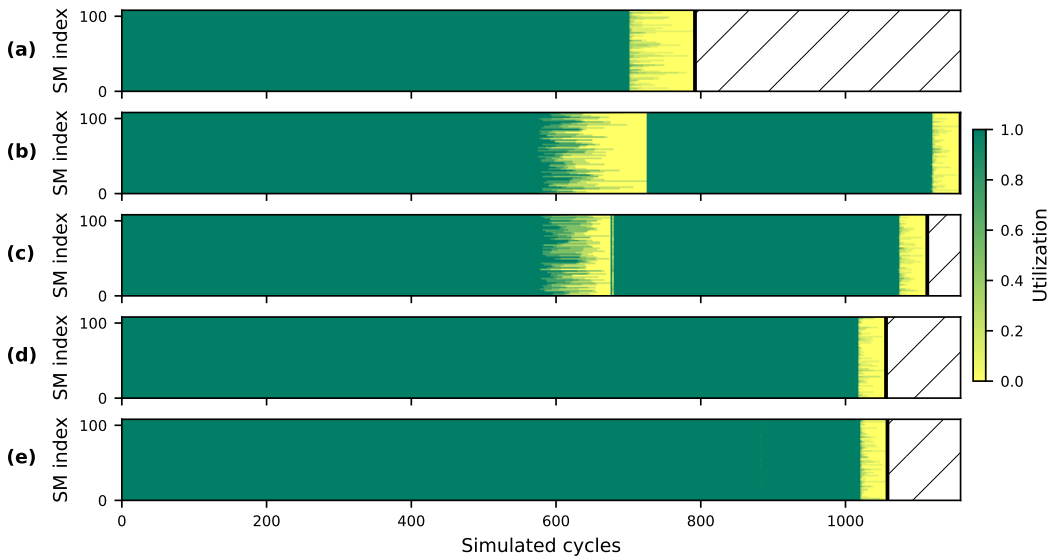

Figure 7: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 792$, $T/T^* = 1.120$ (slot), 1.00×; (b) $T = 1{,}159$, $T/T^* = 1.138$ (slot), 0.68×; (c) $T = 1{,}113$, $T/T^* = 1.090$ (slot), 0.71×; (d) $T = 1{,}056$, $T/T^* = 1.036$ (slot), 0.75×; (e) $T = 1{,}058$, $T/T^* = 1.036$ (slot), 0.75×.

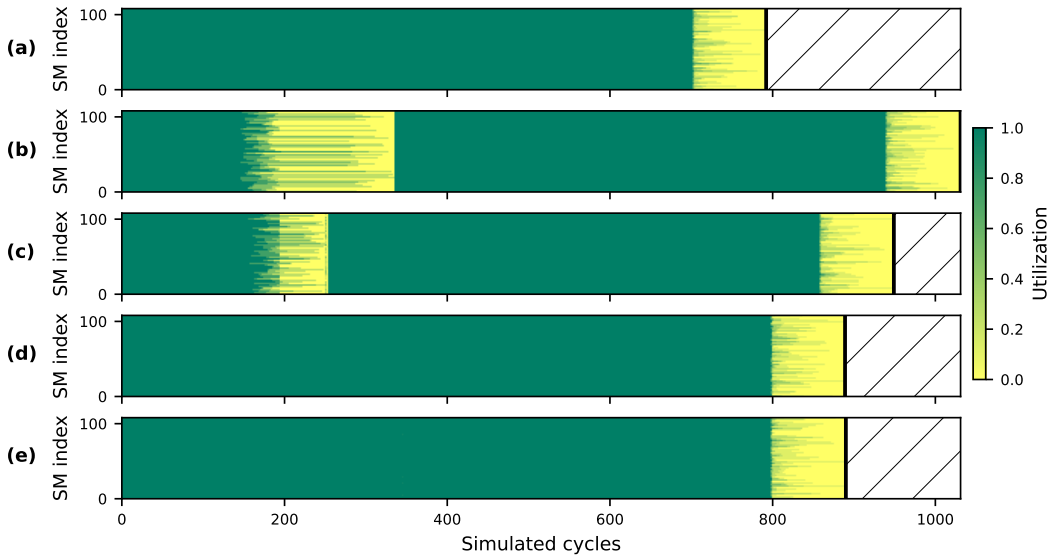

Figure 8: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 792$, $T/T^* = 1.120$ (slot), 1.00×; (b) $T = 1{,}031$, $T/T^* = 1.281$ (slot), 0.77×; (c) $T = 949$, $T/T^* = 1.178$ (slot), 0.83×; (d) $T = 889$, $T/T^* = 1.105$ (slot), 0.89×; (e) $T = 890$, $T/T^* = 1.105$ (slot), 0.89×.

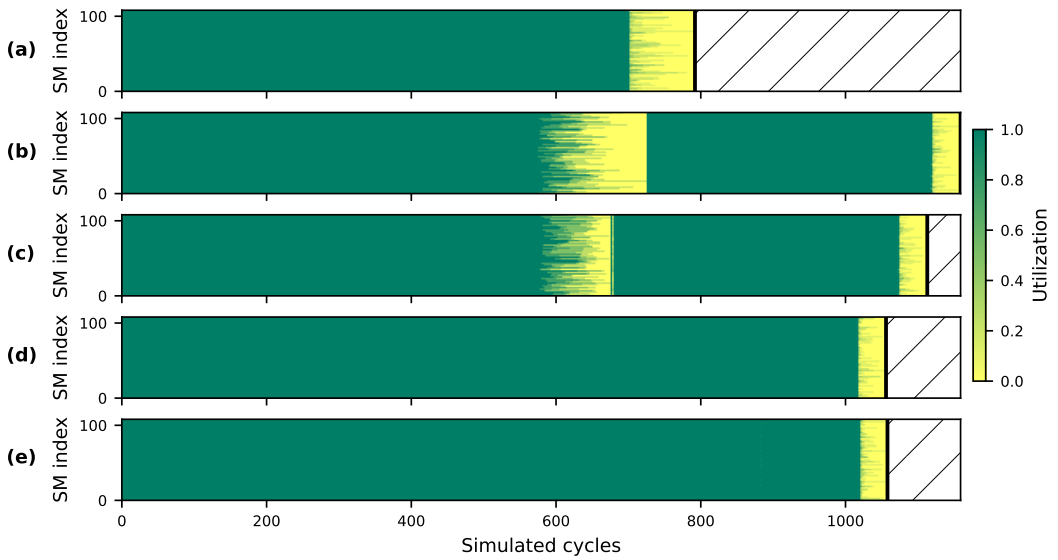

Figure 9: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 792$, $T/T^* = 1.120$ (slot), 1.00×; (b) $T = 1{,}159$, $T/T^* = 1.138$ (slot), 0.68×; (c) $T = 1{,}113$, $T/T^* = 1.090$ (slot), 0.71×; (d) $T = 1{,}056$, $T/T^* = 1.036$ (slot), 0.75×; (e) $T = 1{,}058$, $T/T^* = 1.036$ (slot), 0.75×.

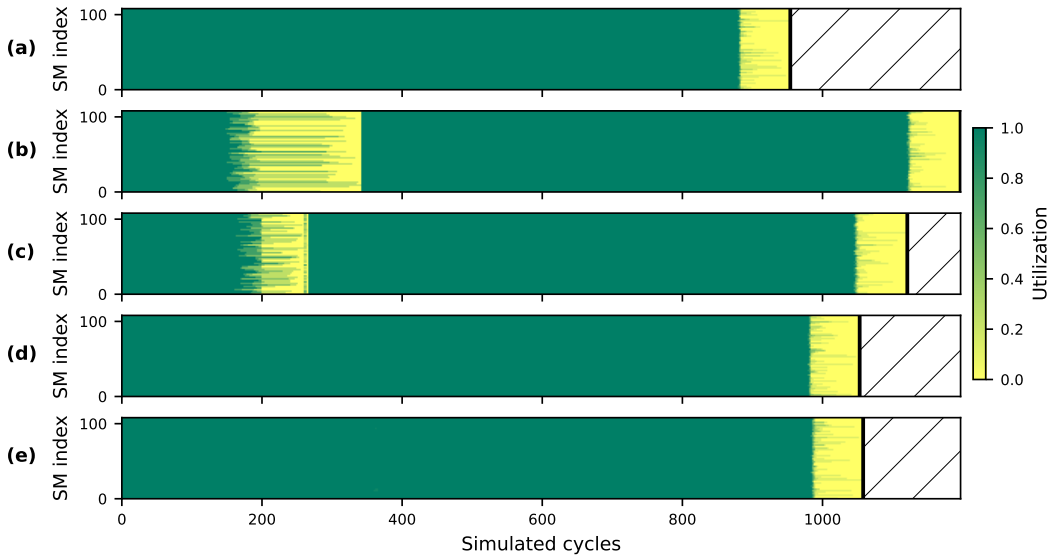

Figure 10: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 954$, $T/T^* = 1.081$ (slot), 1.00×; (b) $T = 1{,}197$, $T/T^* = 1.220$ (slot), 0.80×; (c) $T = 1{,}121$, $T/T^* = 1.136$ (slot), 0.85×; (d) $T = 1{,}053$, $T/T^* = 1.073$ (slot), 0.91×; (e) $T = 1{,}058$, $T/T^* = 1.072$ (slot), 0.90×.

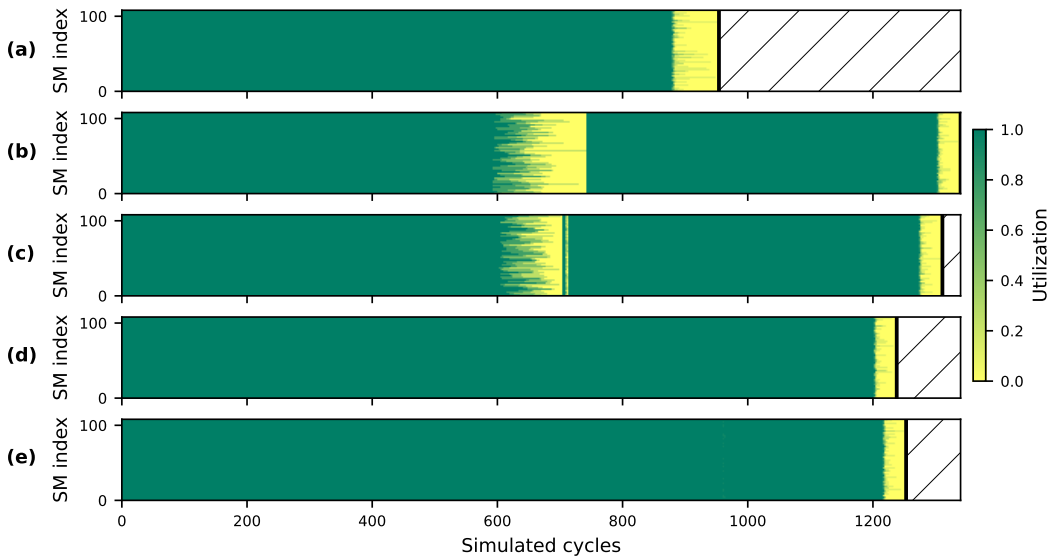

Figure 11: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 954$, $T/T^* = 1.081$ (slot), 1.00×; (b) $T = 1{,}340$, $T/T^* = 1.114$ (slot), 0.71×; (c) $T = 1{,}311$, $T/T^* = 1.077$ (slot), 0.73×; (d) $T = 1{,}238$, $T/T^* = 1.029$ (slot), 0.77×; (e) $T = 1{,}253$, $T/T^* = 1.029$ (slot), 0.76×.

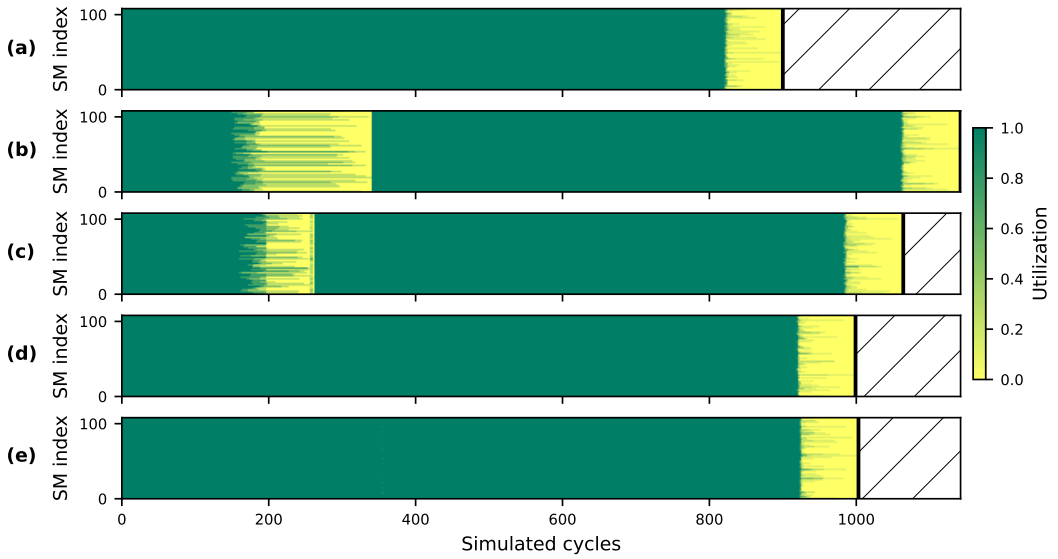

Figure 12: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 900$, $T/T^* = 1.092$ (slot), 1.00×; (b) $T = 1{,}142$, $T/T^* = 1.238$ (slot), 0.79×; (c) $T = 1{,}064$, $T/T^* = 1.149$ (slot), 0.85×; (d) $T = 999$, $T/T^* = 1.083$ (slot), 0.90×; (e) $T = 1{,}003$, $T/T^* = 1.083$ (slot), 0.90×.

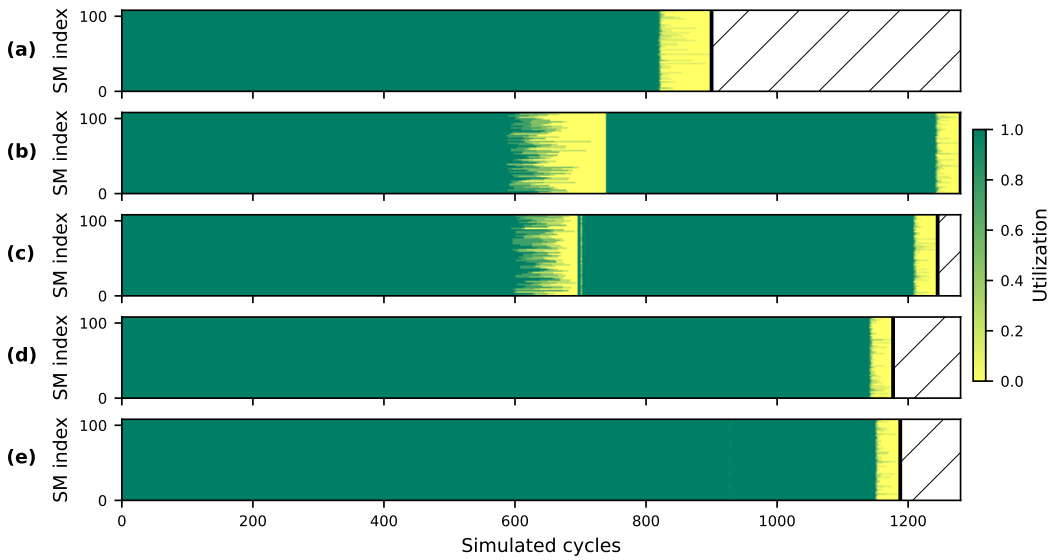

Figure 13: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 900$, $T/T^* = 1.092$ (slot), 1.00×; (b) $T = 1{,}280$, $T/T^* = 1.121$ (slot), 0.70×; (c) $T = 1{,}245$, $T/T^* = 1.081$ (slot), 0.72×; (d) $T = 1{,}177$, $T/T^* = 1.031$ (slot), 0.76×; (e) $T = 1{,}188$, $T/T^* = 1.031$ (slot), 0.76×.

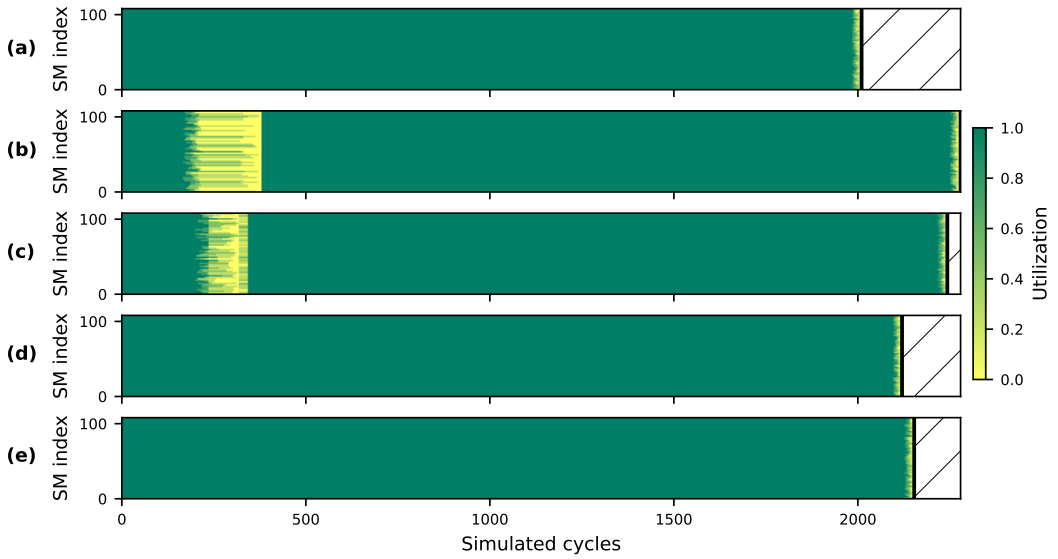

Figure 14: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}010$, $T/T^* = 1.010$ (slot), 1.00×; (b) $T = 2{,}279$, $T/T^* = 1.085$ (slot), 0.88×; (c) $T = 2{,}243$, $T/T^* = 1.051$ (slot), 0.90×; (d) $T = 2{,}120$, $T/T^* = 1.009$ (slot), 0.95×; (e) $T = 2{,}153$, $T/T^* = 1.009$ (slot), 0.93×.

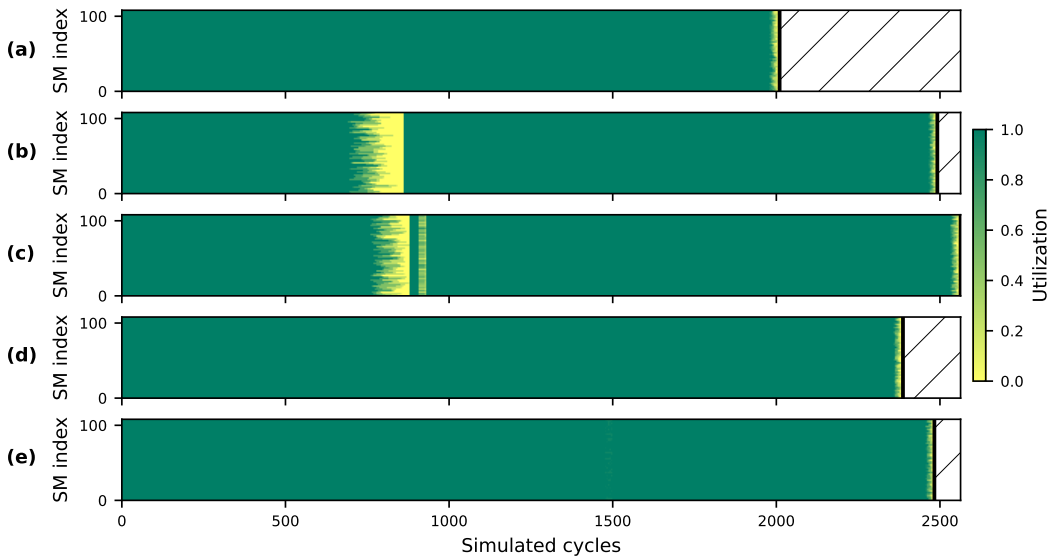

Figure 15: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}010$, $T/T^* = 1.010$ (slot), 1.00×; (b) $T = 2{,}492$, $T/T^* = 1.052$ (slot), 0.81×; (c) $T = 2{,}563$, $T/T^* = 1.040$ (slot), 0.78×; (d) $T = 2{,}387$, $T/T^* = 1.008$ (slot), 0.84×; (e) $T = 2{,}483$, $T/T^* = 1.008$ (slot), 0.81×.

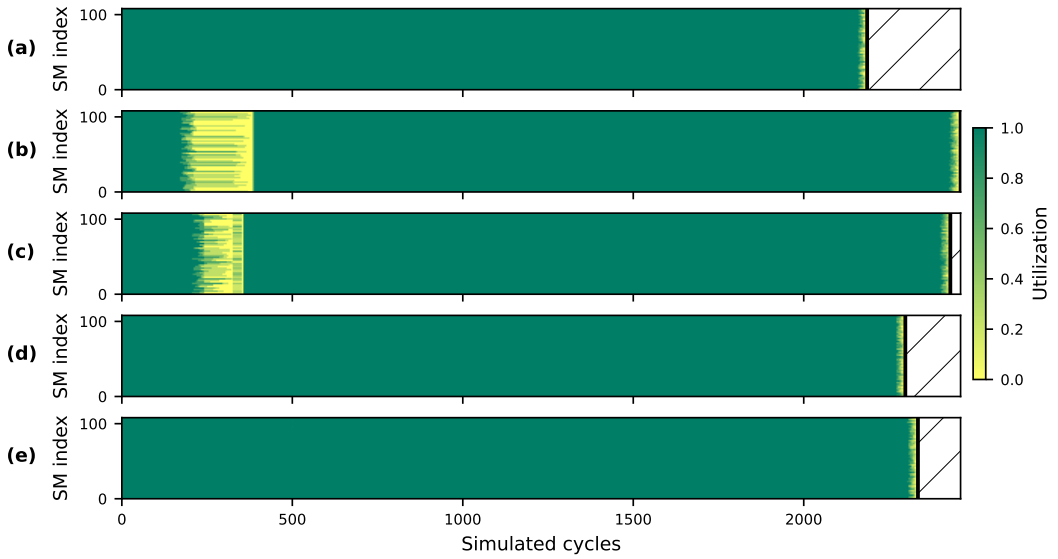

Figure 16: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}186$, $T/T^* = 1.009$ (slot), 1.00×; (b) $T = 2{,}460$, $T/T^* = 1.080$ (slot), 0.89×; (c) $T = 2{,}430$, $T/T^* = 1.049$ (slot), 0.90×; (d) $T = 2{,}298$, $T/T^* = 1.009$ (slot), 0.95×; (e) $T = 2{,}335$, $T/T^* = 1.008$ (slot), 0.94×.

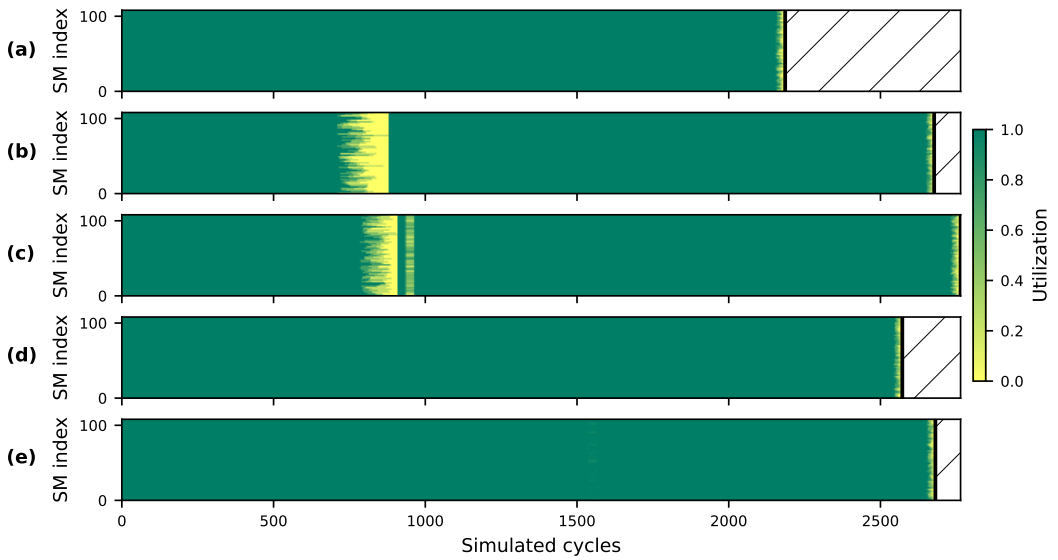

Figure 17: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}186$, $T/T^* = 1.009$ (slot), 1.00×; (b) $T = 2{,}677$, $T/T^* = 1.049$ (slot), 0.82×; (c) $T = 2{,}764$, $T/T^* = 1.039$ (slot), 0.79×; (d) $T = 2{,}572$, $T/T^* = 1.008$ (slot), 0.85×; (e) $T = 2{,}681$, $T/T^* = 1.008$ (slot), 0.82×.

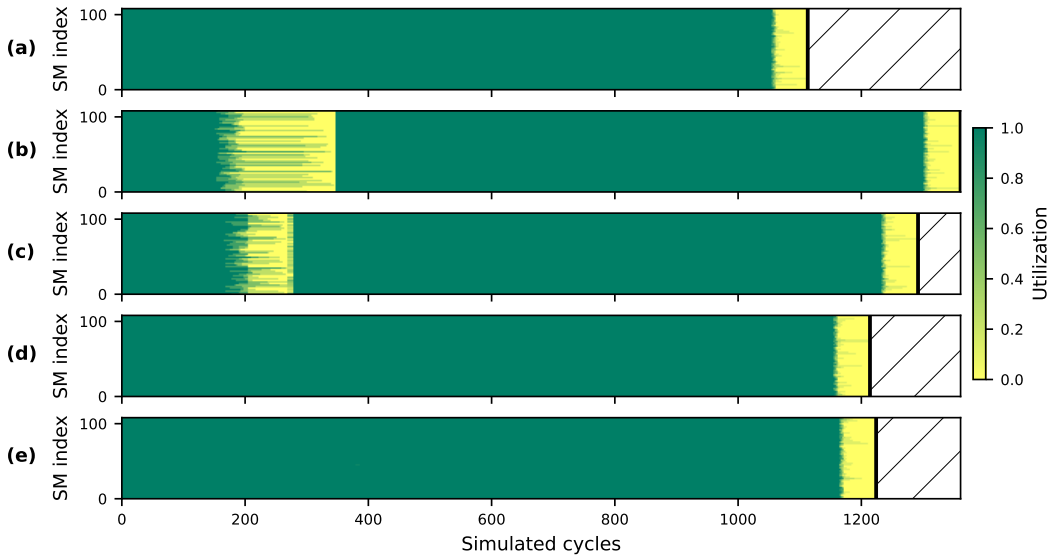

Figure 18: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}113$, $T/T^* = 1.053$ (slot), 1.00×; (b) $T = 1{,}361$, $T/T^* = 1.175$ (slot), 0.82×; (c) $T = 1{,}292$, $T/T^* = 1.106$ (slot), 0.86×; (d) $T = 1{,}214$, $T/T^* = 1.048$ (slot), 0.92×; (e) $T = 1{,}224$, $T/T^* = 1.048$ (slot), 0.91×.

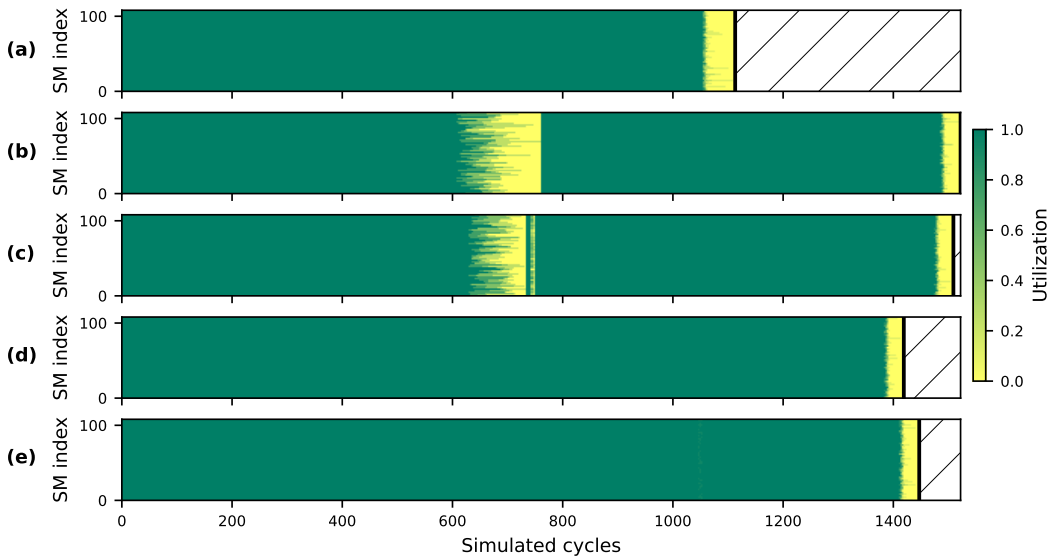

Figure 19: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}113$, $T/T^* = 1.053$ (slot), 1.00×; (b) $T = 1{,}522$, $T/T^* = 1.098$ (slot), 0.73×; (c) $T = 1{,}509$, $T/T^* = 1.067$ (slot), 0.74×; (d) $T = 1{,}419$, $T/T^* = 1.023$ (slot), 0.78×; (e) $T = 1{,}447$, $T/T^* = 1.023$ (slot), 0.77×.

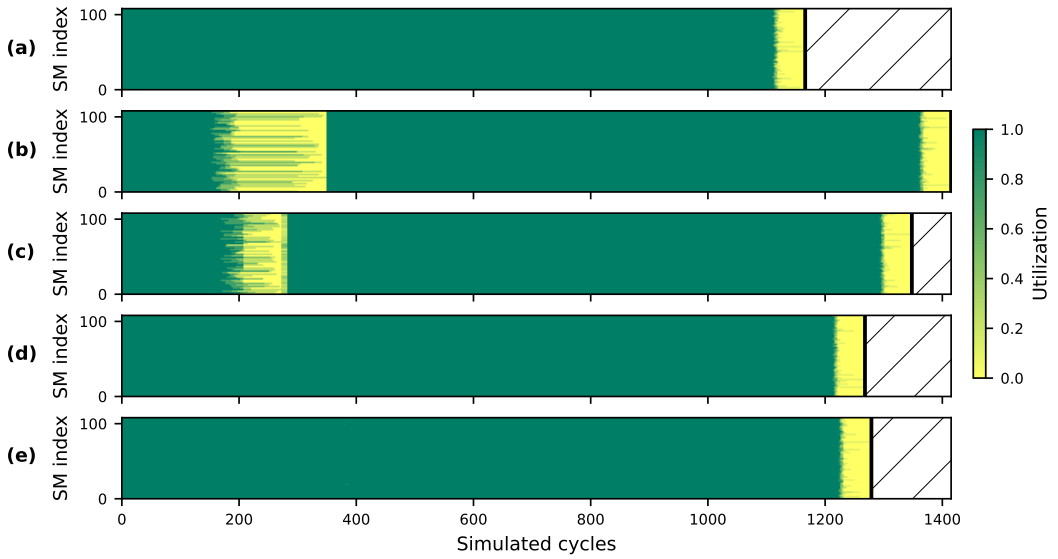

Figure 20: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (507 of them). Edge slices in (c) and (e) hold 97 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}166$, $T/T^* = 1.045$ (slot), 1.00×; (b) $T = 1{,}415$, $T/T^* = 1.163$ (slot), 0.82×; (c) $T = 1{,}348$, $T/T^* = 1.098$ (slot), 0.86×; (d) $T = 1{,}268$, $T/T^* = 1.042$ (slot), 0.92×; (e) $T = 1{,}279$, $T/T^* = 1.041$ (slot), 0.91×.

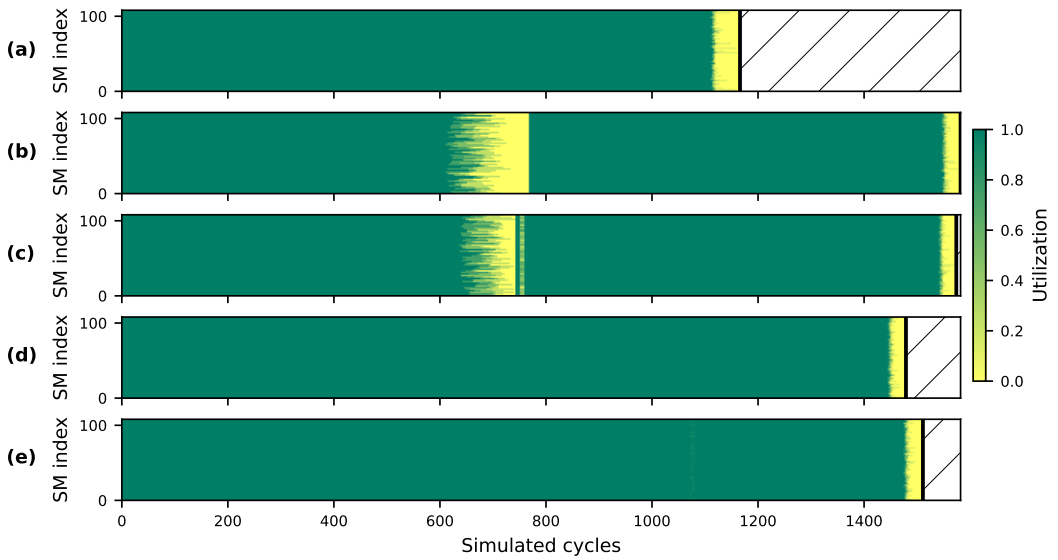

Figure 21: Per-SM occupancy over time for `artnet-exp` ($N = 50{,}405$ vertices, $E = 611{,}101$ edges, mean degree 12.1, maximum degree 199, skew 16×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,569 of them). Edge slices in (c) and (e) hold 99 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}166$, $T/T^* = 1.045$ (slot), 1.00×; (b) $T = 1{,}582$, $T/T^* = 1.093$ (slot), 0.74×; (c) $T = 1{,}574$, $T/T^* = 1.063$ (slot), 0.74×; (d) $T = 1{,}479$, $T/T^* = 1.021$ (slot), 0.79×; (e) $T = 1{,}511$, $T/T^* = 1.021$ (slot), 0.77×.

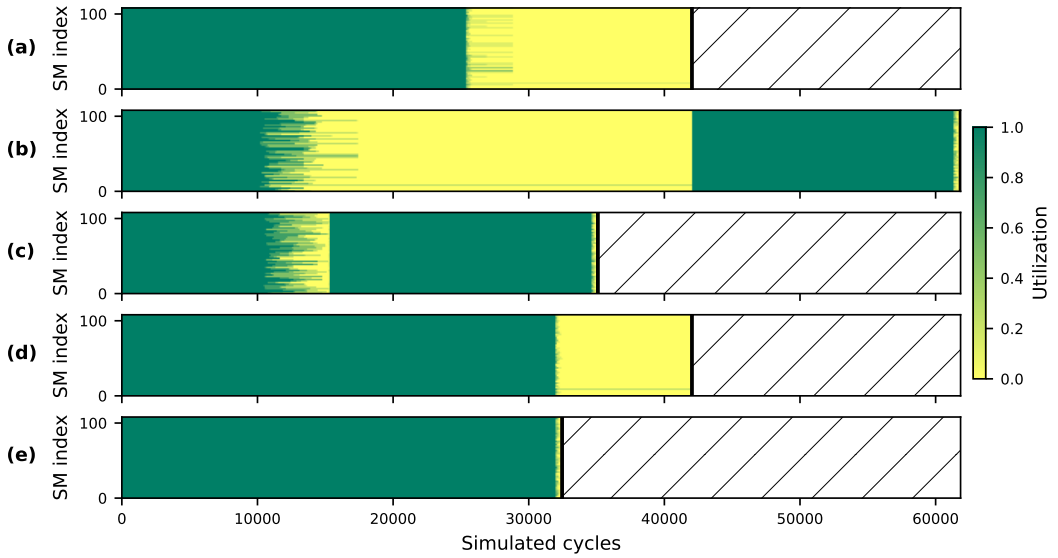

Figure 22: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}839$, $T/T^* = 1.471$ (critical path), 0.68×; (c) $T = 35{,}098$, $T/T^* = 1.096$ (slot), 1.20×; (d) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}459$, $T/T^* = 1.014$ (slot), 1.29×.

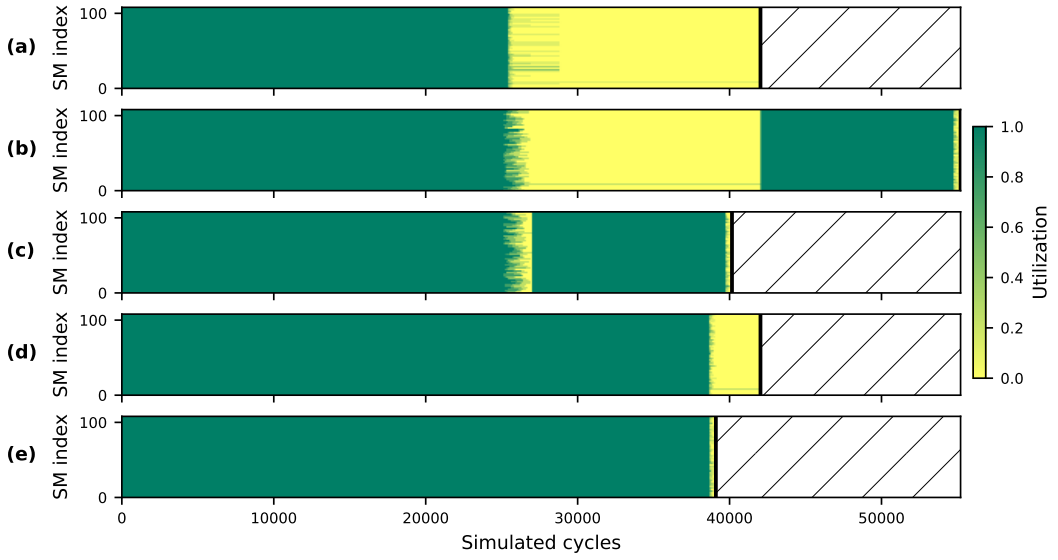

Figure 23: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}204$, $T/T^* = 1.313$ (critical path), 0.76×; (c) $T = 40{,}159$, $T/T^* = 1.039$ (slot), 1.05×; (d) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}097$, $T/T^* = 1.011$ (slot), 1.08×.

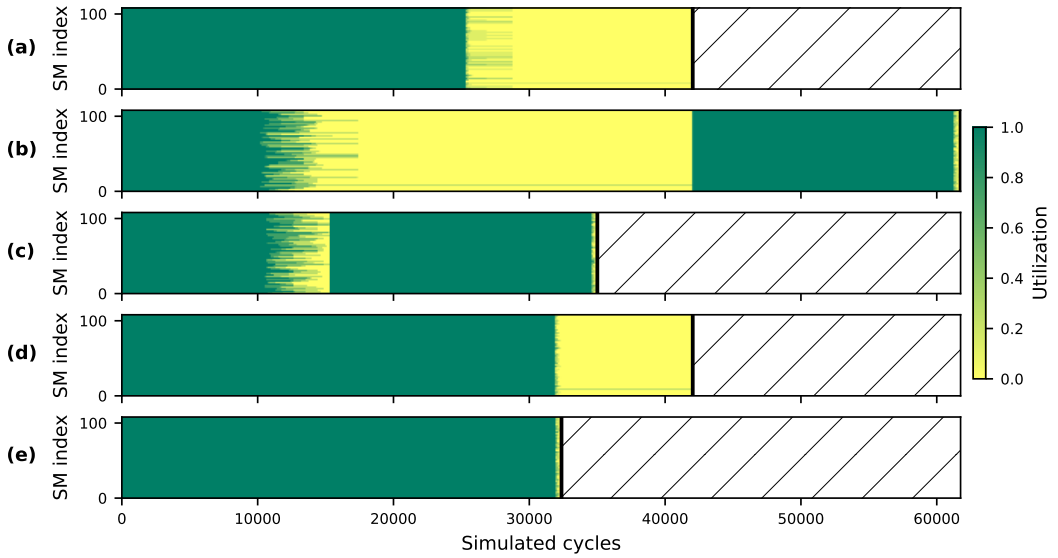

Figure 24: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}033$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}753$, $T/T^* = 1.469$ (critical path), 0.68×; (c) $T = 35{,}009$, $T/T^* = 1.096$ (slot), 1.20×; (d) $T = 42{,}033$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}370$, $T/T^* = 1.014$ (slot), 1.30×.

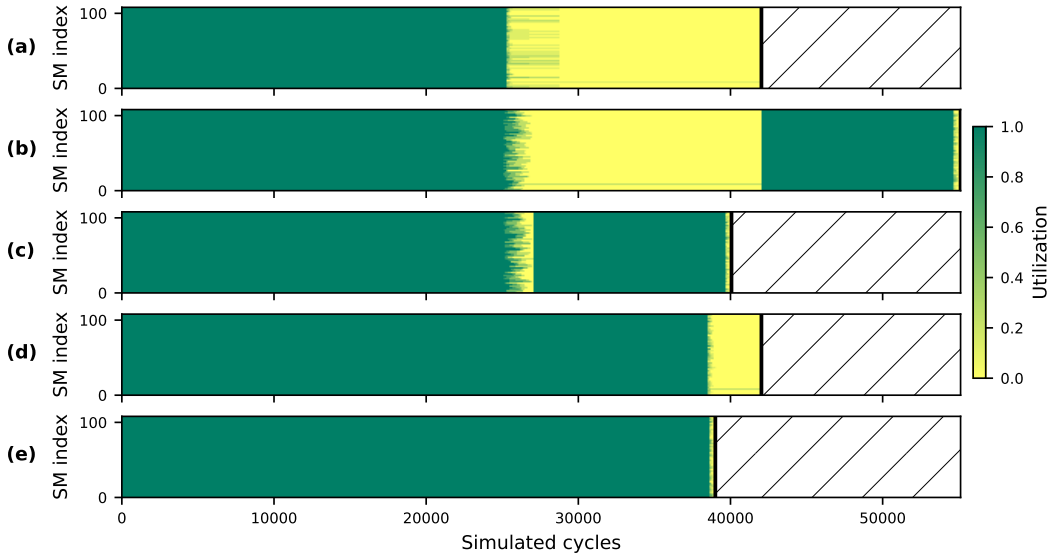

Figure 25: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}033$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}121$, $T/T^* = 1.311$ (critical path), 0.76×; (c) $T = 40{,}065$, $T/T^* = 1.039$ (slot), 1.05×; (d) $T = 42{,}033$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}004$, $T/T^* = 1.011$ (slot), 1.08×.

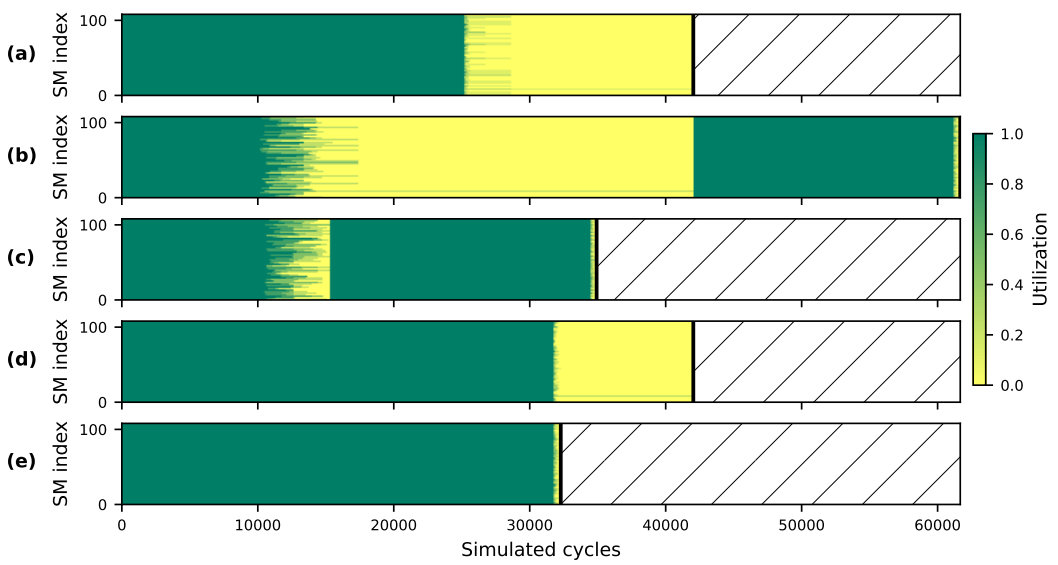

Figure 26: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}666$, $T/T^* = 1.467$ (critical path), 0.68×; (c) $T = 34{,}919$, $T/T^* = 1.097$ (slot), 1.20×; (d) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}282$, $T/T^* = 1.014$ (slot), 1.30×.

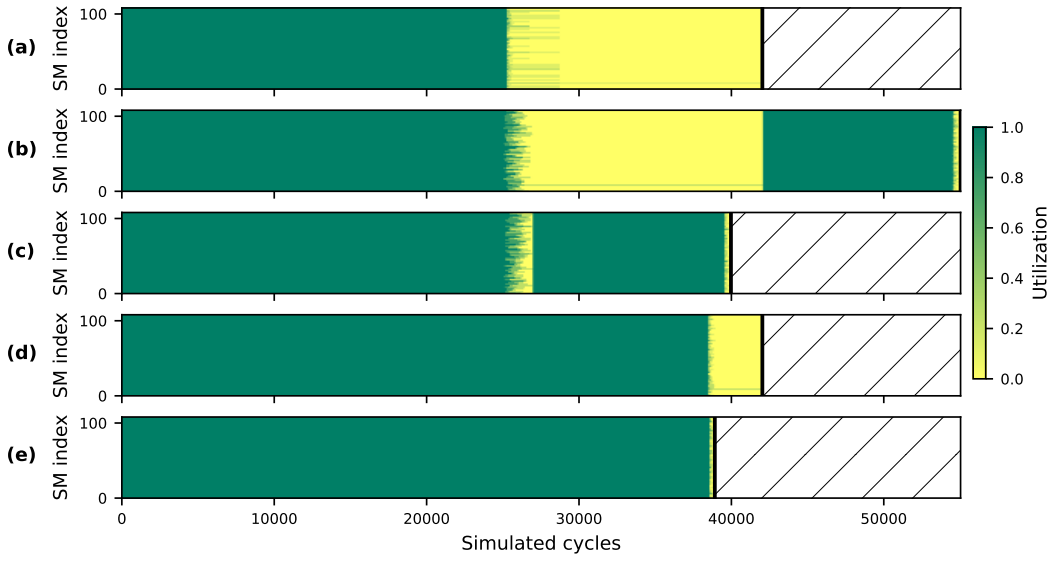

Figure 27: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}039$, $T/T^* = 1.309$ (critical path), 0.76×; (c) $T = 39{,}971$, $T/T^* = 1.039$ (slot), 1.05×; (d) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 38{,}912$, $T/T^* = 1.012$ (slot), 1.08×.

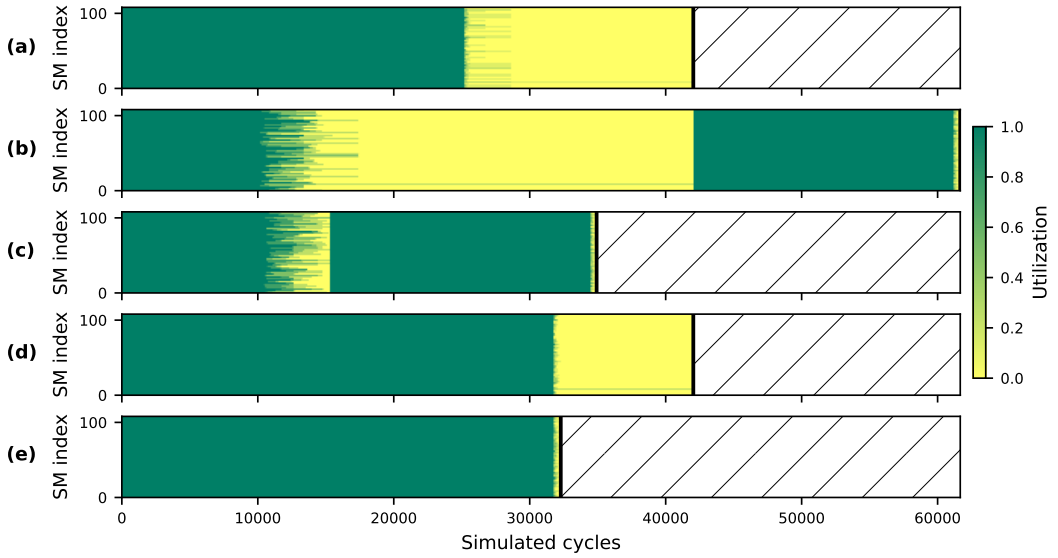

Figure 28: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}666$, $T/T^* = 1.467$ (critical path), 0.68×; (c) $T = 34{,}919$, $T/T^* = 1.097$ (slot), 1.20×; (d) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}282$, $T/T^* = 1.014$ (slot), 1.30×.

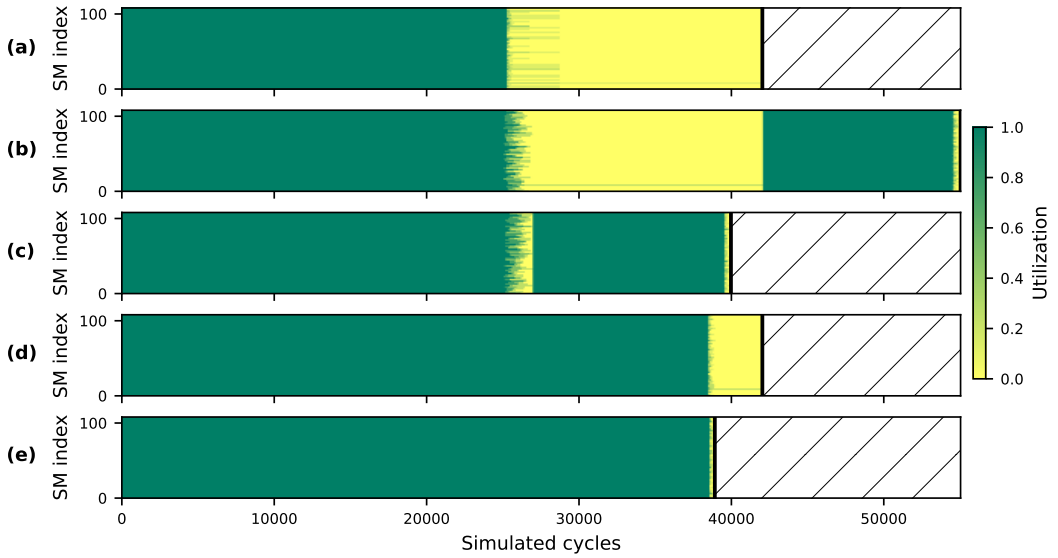

Figure 29: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}039$, $T/T^* = 1.309$ (critical path), 0.76×; (c) $T = 39{,}971$, $T/T^* = 1.039$ (slot), 1.05×; (d) $T = 42{,}032$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 38{,}912$, $T/T^* = 1.012$ (slot), 1.08×.

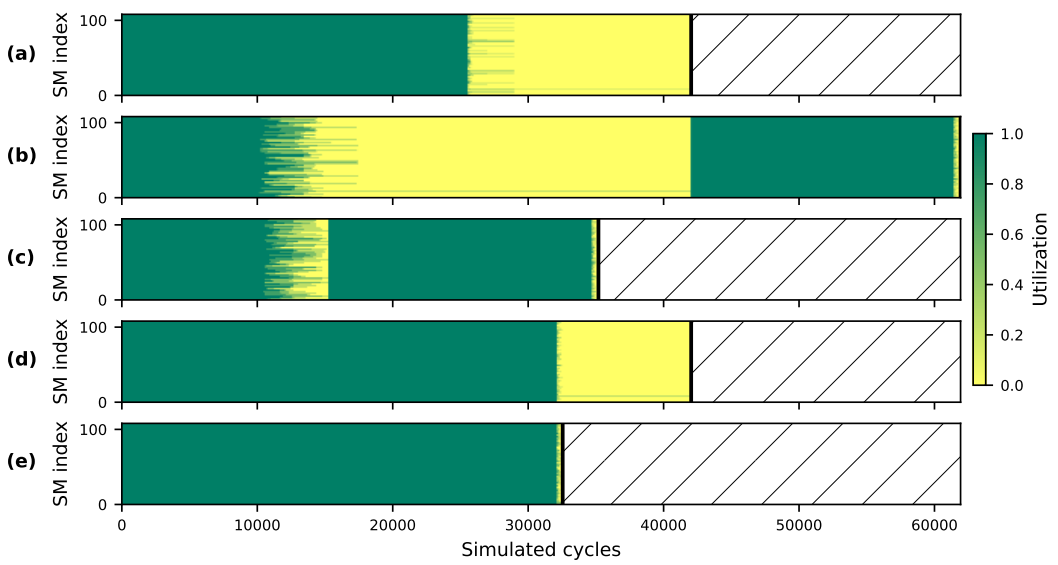

Figure 30: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}035$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}926$, $T/T^* = 1.473$ (critical path), 0.68×; (c) $T = 35{,}188$, $T/T^* = 1.096$ (slot), 1.19×; (d) $T = 42{,}035$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}548$, $T/T^* = 1.014$ (slot), 1.29×.

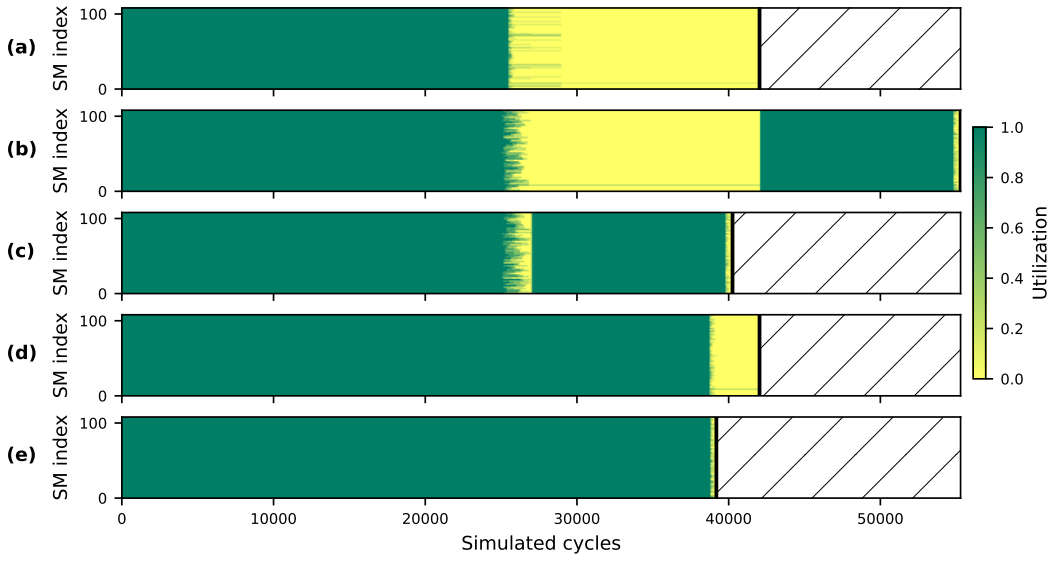

Figure 31: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}035$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}287$, $T/T^* = 1.315$ (critical path), 0.76×; (c) $T = 40{,}254$, $T/T^* = 1.039$ (slot), 1.04×; (d) $T = 42{,}035$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}190$, $T/T^* = 1.011$ (slot), 1.07×.

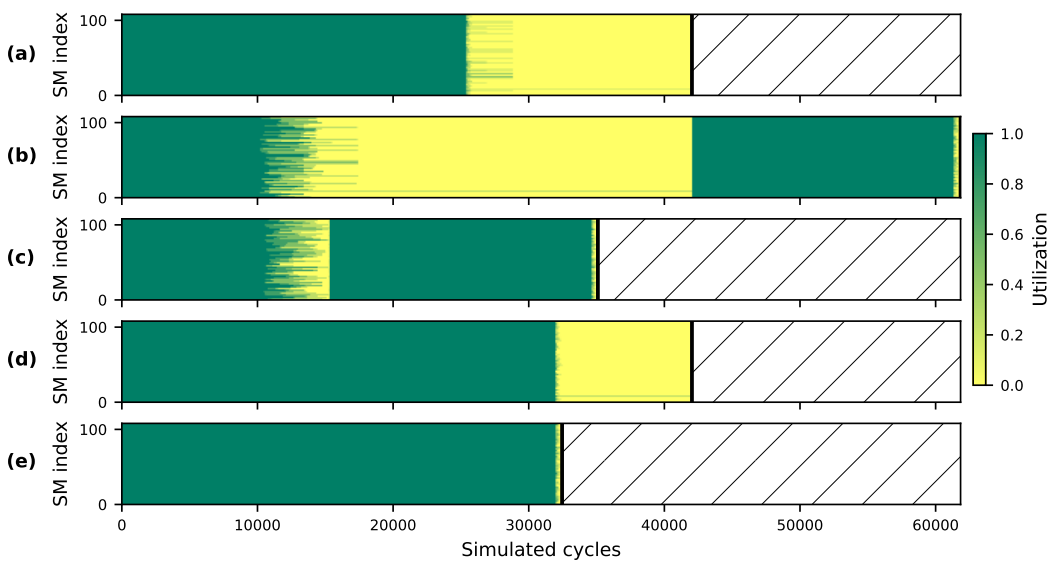

Figure 32: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 61{,}839$, $T/T^* = 1.471$ (critical path), 0.68×; (c) $T = 35{,}098$, $T/T^* = 1.096$ (slot), 1.20×; (d) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}459$, $T/T^* = 1.014$ (slot), 1.29×.

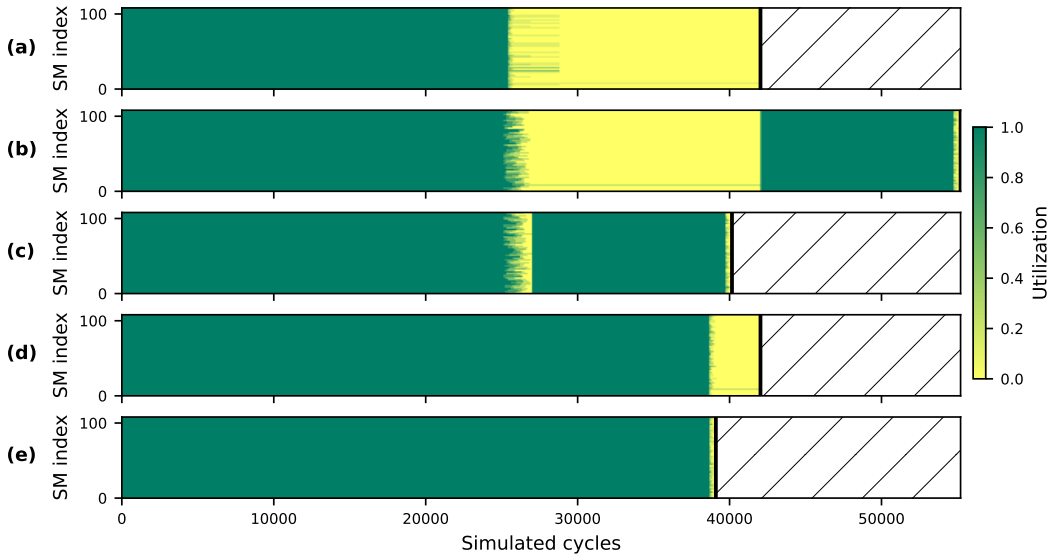

Figure 33: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}204$, $T/T^* = 1.313$ (critical path), 0.76×; (c) $T = 40{,}159$, $T/T^* = 1.039$ (slot), 1.05×; (d) $T = 42{,}034$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}097$, $T/T^* = 1.011$ (slot), 1.08×.

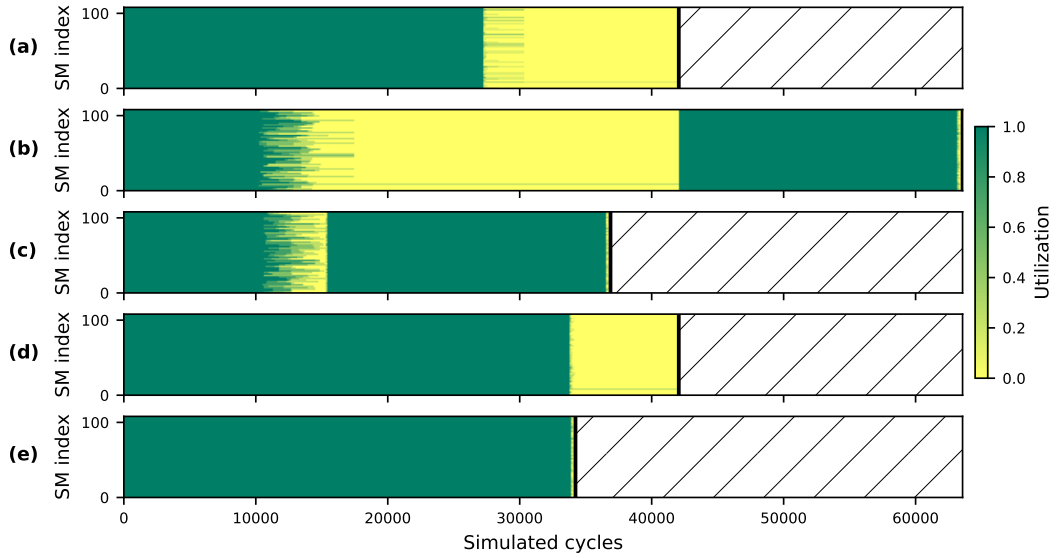

Figure 34: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}054$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 63{,}560$, $T/T^* = 1.511$ (critical path), 0.66×; (c) $T = 36{,}879$, $T/T^* = 1.090$ (slot), 1.14×; (d) $T = 42{,}054$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 34{,}226$, $T/T^* = 1.012$ (slot), 1.23×.

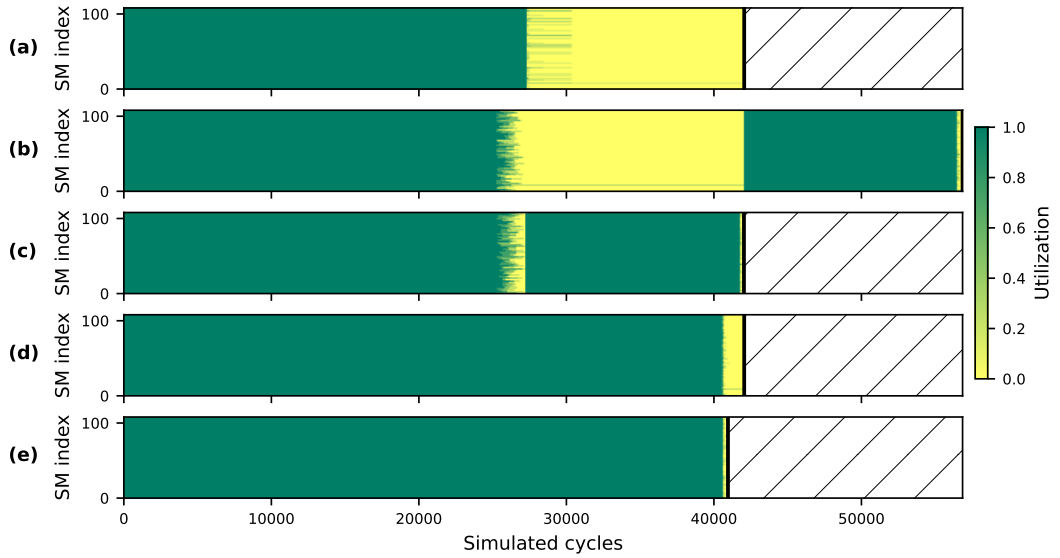

Figure 35: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}054$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 56{,}856$, $T/T^* = 1.352$ (critical path), 0.74×; (c) $T = 42{,}036$, $T/T^* = 1.036$ (slot), 1.00×; (d) $T = 42{,}054$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 40{,}953$, $T/T^* = 1.010$ (slot), 1.03×.

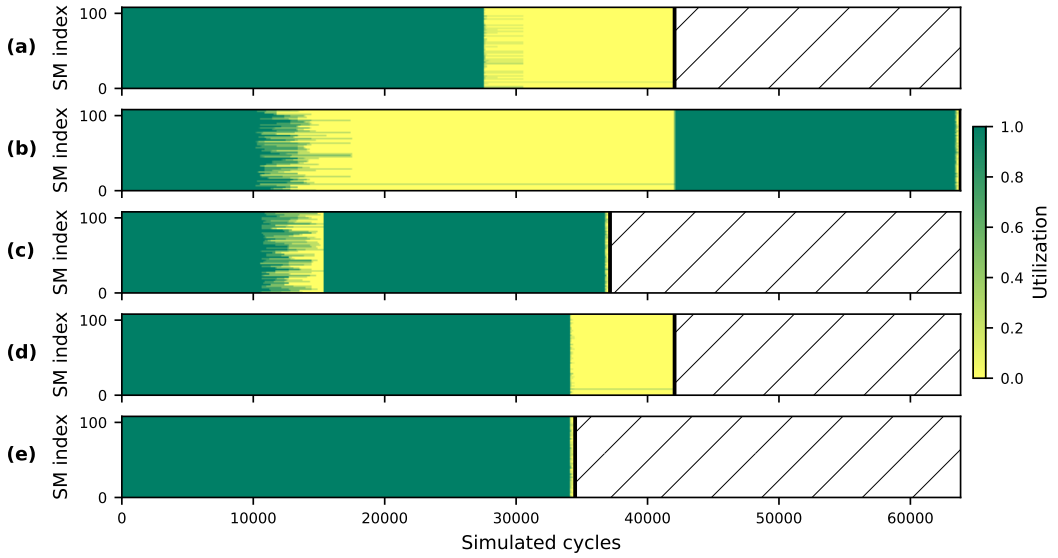

Figure 36: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}057$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 63{,}818$, $T/T^* = 1.517$ (critical path), 0.66×; (c) $T = 37{,}146$, $T/T^* = 1.089$ (slot), 1.13×; (d) $T = 42{,}057$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 34{,}491$, $T/T^* = 1.011$ (slot), 1.22×.

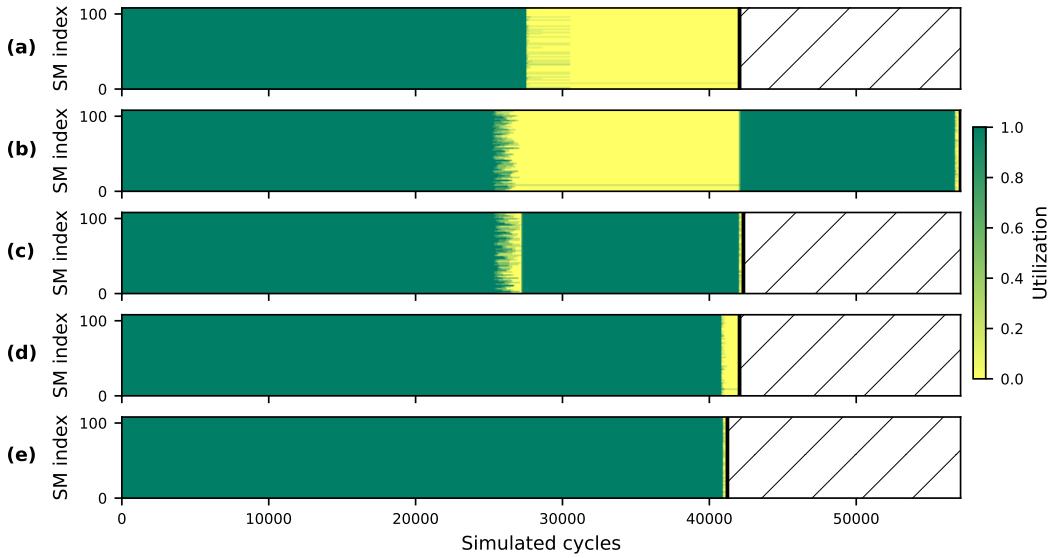

Figure 37: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}057$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 57{,}104$, $T/T^* = 1.358$ (critical path), 0.74×; (c) $T = 42{,}319$, $T/T^* = 1.036$ (slot), 0.99×; (d) $T = 42{,}057$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 41{,}230$, $T/T^* = 1.009$ (slot), 1.02×.

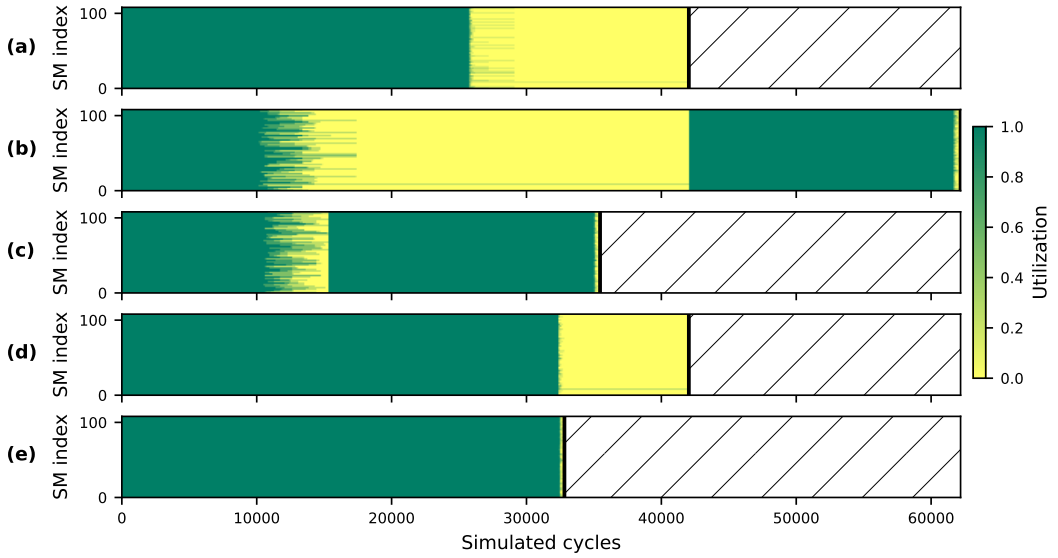

Figure 38: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}038$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 62{,}184$, $T/T^* = 1.479$ (critical path), 0.68×; (c) $T = 35{,}455$, $T/T^* = 1.095$ (slot), 1.19×; (d) $T = 42{,}038$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}813$, $T/T^* = 1.013$ (slot), 1.28×.

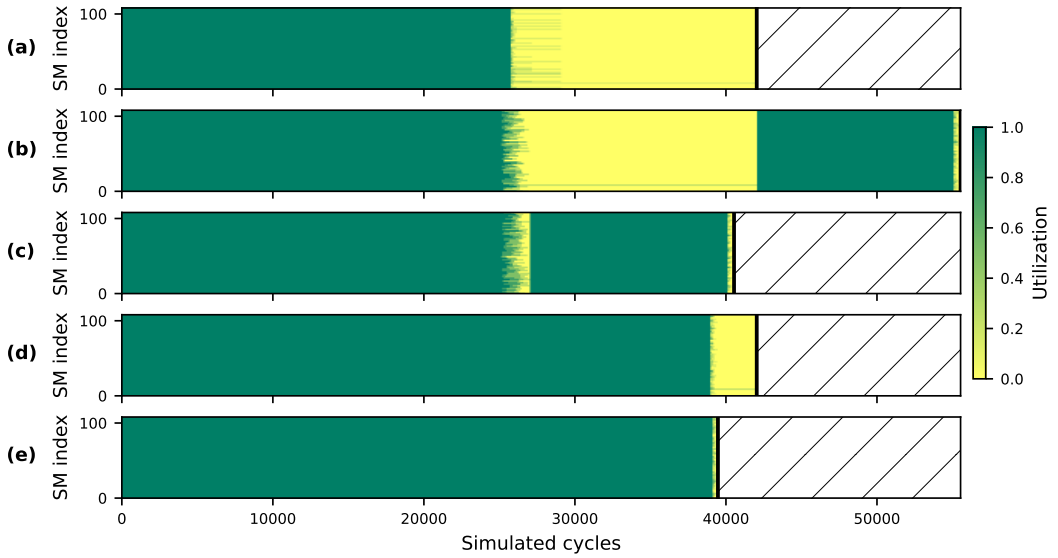

Figure 39: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}038$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}535$, $T/T^* = 1.321$ (critical path), 0.76×; (c) $T = 40{,}536$, $T/T^* = 1.038$ (slot), 1.04×; (d) $T = 42{,}038$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}469$, $T/T^* = 1.011$ (slot), 1.07×.

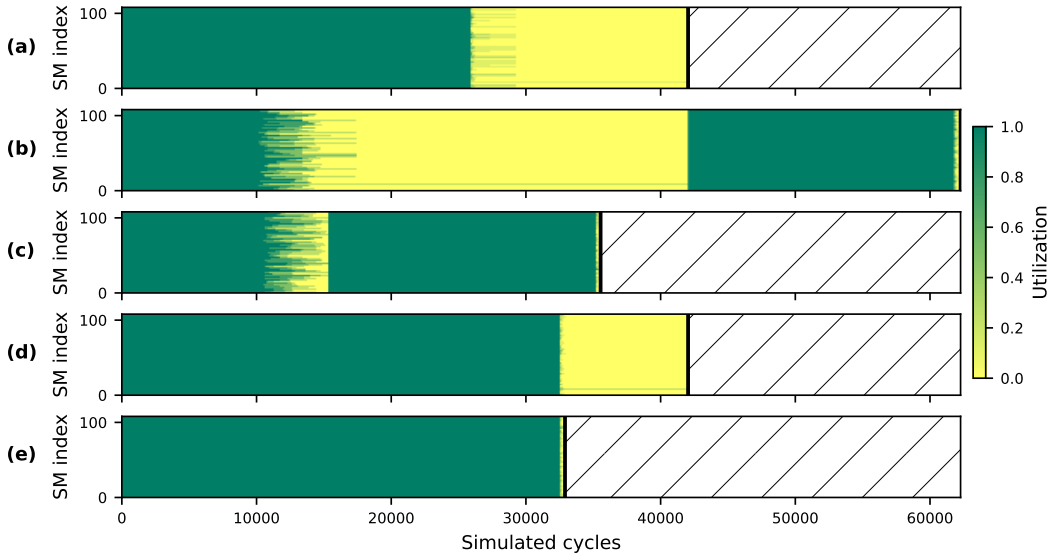

Figure 40: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (842 of them). Edge slices in (c) and (e) hold 6,323 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}039$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 62{,}269$, $T/T^* = 1.481$ (critical path), 0.68×; (c) $T = 35{,}543$, $T/T^* = 1.095$ (slot), 1.18×; (d) $T = 42{,}039$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 32{,}901$, $T/T^* = 1.013$ (slot), 1.28×.

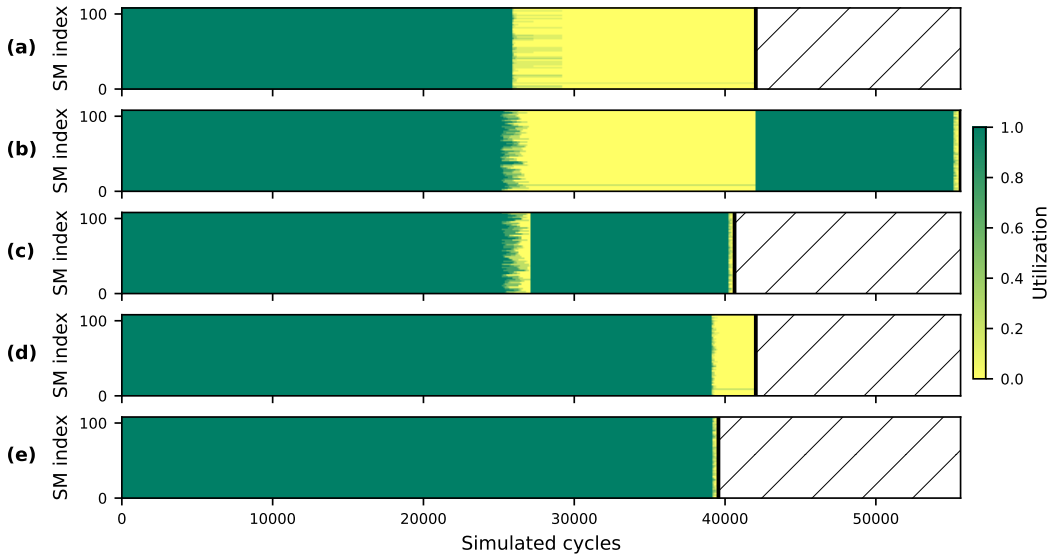

Figure 41: Per-SM occupancy over time for `avazu-ctr` ($N = 76{,}269$ vertices, $E = 22{,}044{,}423$ edges, mean degree 289.0, maximum degree 42,032, skew 145×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (3,814 of them). Edge slices in (c) and (e) hold 12,951 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}039$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 55{,}617$, $T/T^* = 1.323$ (critical path), 0.76×; (c) $T = 40{,}629$, $T/T^* = 1.038$ (slot), 1.03×; (d) $T = 42{,}039$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 39{,}561$, $T/T^* = 1.011$ (slot), 1.06×.

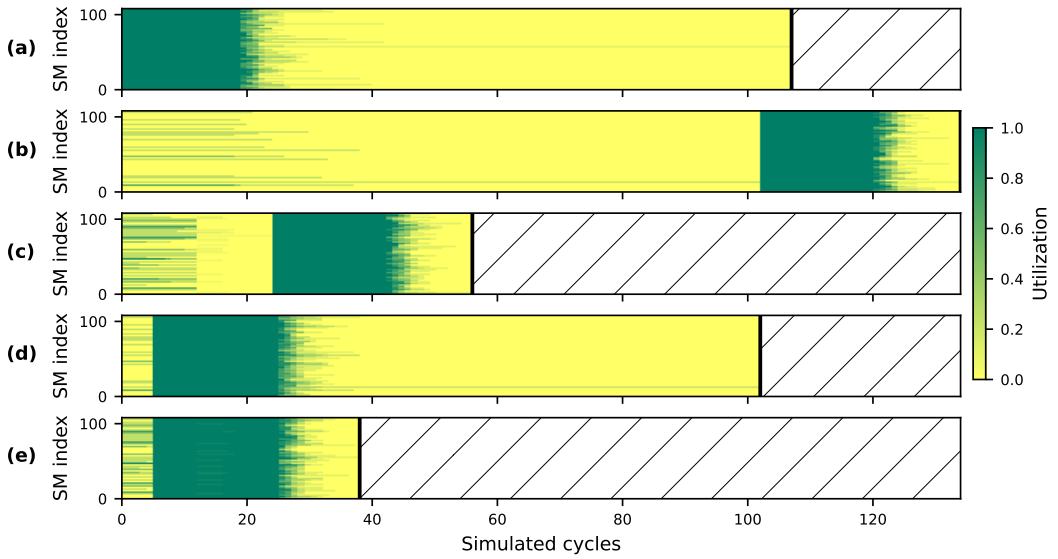

Figure 42: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 107$, $T/T^* = 1.049$ (critical path), 1.00×; (b) $T = 134$, $T/T^* = 1.314$ (critical path), 0.80×; (c) $T = 56$, $T/T^* = 2.372$ (slot), 1.91×; (d) $T = 102$, $T/T^* = 1.000$ (critical path), 1.05×; (e) $T = 38$, $T/T^* = 1.609$ (slot), 2.82×.

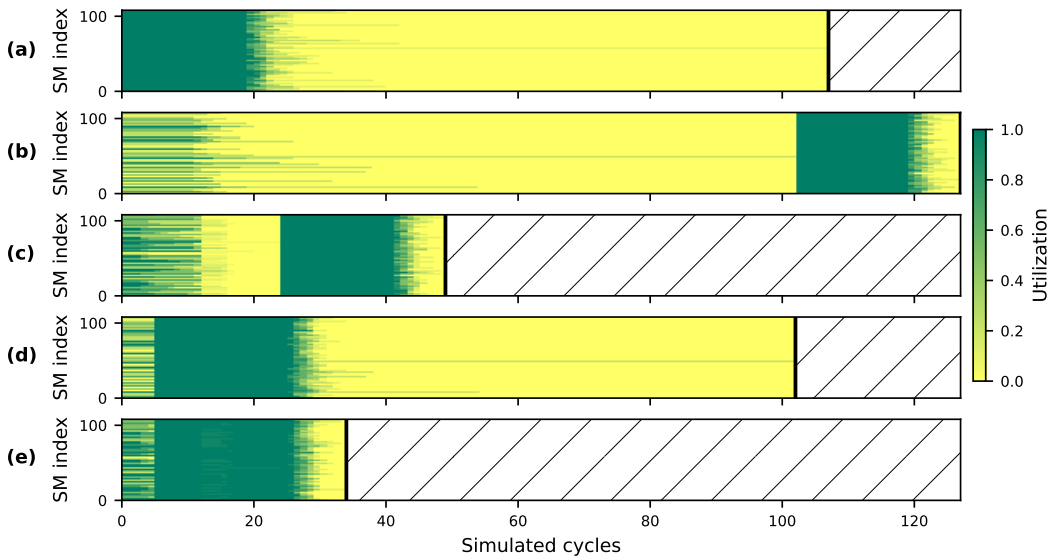

Figure 43: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 107$, $T/T^* = 1.049$ (critical path), 1.00×; (b) $T = 127$, $T/T^* = 1.245$ (critical path), 0.84×; (c) $T = 49$, $T/T^* = 1.873$ (slot), 2.18×; (d) $T = 102$, $T/T^* = 1.000$ (critical path), 1.05×; (e) $T = 34$, $T/T^* = 1.300$ (slot), 3.15×.

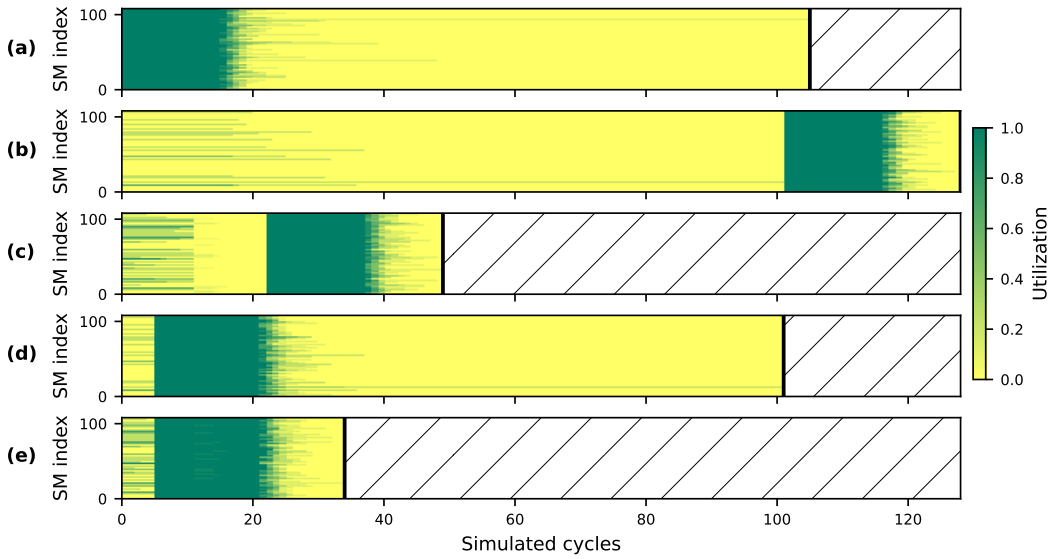

Figure 44: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 105$, $T/T^* = 1.040$ (critical path), 1.00×; (b) $T = 128$, $T/T^* = 1.267$ (critical path), 0.82×; (c) $T = 49$, $T/T^* = 2.507$ (slot), 2.14×; (d) $T = 101$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 34$, $T/T^* = 1.740$ (slot), 3.09×.

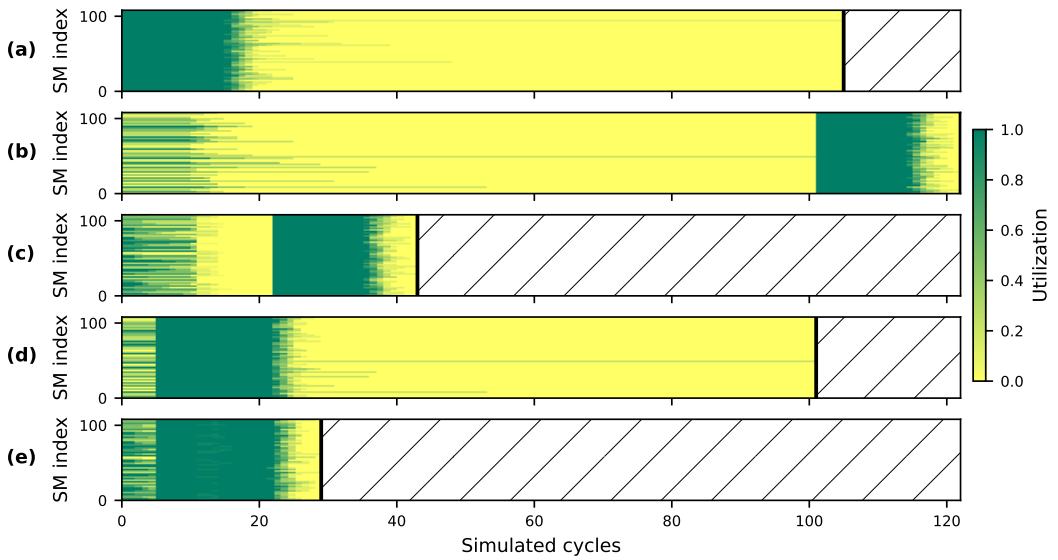

Figure 45: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 105$, $T/T^* = 1.040$ (critical path), 1.00×; (b) $T = 122$, $T/T^* = 1.208$ (critical path), 0.86×; (c) $T = 43$, $T/T^* = 1.982$ (slot), 2.44×; (d) $T = 101$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 29$, $T/T^* = 1.337$ (slot), 3.62×.

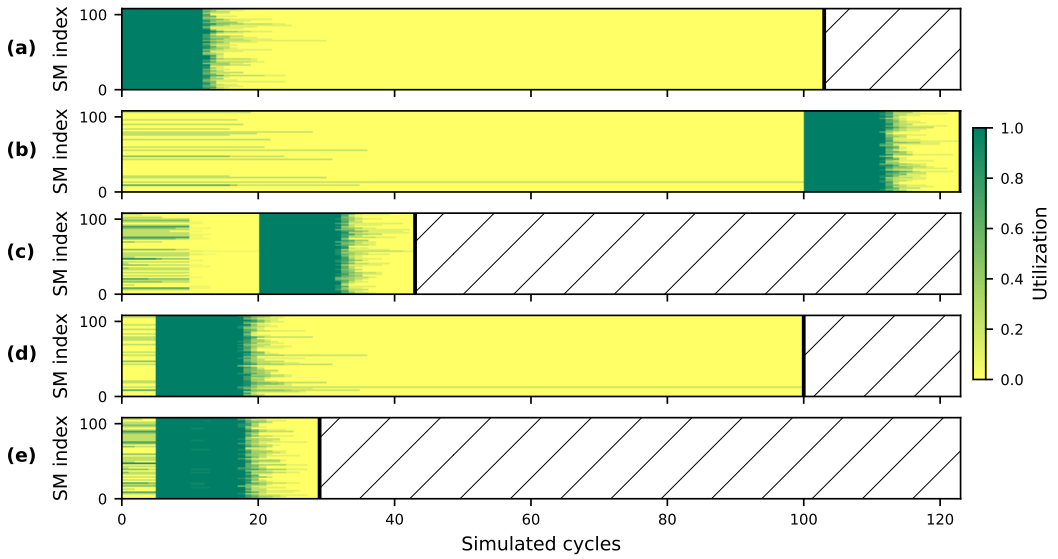

Figure 46: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 103$, $T/T^* = 1.030$ (critical path), 1.00×; (b) $T = 123$, $T/T^* = 1.230$ (critical path), 0.84×; (c) $T = 43$, $T/T^* = 2.778$ (slot), 2.40×; (d) $T = 100$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 29$, $T/T^* = 1.874$ (slot), 3.55×.

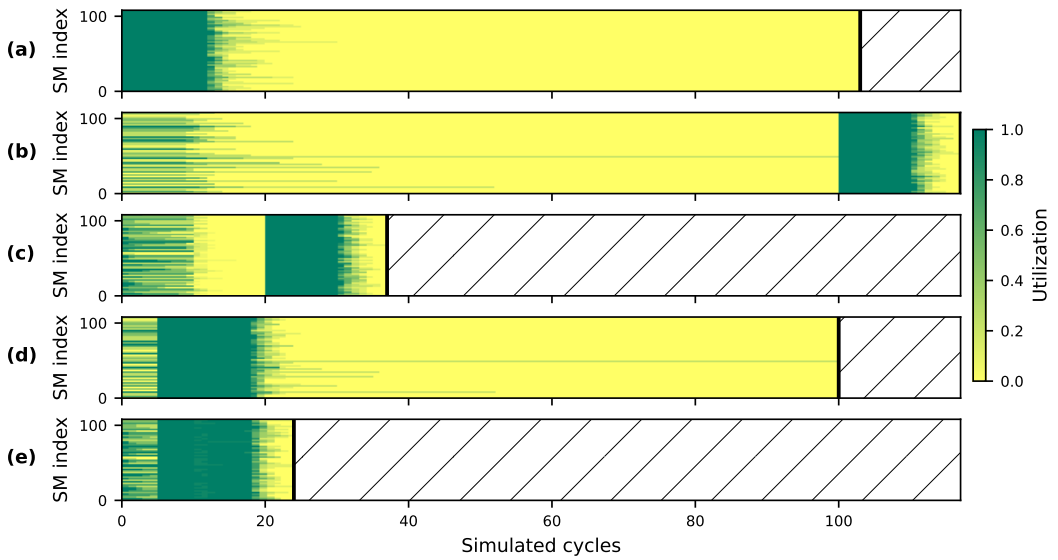

Figure 47: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 103$, $T/T^* = 1.030$ (critical path), 1.00×; (b) $T = 117$, $T/T^* = 1.170$ (critical path), 0.88×; (c) $T = 37$, $T/T^* = 2.147$ (slot), 2.78×; (d) $T = 100$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 24$, $T/T^* = 1.393$ (slot), 4.29×.

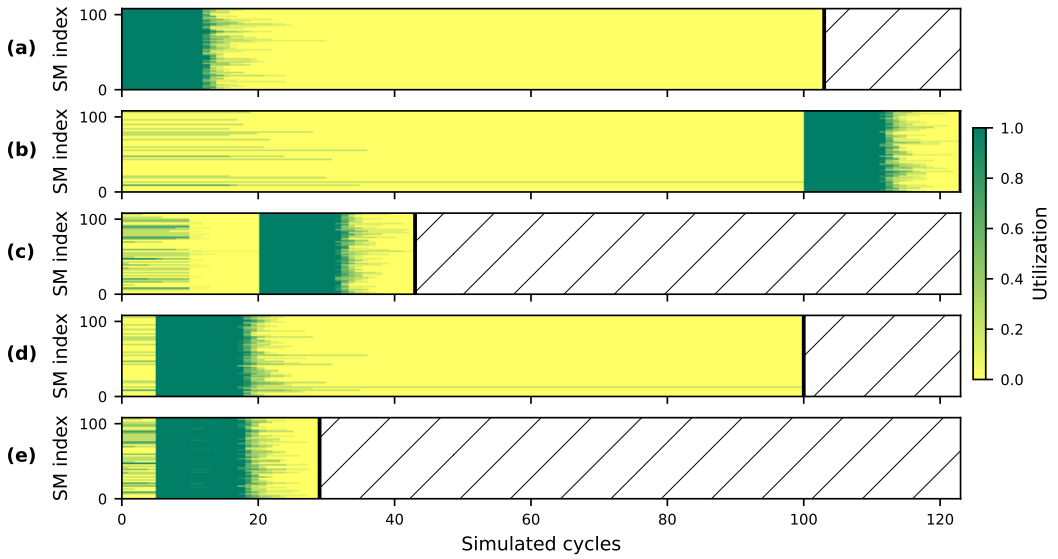

Figure 48: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 103$, $T/T^* = 1.030$ (critical path), 1.00×; (b) $T = 123$, $T/T^* = 1.230$ (critical path), 0.84×; (c) $T = 43$, $T/T^* = 2.778$ (slot), 2.40×; (d) $T = 100$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 29$, $T/T^* = 1.874$ (slot), 3.55×.

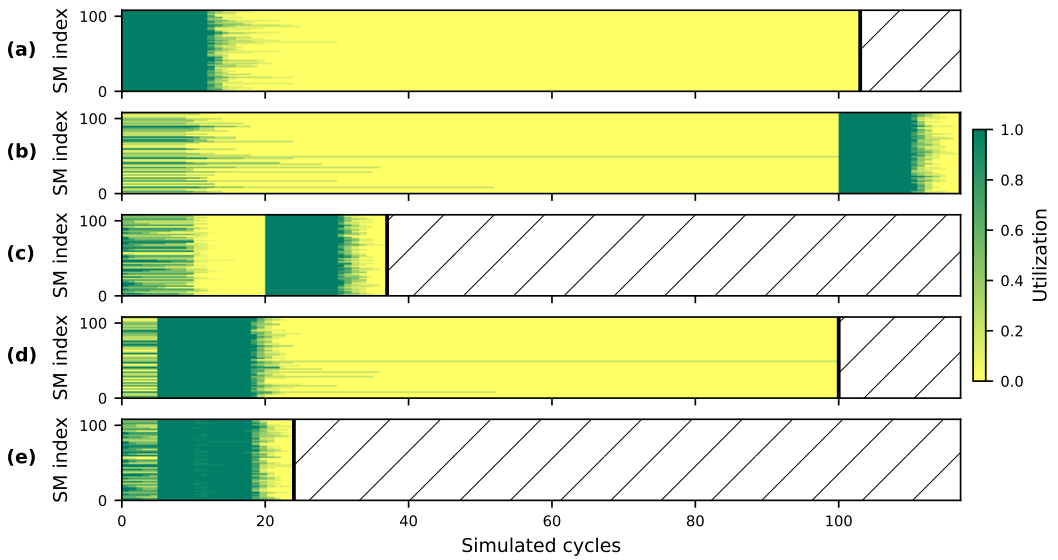

Figure 49: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 103$, $T/T^* = 1.030$ (critical path), 1.00×; (b) $T = 117$, $T/T^* = 1.170$ (critical path), 0.88×; (c) $T = 37$, $T/T^* = 2.147$ (slot), 2.78×; (d) $T = 100$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 24$, $T/T^* = 1.393$ (slot), 4.29×.

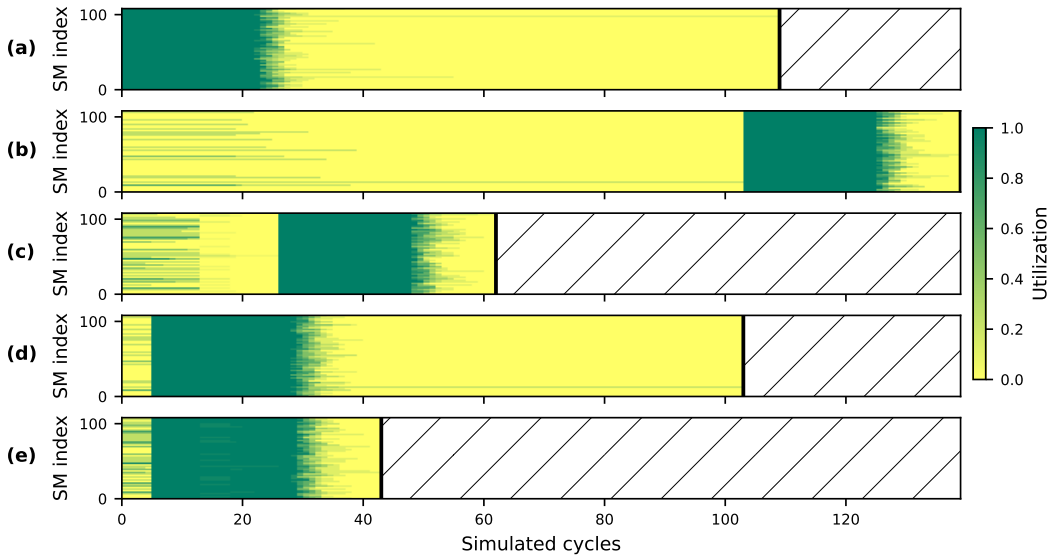

Figure 50: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 109$, $T/T^* = 1.058$ (critical path), 1.00×; (b) $T = 139$, $T/T^* = 1.350$ (critical path), 0.78×; (c) $T = 62$, $T/T^* = 2.240$ (slot), 1.76×; (d) $T = 103$, $T/T^* = 1.000$ (critical path), 1.06×; (e) $T = 43$, $T/T^* = 1.554$ (slot), 2.53×.

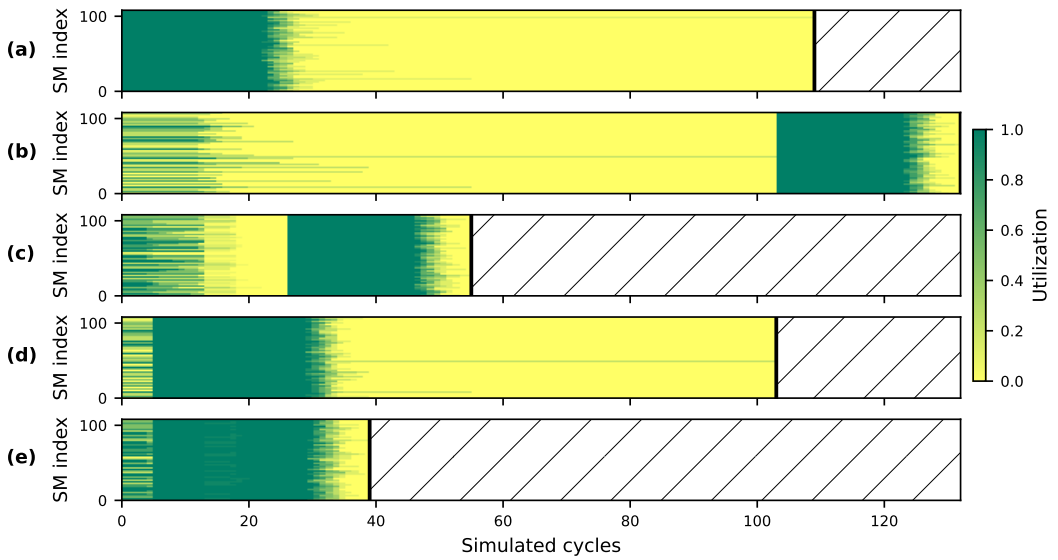

Figure 51: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 109$, $T/T^* = 1.058$ (critical path), 1.00×; (b) $T = 132$, $T/T^* = 1.282$ (critical path), 0.83×; (c) $T = 55$, $T/T^* = 1.796$ (slot), 1.98×; (d) $T = 103$, $T/T^* = 1.000$ (critical path), 1.06×; (e) $T = 39$, $T/T^* = 1.274$ (slot), 2.79×.

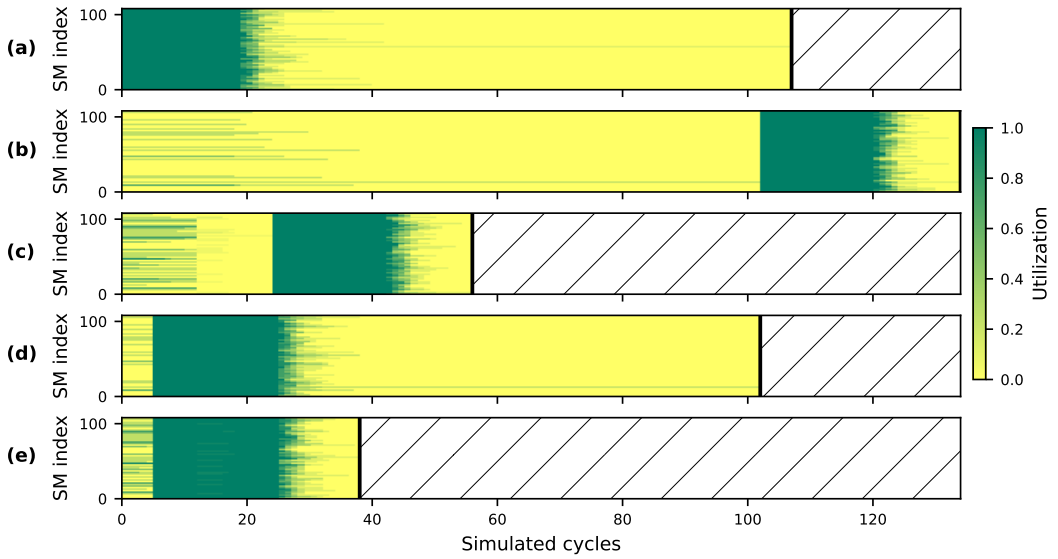

Figure 52: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 107$, $T/T^* = 1.049$ (critical path), 1.00×; (b) $T = 134$, $T/T^* = 1.314$ (critical path), 0.80×; (c) $T = 56$, $T/T^* = 2.372$ (slot), 1.91×; (d) $T = 102$, $T/T^* = 1.000$ (critical path), 1.05×; (e) $T = 38$, $T/T^* = 1.609$ (slot), 2.82×.

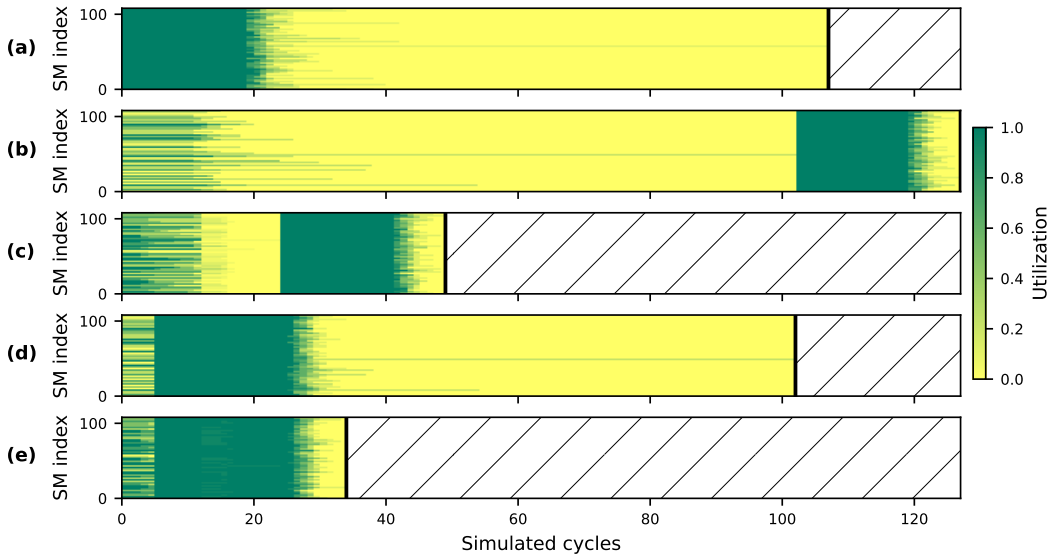

Figure 53: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 107$, $T/T^* = 1.049$ (critical path), 1.00×; (b) $T = 127$, $T/T^* = 1.245$ (critical path), 0.84×; (c) $T = 49$, $T/T^* = 1.873$ (slot), 2.18×; (d) $T = 102$, $T/T^* = 1.000$ (critical path), 1.05×; (e) $T = 34$, $T/T^* = 1.300$ (slot), 3.15×.

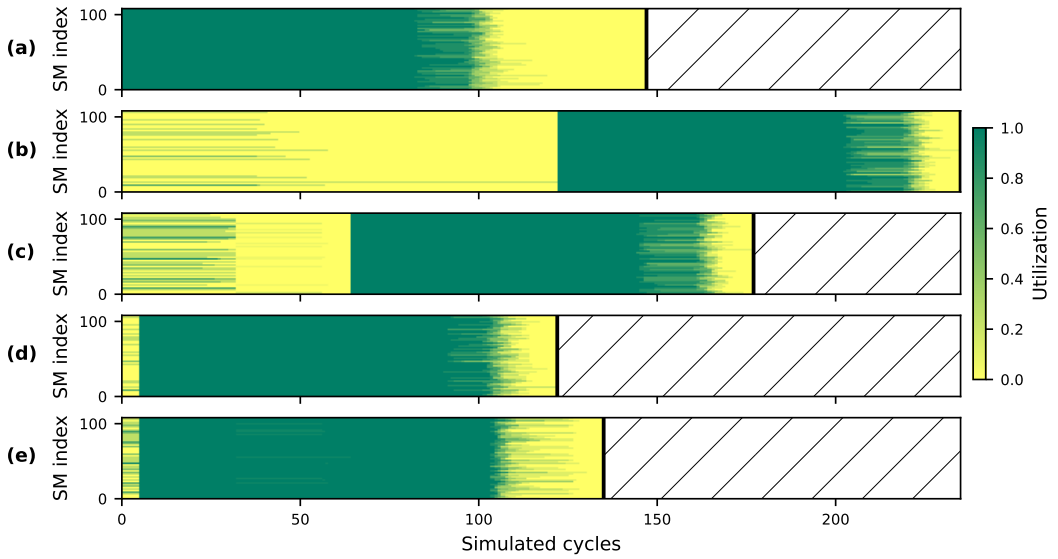

Figure 54: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 147$, $T/T^* = 1.205$ (critical path), 1.00×; (b) $T = 235$, $T/T^* = 1.926$ (critical path), 0.63×; (c) $T = 177$, $T/T^* = 1.686$ (slot), 0.83×; (d) $T = 122$, $T/T^* = 1.000$ (critical path), 1.20×; (e) $T = 135$, $T/T^* = 1.286$ (slot), 1.09×.

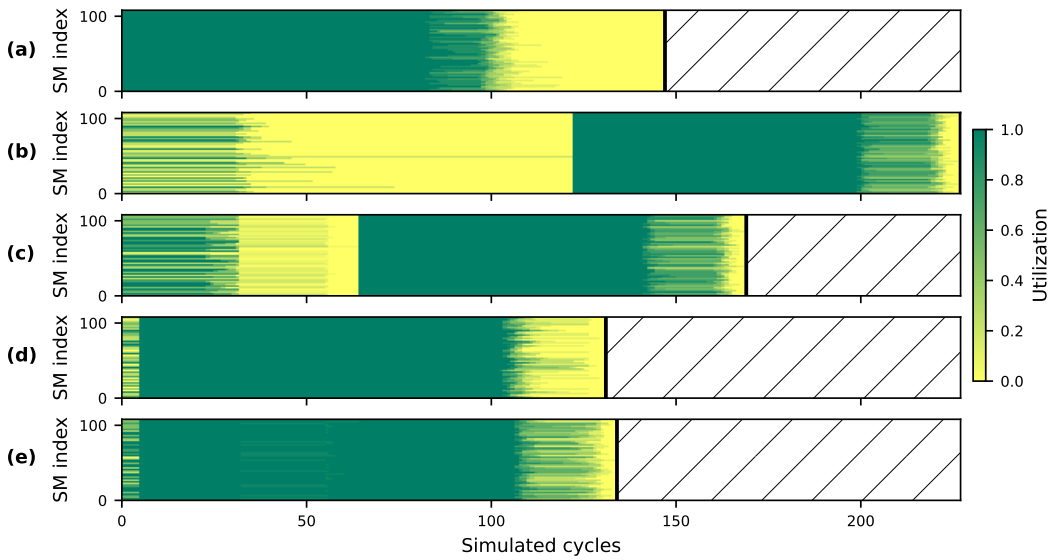

Figure 55: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 147$, $T/T^* = 1.205$ (critical path), 1.00×; (b) $T = 227$, $T/T^* = 1.861$ (critical path), 0.65×; (c) $T = 169$, $T/T^* = 1.465$ (slot), 0.87×; (d) $T = 131$, $T/T^* = 1.074$ (critical path), 1.12×; (e) $T = 134$, $T/T^* = 1.161$ (slot), 1.10×.

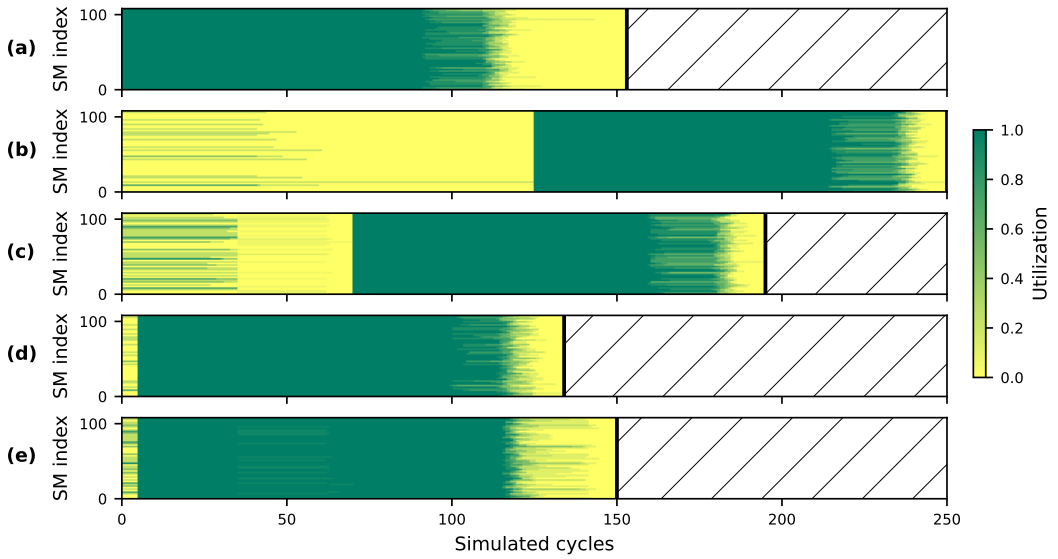

Figure 56: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 153$, $T/T^* = 1.224$ (critical path), 1.00×; (b) $T = 250$, $T/T^* = 2.000$ (critical path), 0.61×; (c) $T = 195$, $T/T^* = 1.664$ (slot), 0.78×; (d) $T = 134$, $T/T^* = 1.072$ (critical path), 1.14×; (e) $T = 150$, $T/T^* = 1.280$ (slot), 1.02×.

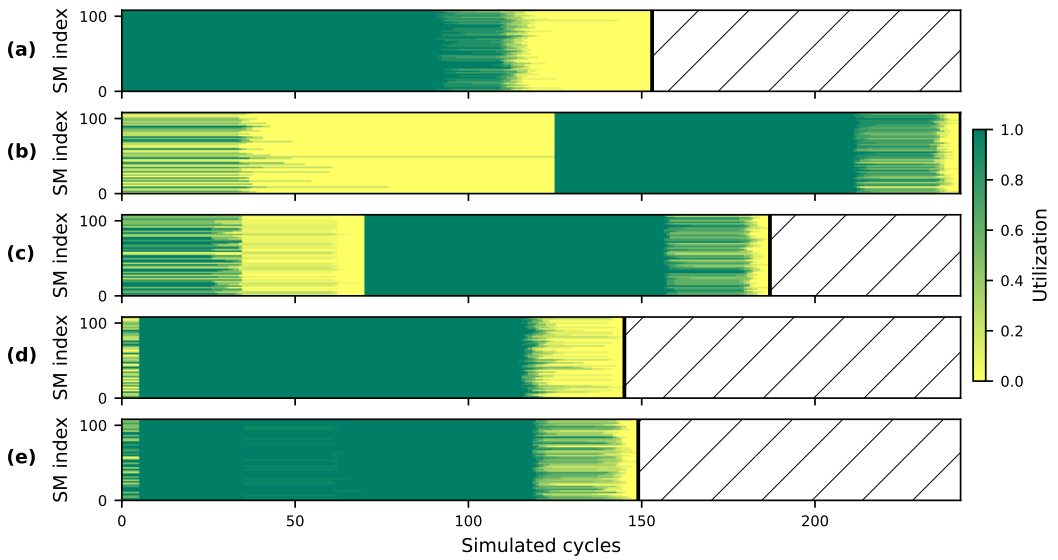

Figure 57: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 153$, $T/T^* = 1.224$ (critical path), 1.00×; (b) $T = 242$, $T/T^* = 1.936$ (critical path), 0.63×; (c) $T = 187$, $T/T^* = 1.452$ (slot), 0.82×; (d) $T = 145$, $T/T^* = 1.160$ (critical path), 1.06×; (e) $T = 149$, $T/T^* = 1.157$ (slot), 1.03×.

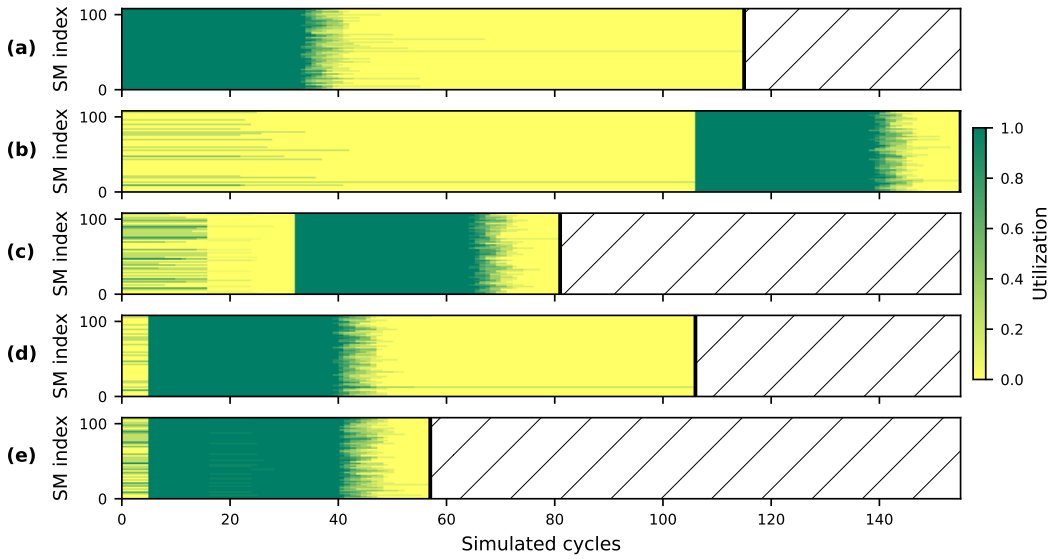

Figure 58: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 115$, $T/T^* = 1.085$ (critical path), 1.00×; (b) $T = 155$, $T/T^* = 1.462$ (critical path), 0.74×; (c) $T = 81$, $T/T^* = 2.031$ (slot), 1.42×; (d) $T = 106$, $T/T^* = 1.000$ (critical path), 1.08×; (e) $T = 57$, $T/T^* = 1.429$ (slot), 2.02×.

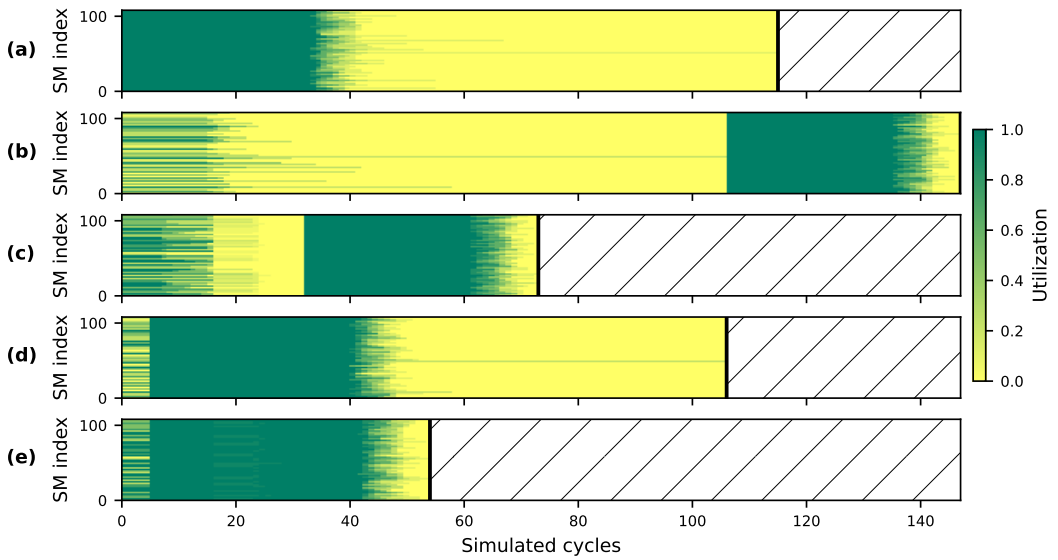

Figure 59: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 115$, $T/T^* = 1.085$ (critical path), 1.00×; (b) $T = 147$, $T/T^* = 1.387$ (critical path), 0.78×; (c) $T = 73$, $T/T^* = 1.659$ (slot), 1.58×; (d) $T = 106$, $T/T^* = 1.000$ (critical path), 1.08×; (e) $T = 54$, $T/T^* = 1.227$ (slot), 2.13×.

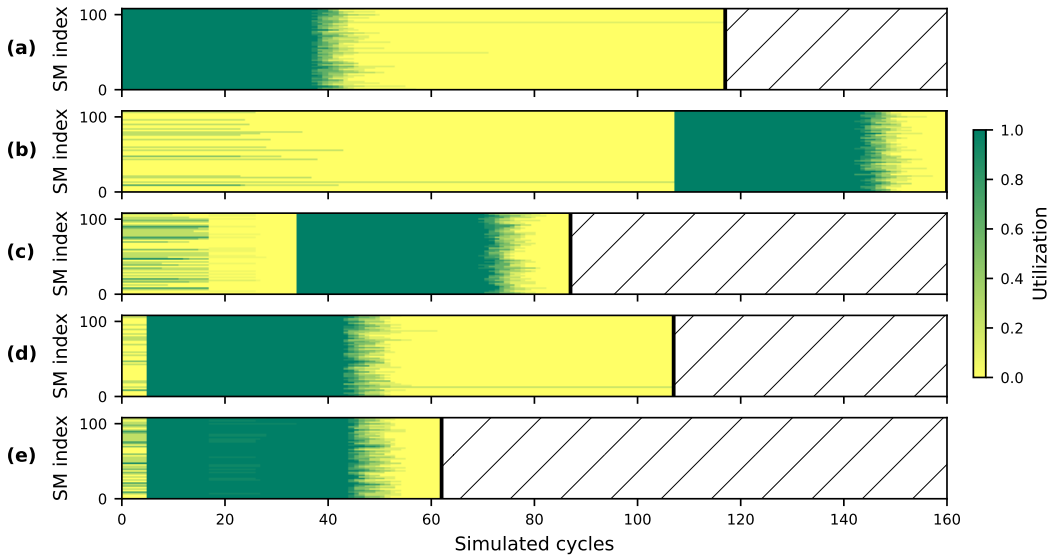

Figure 60: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (38 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 117$, $T/T^* = 1.093$ (critical path), 1.00×; (b) $T = 160$, $T/T^* = 1.495$ (critical path), 0.73×; (c) $T = 87$, $T/T^* = 1.980$ (slot), 1.34×; (d) $T = 107$, $T/T^* = 1.000$ (critical path), 1.09×; (e) $T = 62$, $T/T^* = 1.411$ (slot), 1.89×.

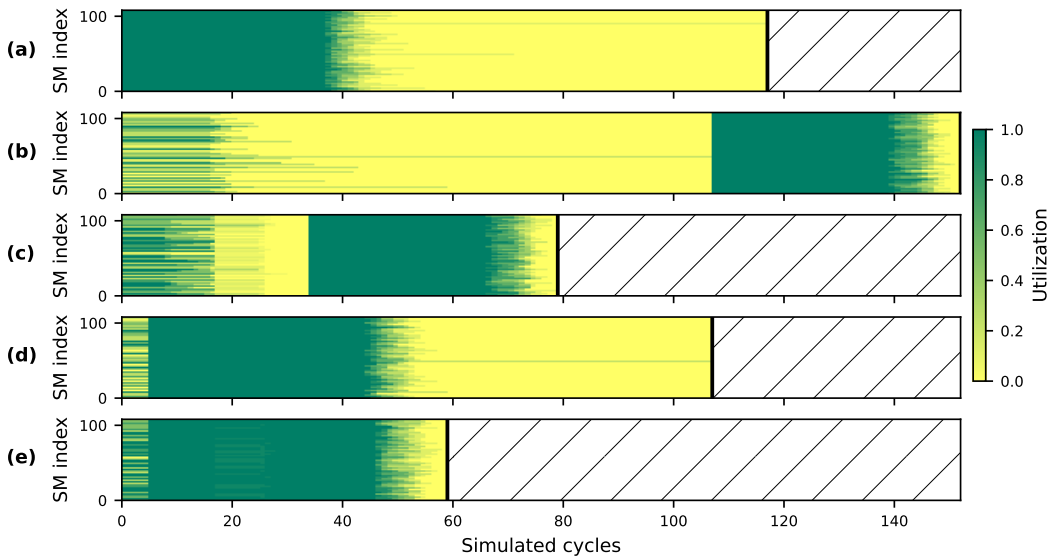

Figure 61: Per-SM occupancy over time for `citeseer` ($N = 3{,}327$ vertices, $E = 12{,}431$ edges, mean degree 3.7, maximum degree 100, skew 27×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (168 of them). Edge slices in (c) and (e) hold 10 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 117$, $T/T^* = 1.093$ (critical path), 1.00×; (b) $T = 152$, $T/T^* = 1.421$ (critical path), 0.77×; (c) $T = 79$, $T/T^* = 1.630$ (slot), 1.48×; (d) $T = 107$, $T/T^* = 1.000$ (critical path), 1.09×; (e) $T = 59$, $T/T^* = 1.217$ (slot), 1.98×.

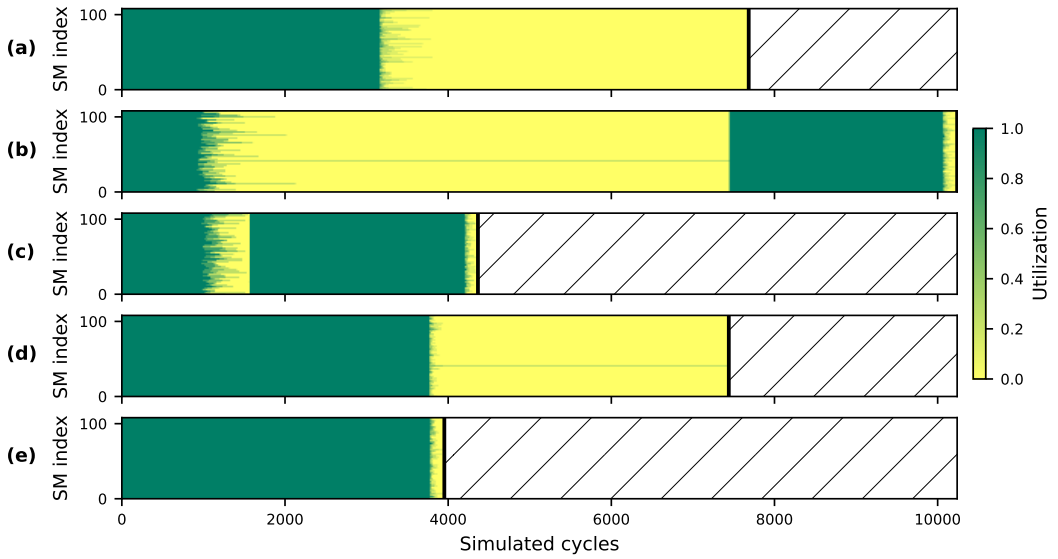

Figure 62: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}684$, $T/T^* = 1.033$ (critical path), 1.00×; (b) $T = 10{,}239$, $T/T^* = 1.376$ (critical path), 0.75×; (c) $T = 4{,}365$, $T/T^* = 1.151$ (slot), 1.76×; (d) $T = 7{,}440$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}953$, $T/T^* = 1.042$ (slot), 1.94×.

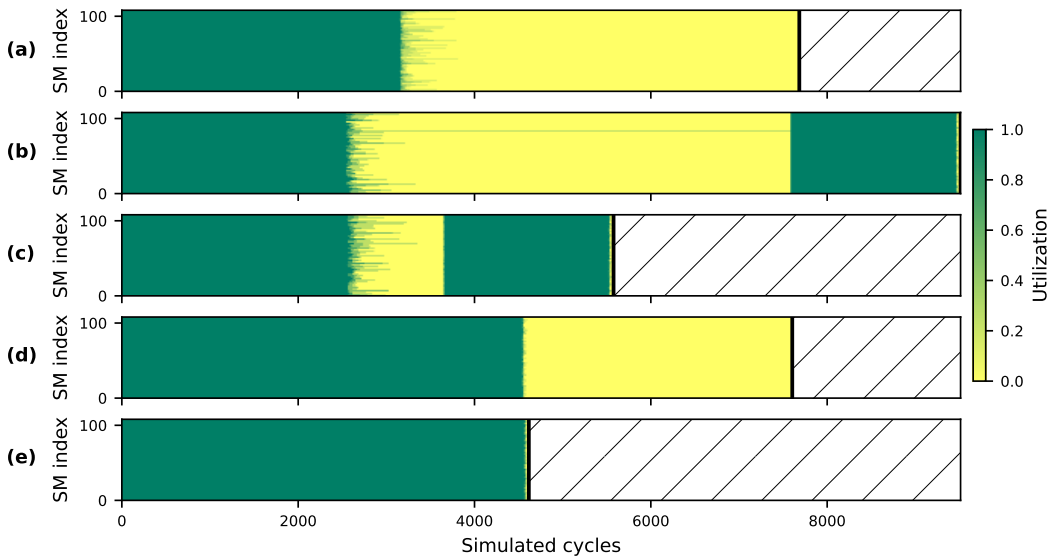

Figure 63: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}684$, $T/T^* = 1.033$ (critical path), 1.00×; (b) $T = 9{,}513$, $T/T^* = 1.279$ (critical path), 0.81×; (c) $T = 5{,}577$, $T/T^* = 1.221$ (slot), 1.38×; (d) $T = 7{,}604$, $T/T^* = 1.022$ (critical path), 1.01×; (e) $T = 4{,}616$, $T/T^* = 1.011$ (slot), 1.66×.

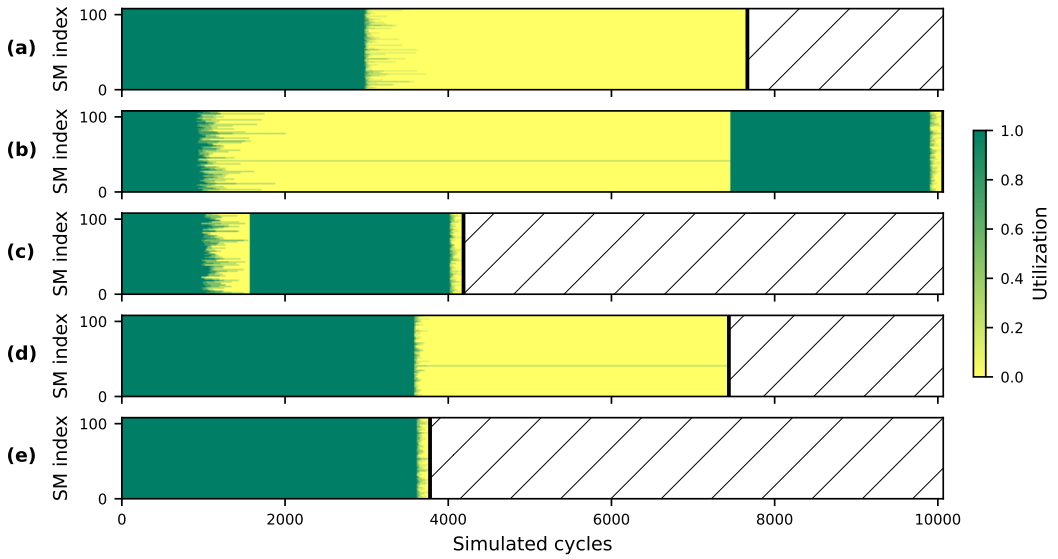

Figure 64: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}666$, $T/T^* = 1.031$ (critical path), 1.00×; (b) $T = 10{,}066$, $T/T^* = 1.353$ (critical path), 0.76×; (c) $T = 4{,}187$, $T/T^* = 1.157$ (slot), 1.83×; (d) $T = 7{,}439$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}777$, $T/T^* = 1.044$ (slot), 2.03×.

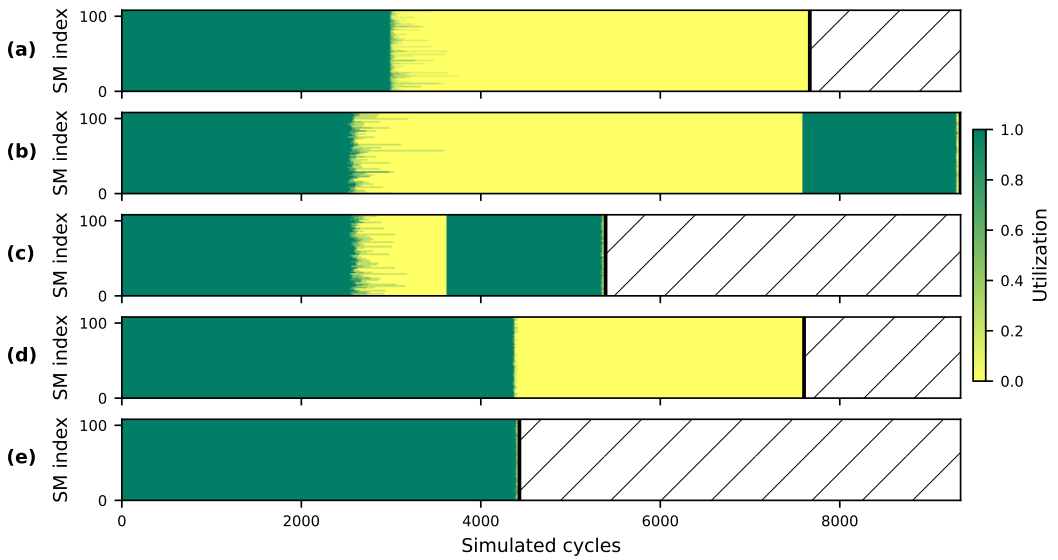

Figure 65: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}666$, $T/T^* = 1.031$ (critical path), 1.00×; (b) $T = 9{,}346$, $T/T^* = 1.256$ (critical path), 0.82×; (c) $T = 5{,}390$, $T/T^* = 1.230$ (slot), 1.42×; (d) $T = 7{,}602$, $T/T^* = 1.022$ (critical path), 1.01×; (e) $T = 4{,}430$, $T/T^* = 1.011$ (slot), 1.73×.

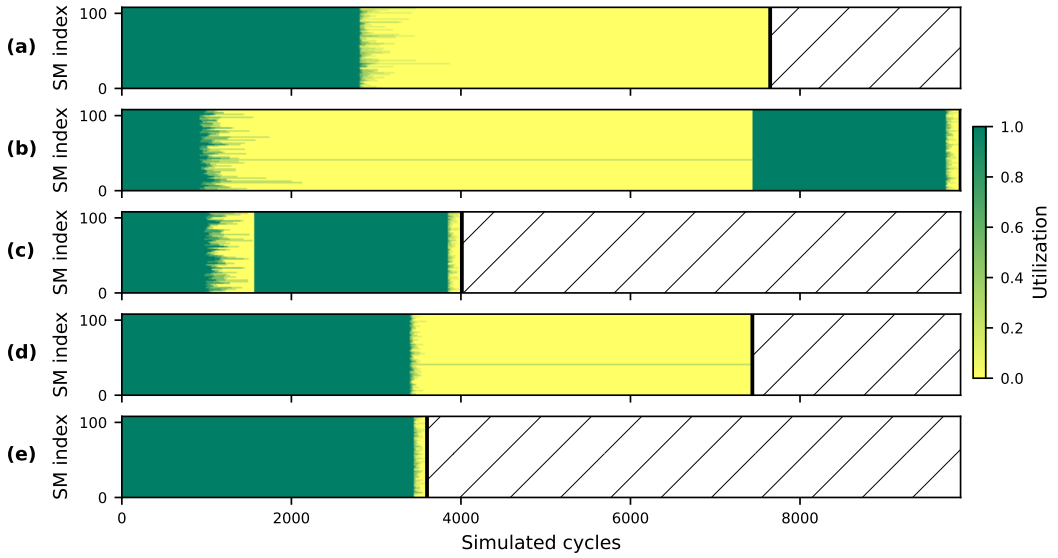

Figure 66: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}648$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 9{,}894$, $T/T^* = 1.330$ (critical path), 0.77×; (c) $T = 4{,}011$, $T/T^* = 1.165$ (slot), 1.91×; (d) $T = 7{,}438$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}600$, $T/T^* = 1.046$ (slot), 2.12×.

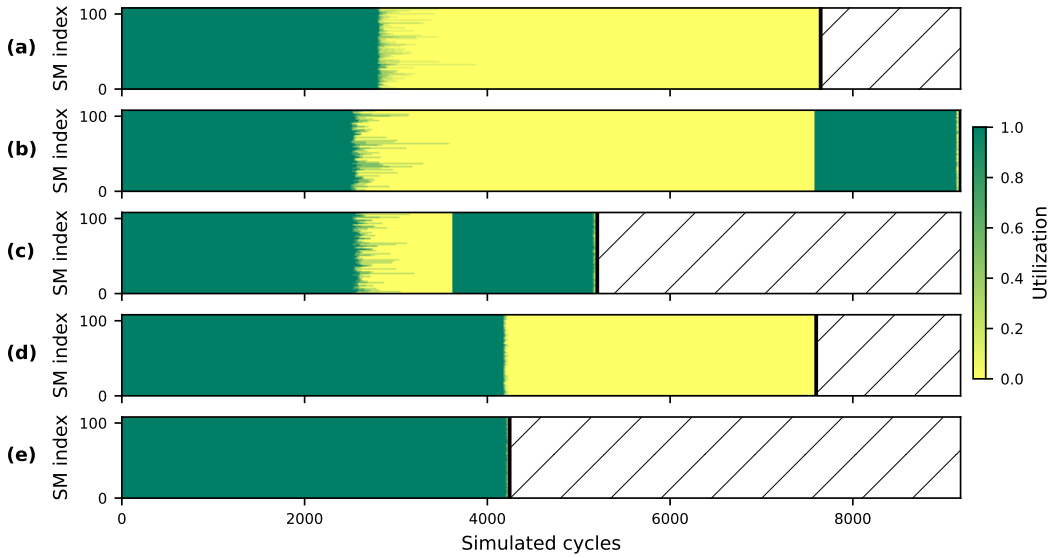

Figure 67: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}648$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 9{,}179$, $T/T^* = 1.234$ (critical path), 0.83×; (c) $T = 5{,}203$, $T/T^* = 1.240$ (slot), 1.47×; (d) $T = 7{,}599$, $T/T^* = 1.022$ (critical path), 1.01×; (e) $T = 4{,}244$, $T/T^* = 1.012$ (slot), 1.80×.

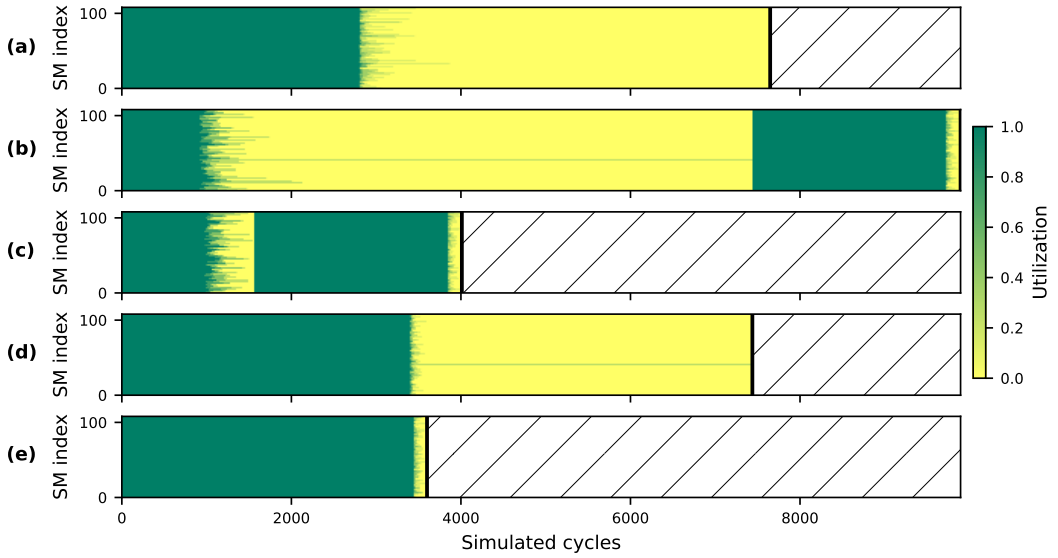

Figure 68: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}648$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 9{,}894$, $T/T^* = 1.330$ (critical path), 0.77×; (c) $T = 4{,}011$, $T/T^* = 1.165$ (slot), 1.91×; (d) $T = 7{,}438$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}600$, $T/T^* = 1.046$ (slot), 2.12×.

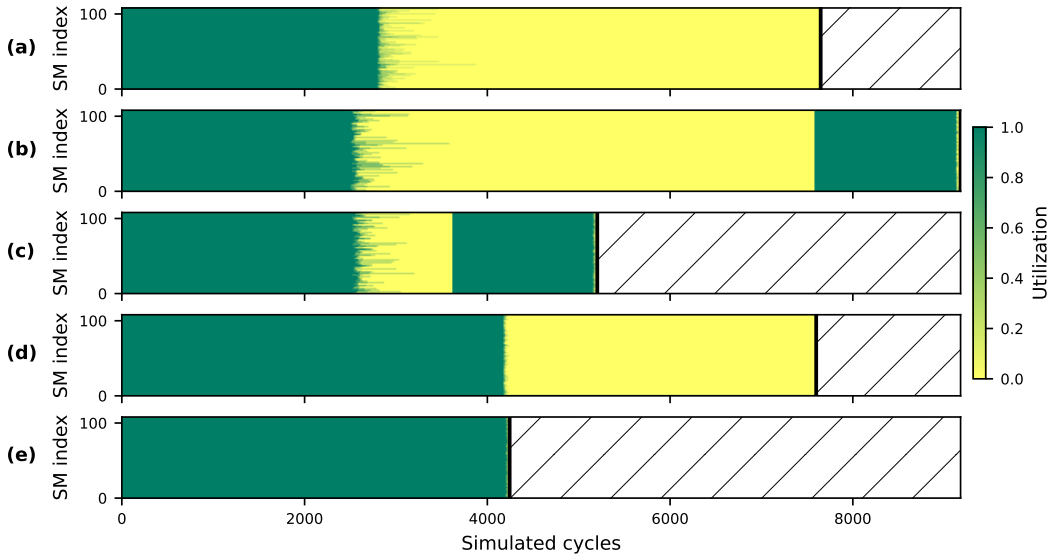

Figure 69: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}648$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 9{,}179$, $T/T^* = 1.234$ (critical path), 0.83×; (c) $T = 5{,}203$, $T/T^* = 1.240$ (slot), 1.47×; (d) $T = 7{,}599$, $T/T^* = 1.022$ (critical path), 1.01×; (e) $T = 4{,}244$, $T/T^* = 1.012$ (slot), 1.80×.

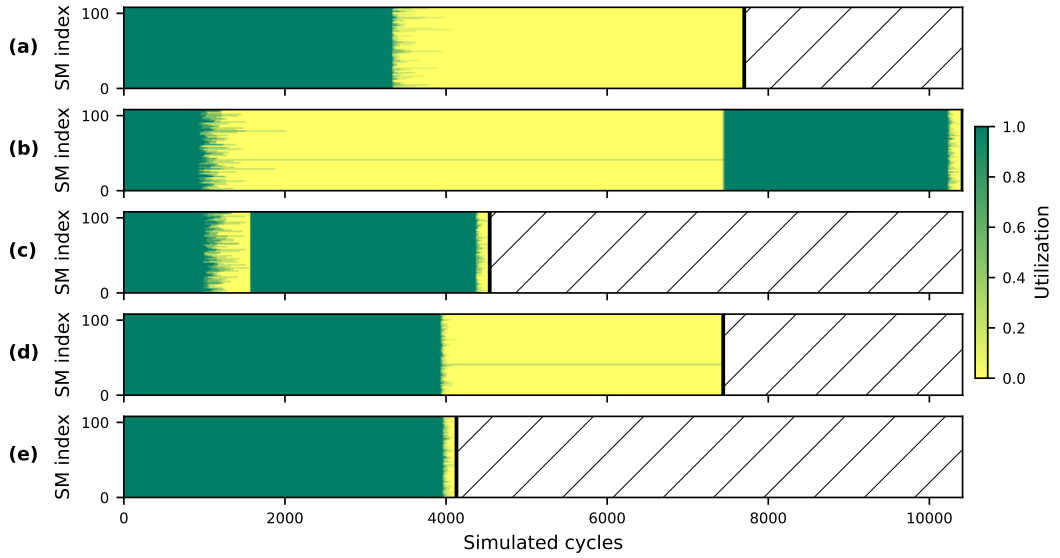

Figure 70: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew $446\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}702$, $T/T^* = 1.035$ (critical path), $1.00\times$; (b) $T = 10{,}412$, $T/T^* = 1.399$ (critical path), $0.74\times$; (c) $T = 4{,}542$, $T/T^* = 1.145$ (slot), $1.70\times$; (d) $T = 7{,}441$, $T/T^* = 1.000$ (critical path), $1.04\times$; (e) $T = 4{,}129$, $T/T^* = 1.041$ (slot), $1.87\times$.

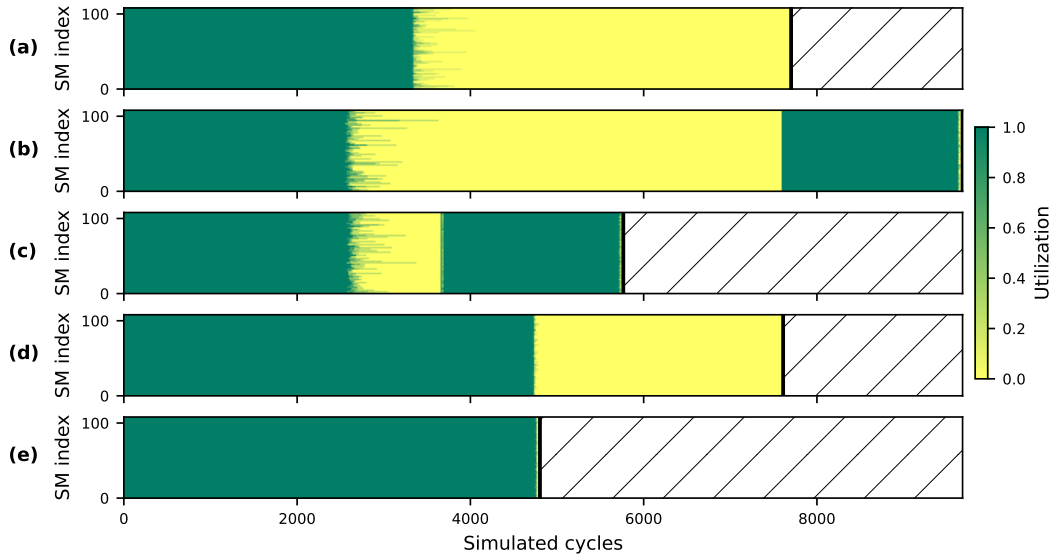

Figure 71: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew $446\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}702$, $T/T^* = 1.035$ (critical path), $1.00\times$; (b) $T = 9{,}681$, $T/T^* = 1.301$ (critical path), $0.80\times$; (c) $T = 5{,}765$, $T/T^* = 1.213$ (slot), $1.34\times$; (d) $T = 7{,}610$, $T/T^* = 1.023$ (critical path), $1.01\times$; (e) $T = 4{,}803$, $T/T^* = 1.011$ (slot), $1.60\times$.

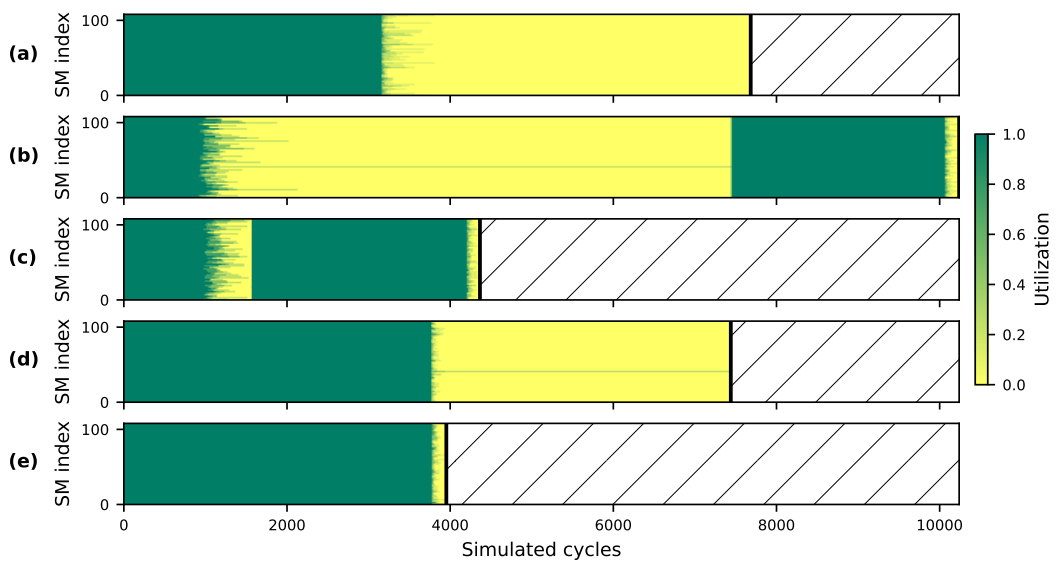

Figure 72: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew $446\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}684$, $T/T^* = 1.033$ (critical path), $1.00\times$; (b) $T = 10{,}239$, $T/T^* = 1.376$ (critical path), $0.75\times$; (c) $T = 4{,}365$, $T/T^* = 1.151$ (slot), $1.76\times$; (d) $T = 7{,}440$, $T/T^* = 1.000$ (critical path), $1.03\times$; (e) $T = 3{,}953$, $T/T^* = 1.042$ (slot), $1.94\times$.

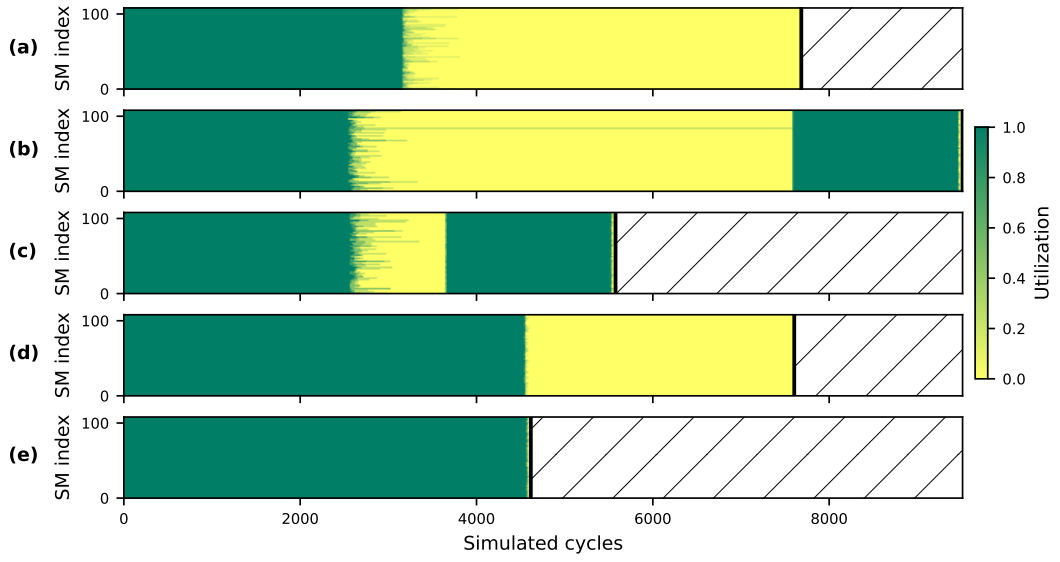

Figure 73: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew $446\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}684$, $T/T^* = 1.033$ (critical path), $1.00\times$; (b) $T = 9{,}513$, $T/T^* = 1.279$ (critical path), $0.81\times$; (c) $T = 5{,}577$, $T/T^* = 1.221$ (slot), $1.38\times$; (d) $T = 7{,}604$, $T/T^* = 1.022$ (critical path), $1.01\times$; (e) $T = 4{,}616$, $T/T^* = 1.011$ (slot), $1.66\times$.

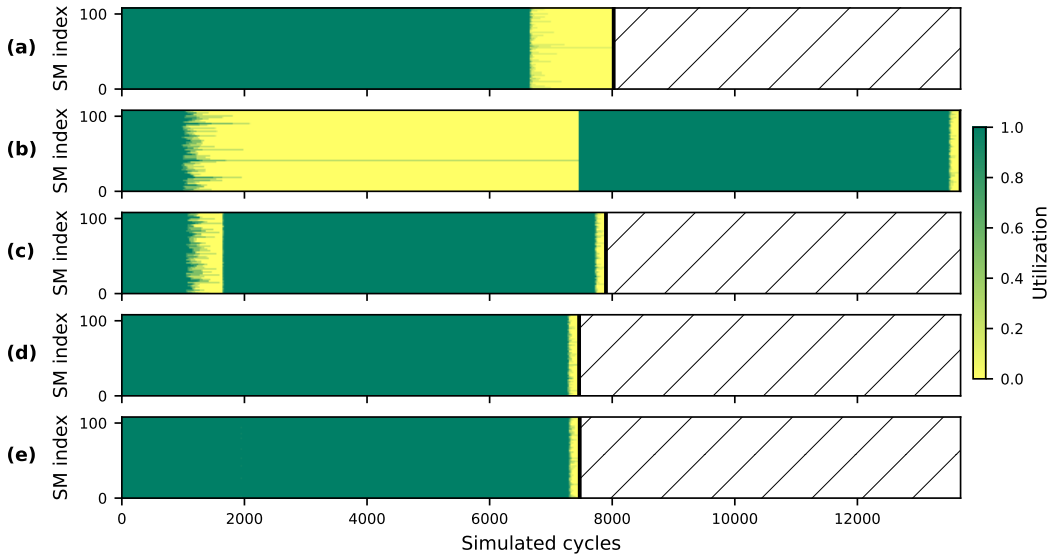

Figure 74: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 8{,}024$, $T/T^* = 1.076$ (critical path), 1.00×; (b) $T = 13{,}683$, $T/T^* = 1.834$ (critical path), 0.59×; (c) $T = 7{,}898$, $T/T^* = 1.083$ (slot), 1.02×; (d) $T = 7{,}460$, $T/T^* = 1.000$ (critical path), 1.08×; (e) $T = 7{,}470$, $T/T^* = 1.024$ (slot), 1.07×.

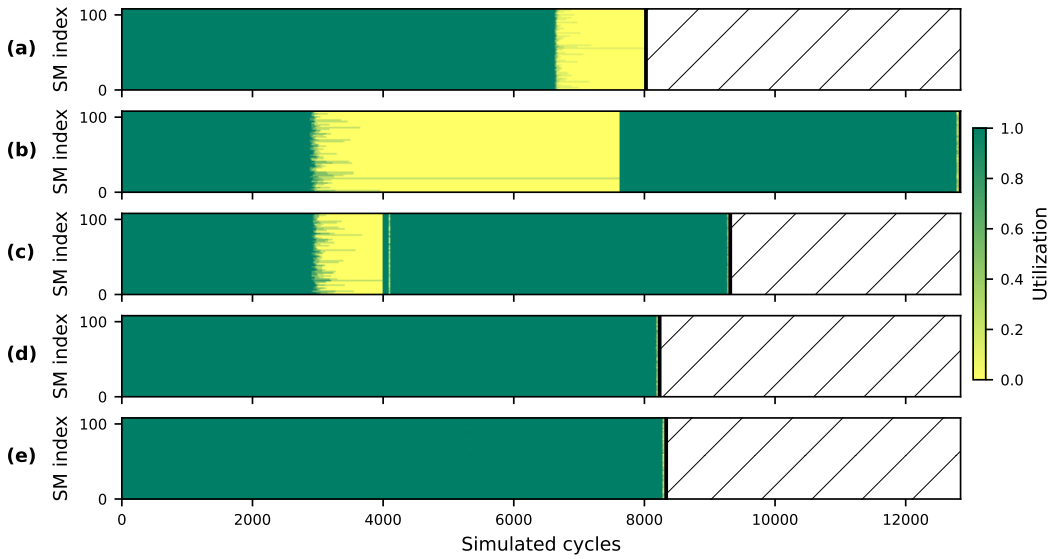

Figure 75: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 8{,}024$, $T/T^* = 1.076$ (critical path), 1.00×; (b) $T = 12{,}840$, $T/T^* = 1.572$ (slot), 0.62×; (c) $T = 9{,}314$, $T/T^* = 1.126$ (slot), 0.86×; (d) $T = 8{,}233$, $T/T^* = 1.008$ (slot), 0.97×; (e) $T = 8{,}333$, $T/T^* = 1.008$ (slot), 0.96×.

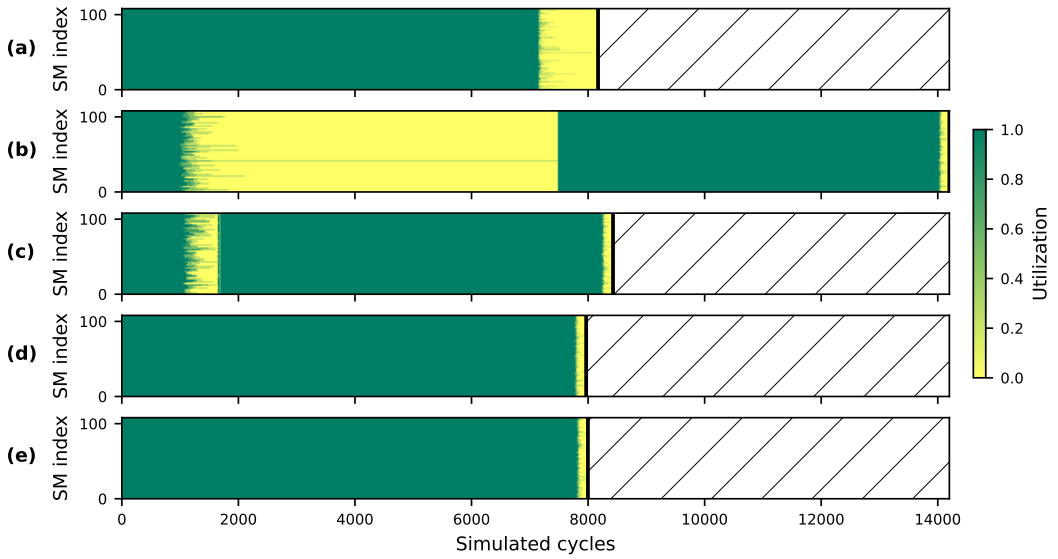

Figure 76: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 8{,}171$, $T/T^* = 1.095$ (critical path), 1.00×; (b) $T = 14{,}199$, $T/T^* = 1.823$ (slot), 0.58×; (c) $T = 8{,}428$, $T/T^* = 1.078$ (slot), 0.97×; (d) $T = 7{,}967$, $T/T^* = 1.023$ (slot), 1.03×; (e) $T = 7{,}997$, $T/T^* = 1.023$ (slot), 1.02×.

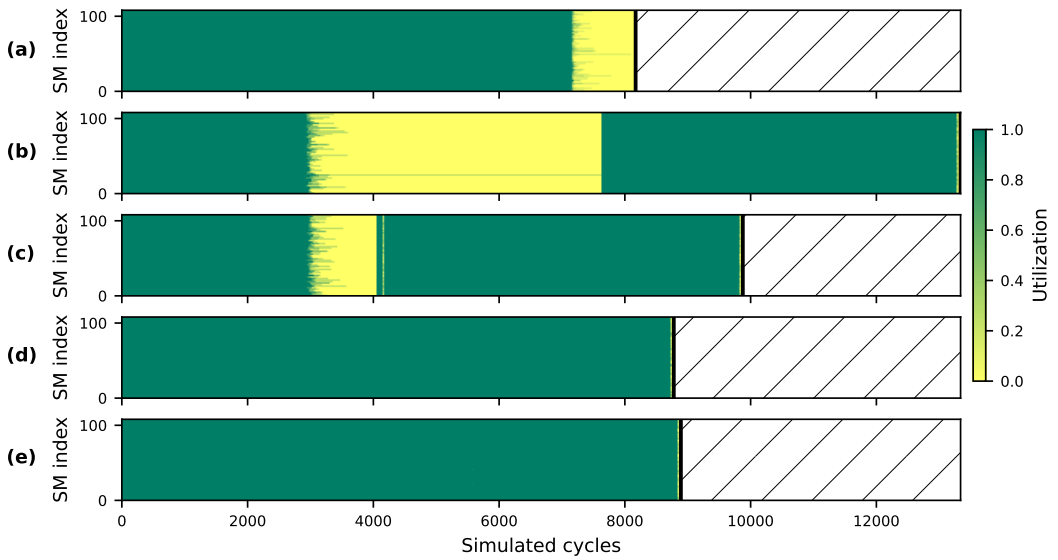

Figure 77: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 8{,}171$, $T/T^* = 1.095$ (critical path), 1.00×; (b) $T = 13{,}339$, $T/T^* = 1.531$ (slot), 0.61×; (c) $T = 9{,}876$, $T/T^* = 1.119$ (slot), 0.83×; (d) $T = 8{,}778$, $T/T^* = 1.007$ (slot), 0.93×; (e) $T = 8{,}891$, $T/T^* = 1.007$ (slot), 0.92×.

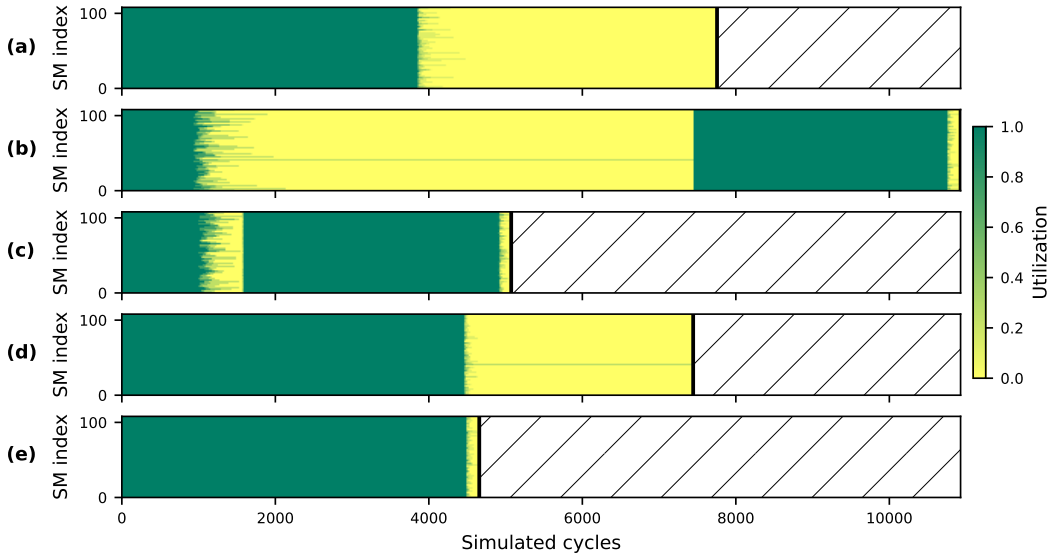

Figure 78: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}755$, $T/T^* = 1.042$ (critical path), 1.00×; (b) $T = 10{,}928$, $T/T^* = 1.468$ (critical path), 0.71×; (c) $T = 5{,}073$, $T/T^* = 1.129$ (slot), 1.53×; (d) $T = 7{,}444$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 4{,}657$, $T/T^* = 1.036$ (slot), 1.67×.

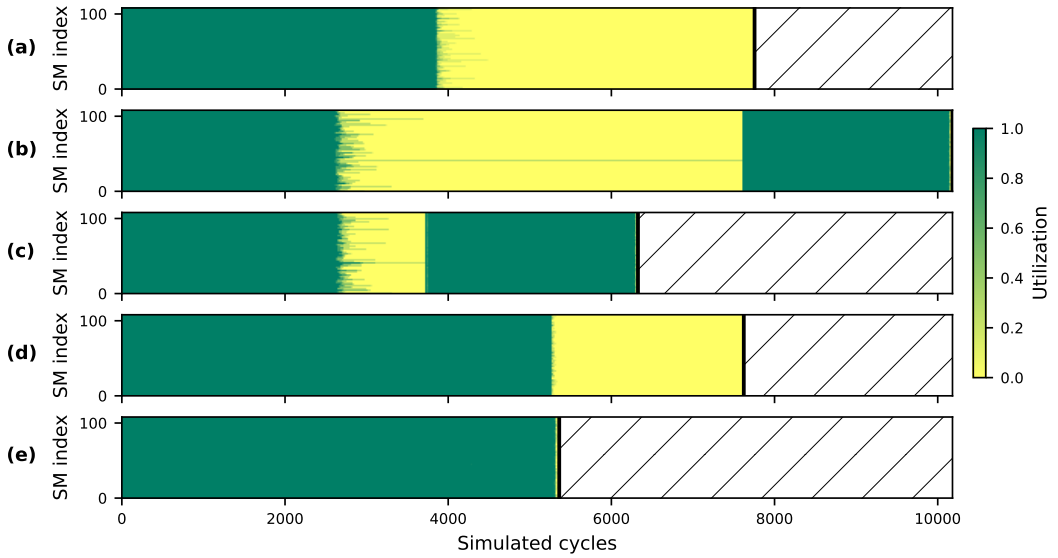

Figure 79: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}755$, $T/T^* = 1.042$ (critical path), 1.00×; (b) $T = 10{,}181$, $T/T^* = 1.368$ (critical path), 0.76×; (c) $T = 6{,}326$, $T/T^* = 1.192$ (slot), 1.23×; (d) $T = 7{,}623$, $T/T^* = 1.024$ (critical path), 1.02×; (e) $T = 5{,}361$, $T/T^* = 1.010$ (slot), 1.45×.

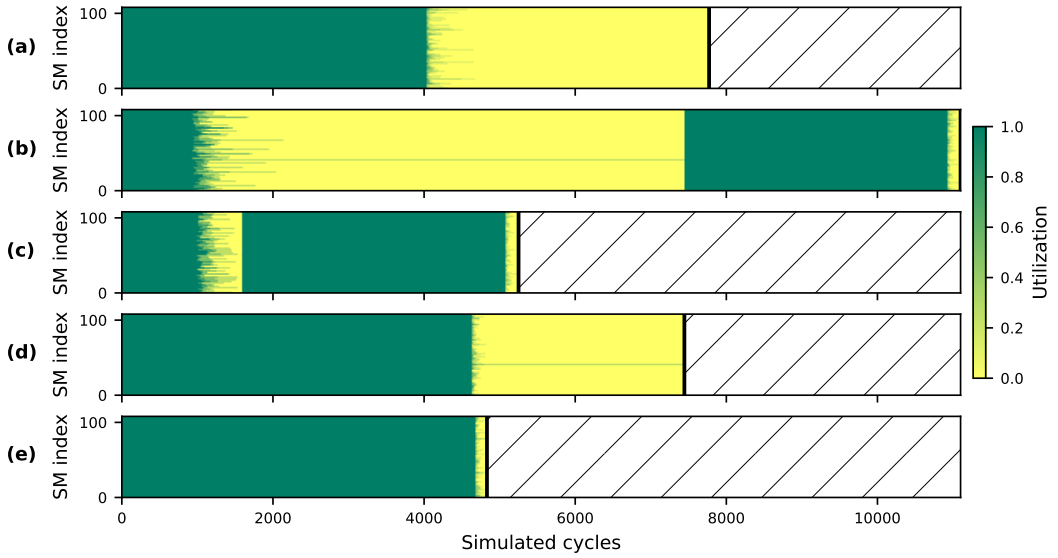

Figure 80: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,500 of them). Edge slices in (c) and (e) hold 572 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}772$, $T/T^* = 1.044$ (critical path), 1.00×; (b) $T = 11{,}100$, $T/T^* = 1.491$ (critical path), 0.70×; (c) $T = 5{,}250$, $T/T^* = 1.125$ (slot), 1.48×; (d) $T = 7{,}445$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 4{,}832$, $T/T^* = 1.035$ (slot), 1.61×.

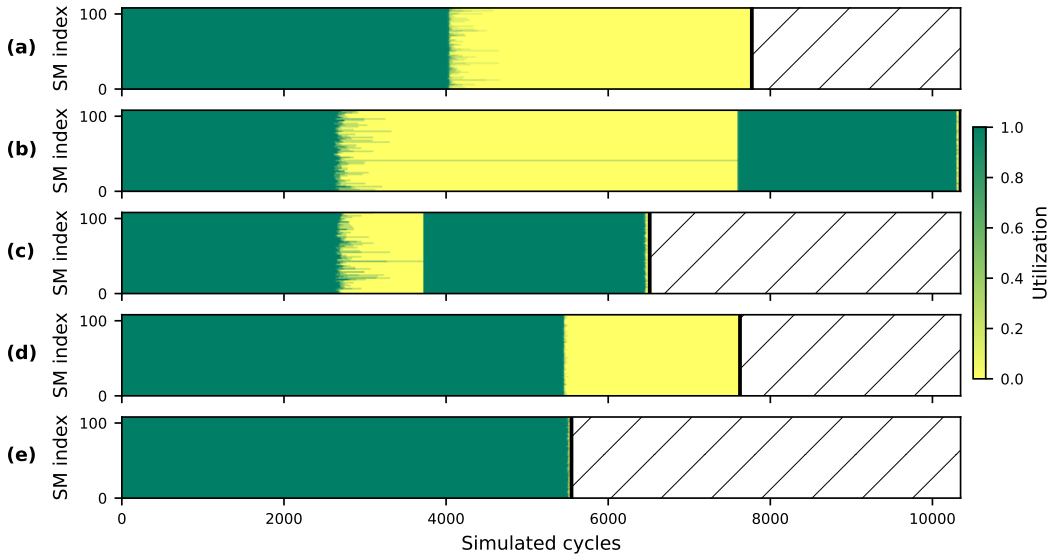

Figure 81: Per-SM occupancy over time for `city-reviews` ($N = 148{,}801$ vertices, $E = 2{,}479{,}631$ edges, mean degree 16.7, maximum degree 7,438, skew 446×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (7,466 of them). Edge slices in (c) and (e) hold 1,321 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 7{,}772$, $T/T^* = 1.044$ (critical path), 1.00×; (b) $T = 10{,}347$, $T/T^* = 1.390$ (critical path), 0.75×; (c) $T = 6{,}512$, $T/T^* = 1.186$ (slot), 1.19×; (d) $T = 7{,}626$, $T/T^* = 1.024$ (critical path), 1.02×; (e) $T = 5{,}547$, $T/T^* = 1.010$ (slot), 1.40×.

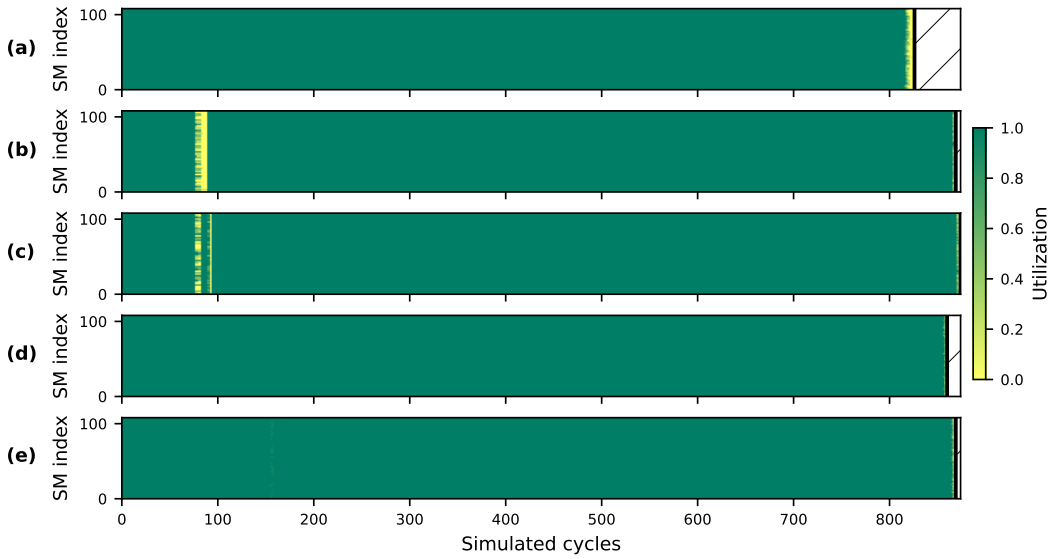

Figure 82: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 826$, $T/T^* = 1.011$ (slot), 1.00×; (b) $T = 869$, $T/T^* = 1.014$ (slot), 0.95×; (c) $T = 874$, $T/T^* = 1.010$ (slot), 0.95×; (d) $T = 860$, $T/T^* = 1.004$ (slot), 0.96×; (e) $T = 869$, $T/T^* = 1.004$ (slot), 0.95×.

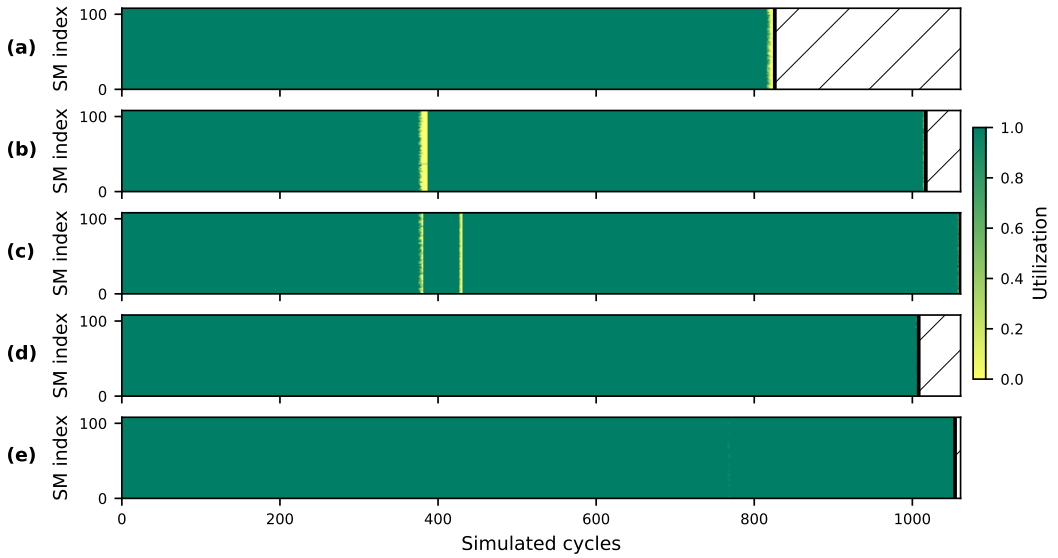

Figure 83: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 826$, $T/T^* = 1.011$ (slot), 1.00×; (b) $T = 1{,}017$, $T/T^* = 1.011$ (slot), 0.81×; (c) $T = 1{,}061$, $T/T^* = 1.009$ (slot), 0.78×; (d) $T = 1{,}008$, $T/T^* = 1.002$ (slot), 0.82×; (e) $T = 1{,}054$, $T/T^* = 1.002$ (slot), 0.78×.

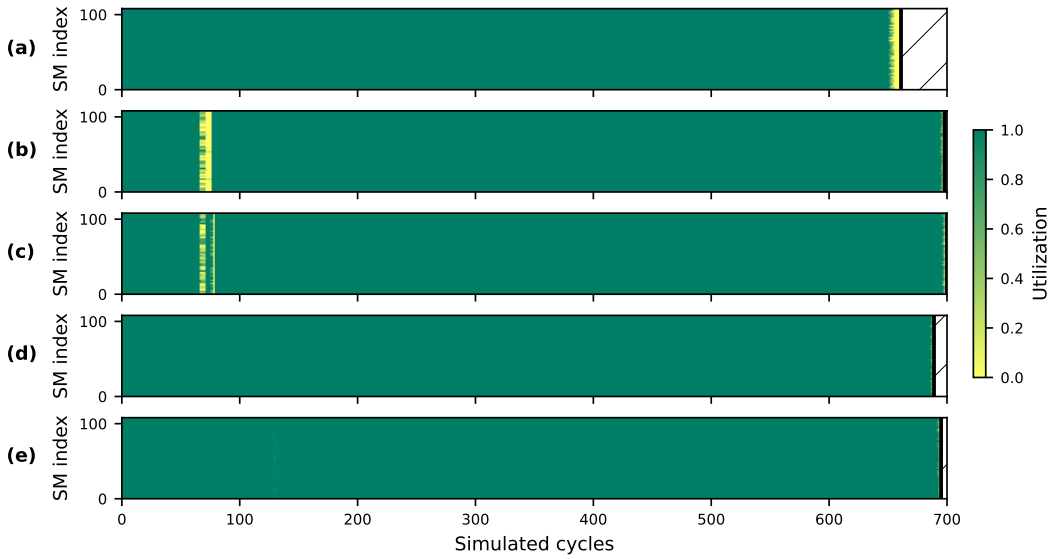

Figure 84: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 661$, $T/T^* = 1.013$ (slot), 1.00×; (b) $T = 698$, $T/T^* = 1.017$ (slot), 0.95×; (c) $T = 700$, $T/T^* = 1.011$ (slot), 0.94×; (d) $T = 689$, $T/T^* = 1.004$ (slot), 0.96×; (e) $T = 695$, $T/T^* = 1.004$ (slot), 0.95×.

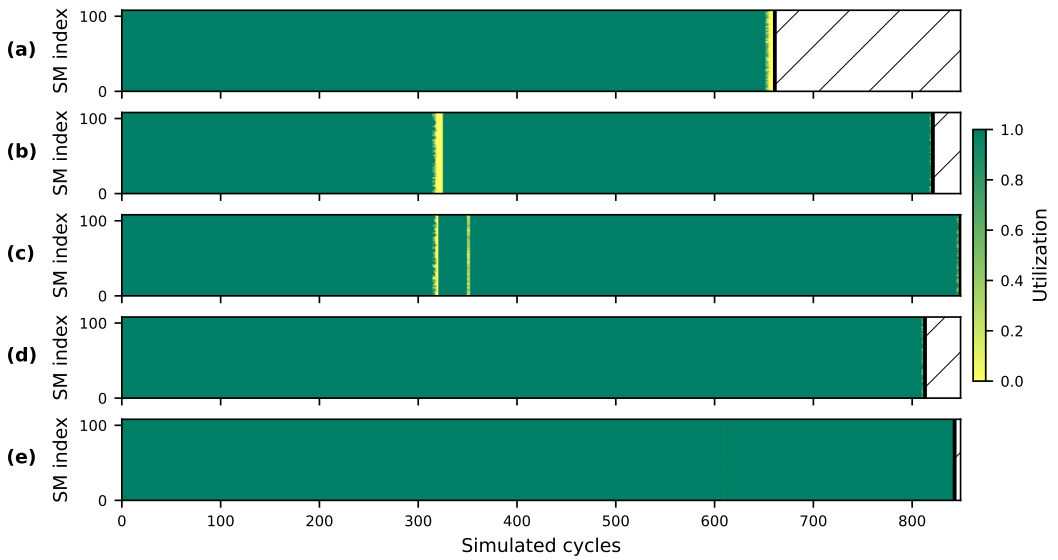

Figure 85: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 661$, $T/T^* = 1.013$ (slot), 1.00×; (b) $T = 821$, $T/T^* = 1.013$ (slot), 0.81×; (c) $T = 849$, $T/T^* = 1.009$ (slot), 0.78×; (d) $T = 813$, $T/T^* = 1.003$ (slot), 0.81×; (e) $T = 843$, $T/T^* = 1.002$ (slot), 0.78×.

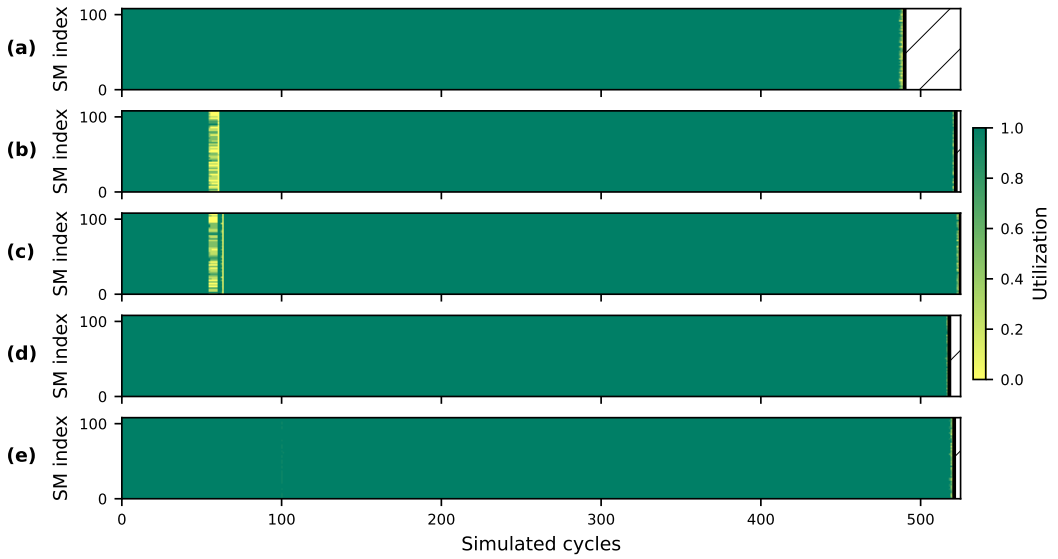

Figure 86: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,903 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 490$, $T/T^* = 1.005$ (slot), 1.00×; (b) $T = 522$, $T/T^* = 1.011$ (slot), 0.94×; (c) $T = 525$, $T/T^* = 1.012$ (slot), 0.93×; (d) $T = 518$, $T/T^* = 1.004$ (slot), 0.95×; (e) $T = 521$, $T/T^* = 1.004$ (slot), 0.94×.

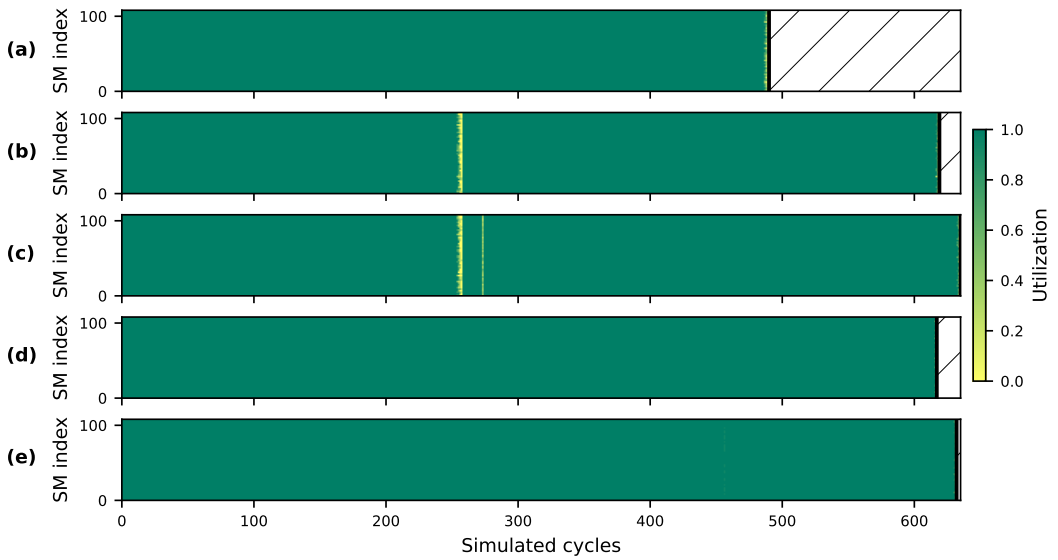

Figure 87: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,381 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 490$, $T/T^* = 1.005$ (slot), 1.00×; (b) $T = 619$, $T/T^* = 1.006$ (slot), 0.79×; (c) $T = 635$, $T/T^* = 1.007$ (slot), 0.77×; (d) $T = 617$, $T/T^* = 1.002$ (slot), 0.79×; (e) $T = 632$, $T/T^* = 1.002$ (slot), 0.78×.

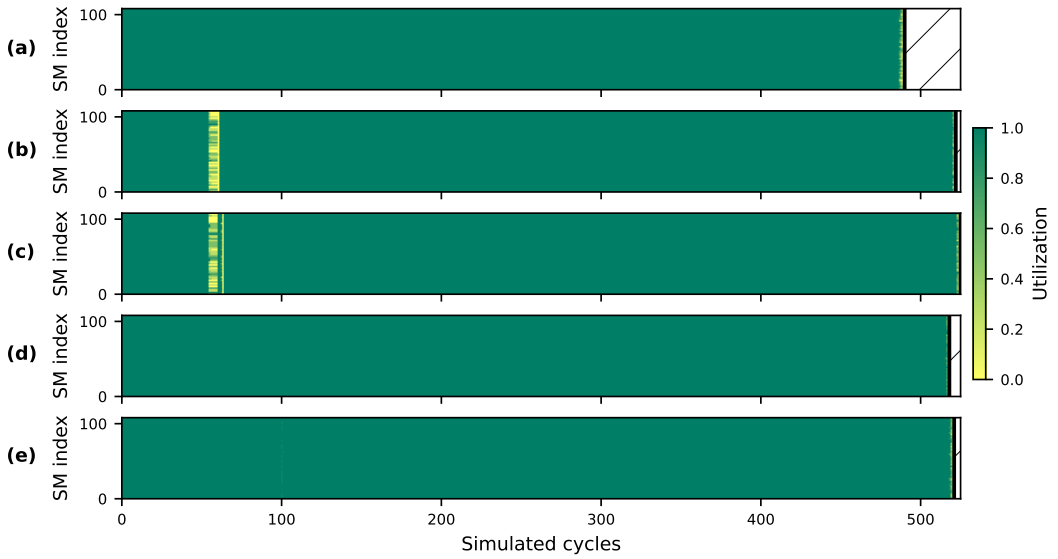

Figure 88: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,903 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 490$, $T/T^* = 1.005$ (slot), 1.00×; (b) $T = 522$, $T/T^* = 1.011$ (slot), 0.94×; (c) $T = 525$, $T/T^* = 1.012$ (slot), 0.93×; (d) $T = 518$, $T/T^* = 1.004$ (slot), 0.95×; (e) $T = 521$, $T/T^* = 1.004$ (slot), 0.94×.

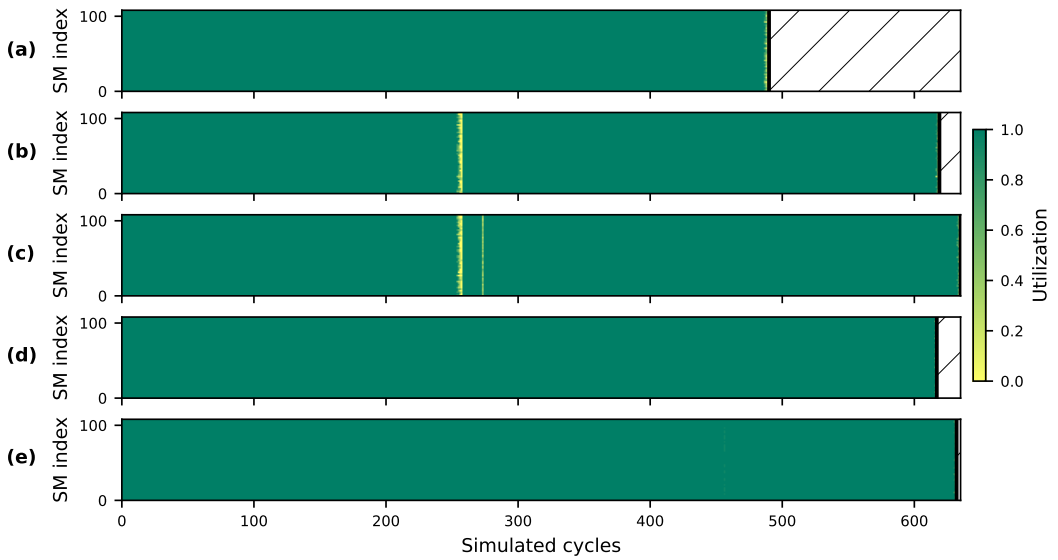

Figure 89: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew 3×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,381 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 490$, $T/T^* = 1.005$ (slot), 1.00×; (b) $T = 619$, $T/T^* = 1.006$ (slot), 0.79×; (c) $T = 635$, $T/T^* = 1.007$ (slot), 0.77×; (d) $T = 617$, $T/T^* = 1.002$ (slot), 0.79×; (e) $T = 632$, $T/T^* = 1.002$ (slot), 0.78×.

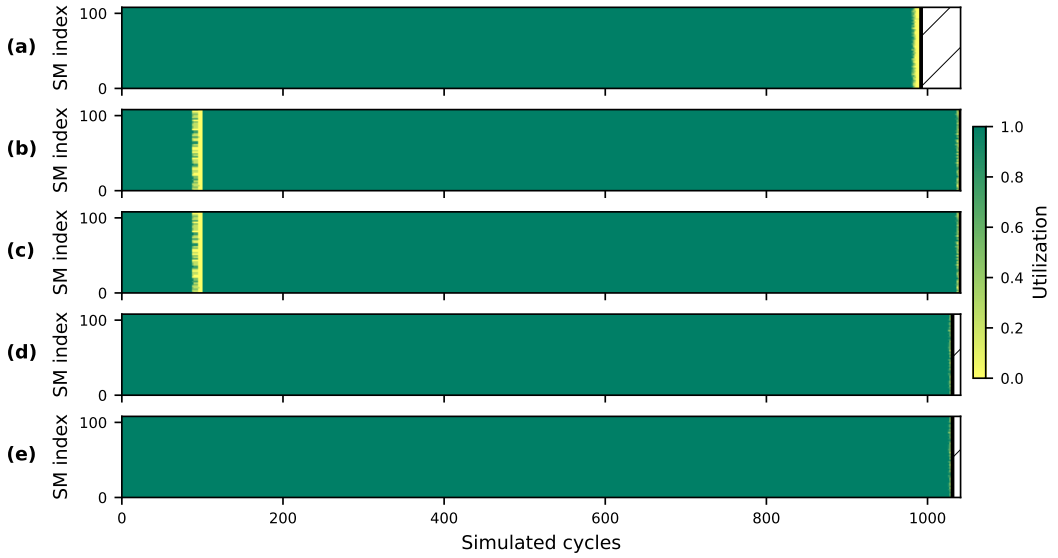

Figure 90: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 992$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 1{,}041$, $T/T^* = 1.014$ (slot), $0.95\times$; (c) $T = 1{,}041$, $T/T^* = 1.014$ (slot), $0.95\times$; (d) $T = 1{,}031$, $T/T^* = 1.004$ (slot), $0.96\times$; (e) $T = 1{,}031$, $T/T^* = 1.004$ (slot), $0.96\times$.

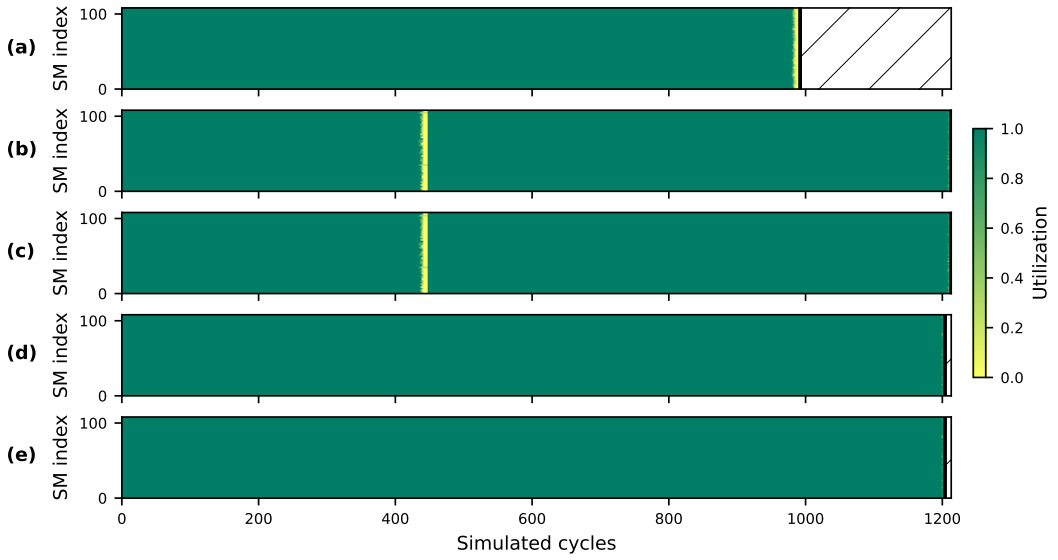

Figure 91: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 992$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 1{,}213$, $T/T^* = 1.010$ (slot), $0.82\times$; (c) $T = 1{,}213$, $T/T^* = 1.010$ (slot), $0.82\times$; (d) $T = 1{,}204$, $T/T^* = 1.002$ (slot), $0.82\times$; (e) $T = 1{,}204$, $T/T^* = 1.002$ (slot), $0.82\times$.

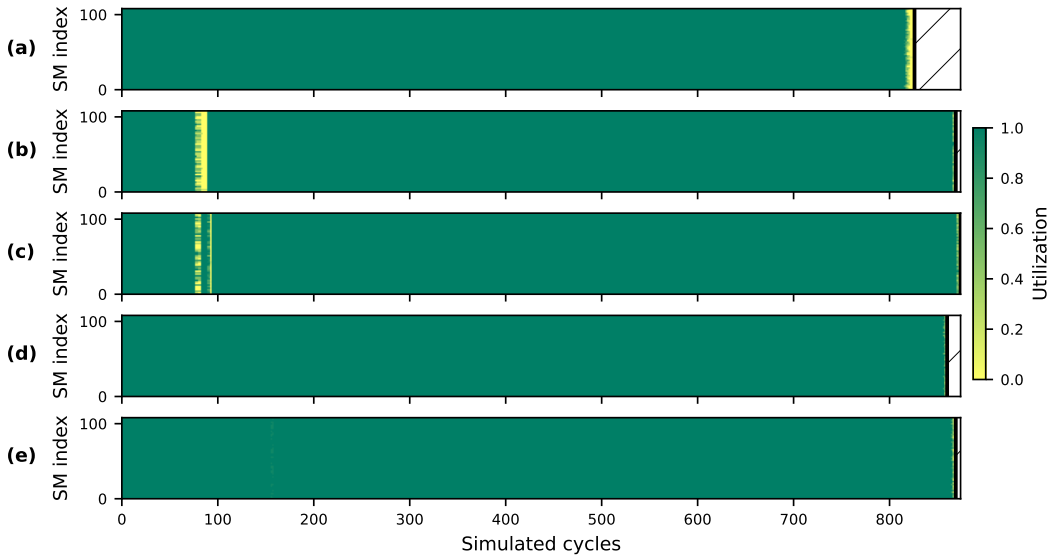

Figure 92: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 826$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 869$, $T/T^* = 1.014$ (slot), $0.95\times$; (c) $T = 874$, $T/T^* = 1.010$ (slot), $0.95\times$; (d) $T = 860$, $T/T^* = 1.004$ (slot), $0.96\times$; (e) $T = 869$, $T/T^* = 1.004$ (slot), $0.95\times$.

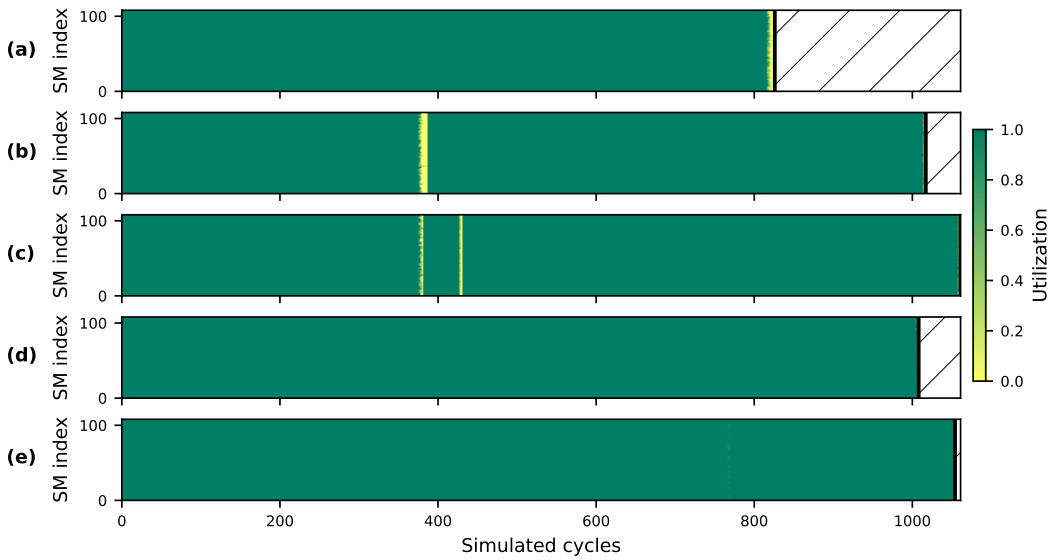

Figure 93: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slices in (c) and (e) hold 5 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 826$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 1{,}017$, $T/T^* = 1.011$ (slot), $0.81\times$; (c) $T = 1{,}061$, $T/T^* = 1.009$ (slot), $0.78\times$; (d) $T = 1{,}008$, $T/T^* = 1.002$ (slot), $0.82\times$; (e) $T = 1{,}054$, $T/T^* = 1.002$ (slot), $0.78\times$.

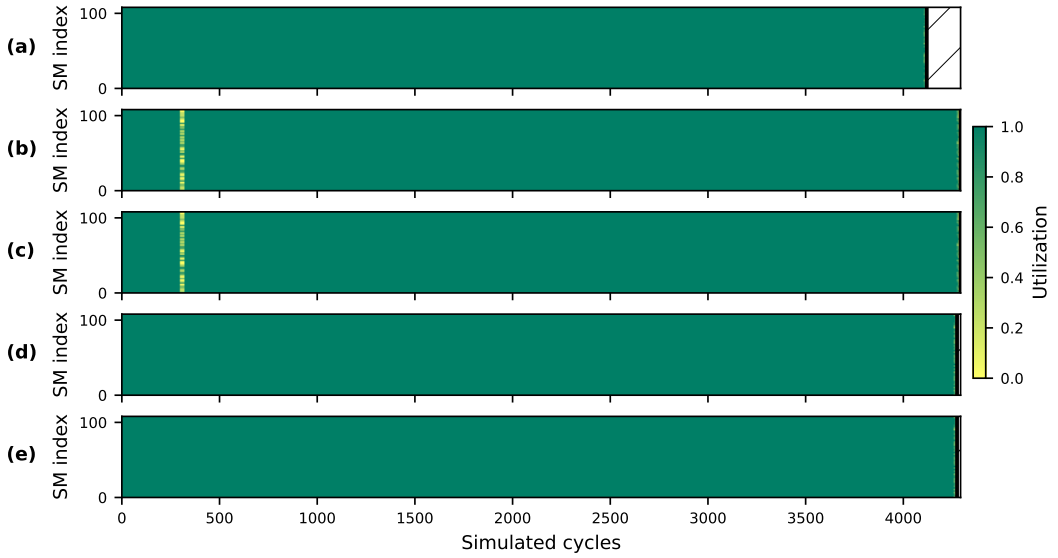

Figure 94: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,903 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 4{,}120$, $T/T^* = 1.002$ (slot), $1.00\times$; (b) $T = 4{,}293$, $T/T^* = 1.007$ (slot), $0.96\times$; (c) $T = 4{,}293$, $T/T^* = 1.007$ (slot), $0.96\times$; (d) $T = 4{,}275$, $T/T^* = 1.003$ (slot), $0.96\times$; (e) $T = 4{,}275$, $T/T^* = 1.003$ (slot), $0.96\times$.

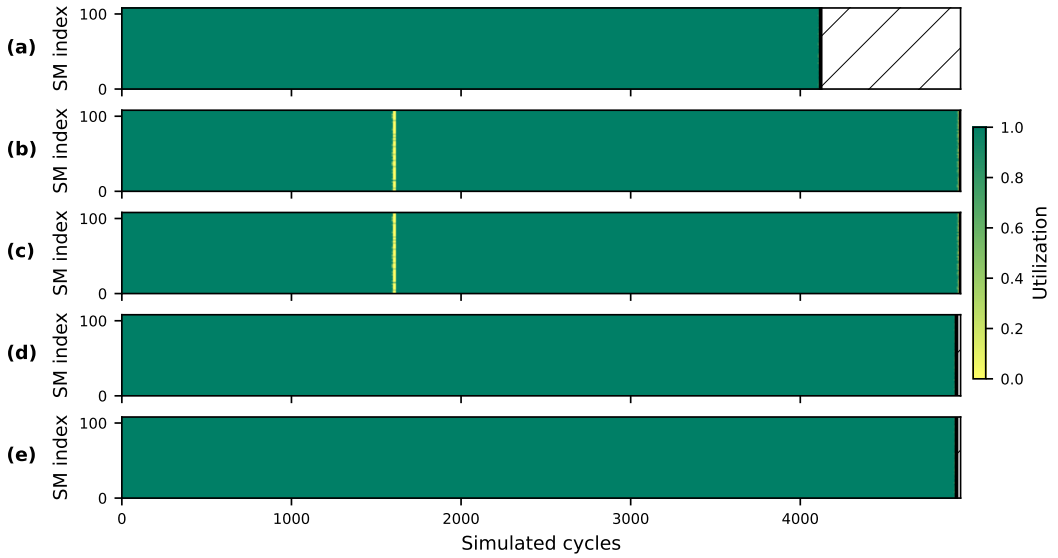

Figure 95: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,381 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 4{,}120$, $T/T^* = 1.002$ (slot), $1.00\times$; (b) $T = 4{,}945$, $T/T^* = 1.007$ (slot), $0.83\times$; (c) $T = 4{,}945$, $T/T^* = 1.007$ (slot), $0.83\times$; (d) $T = 4{,}921$, $T/T^* = 1.002$ (slot), $0.84\times$; (e) $T = 4{,}921$, $T/T^* = 1.002$ (slot), $0.84\times$.

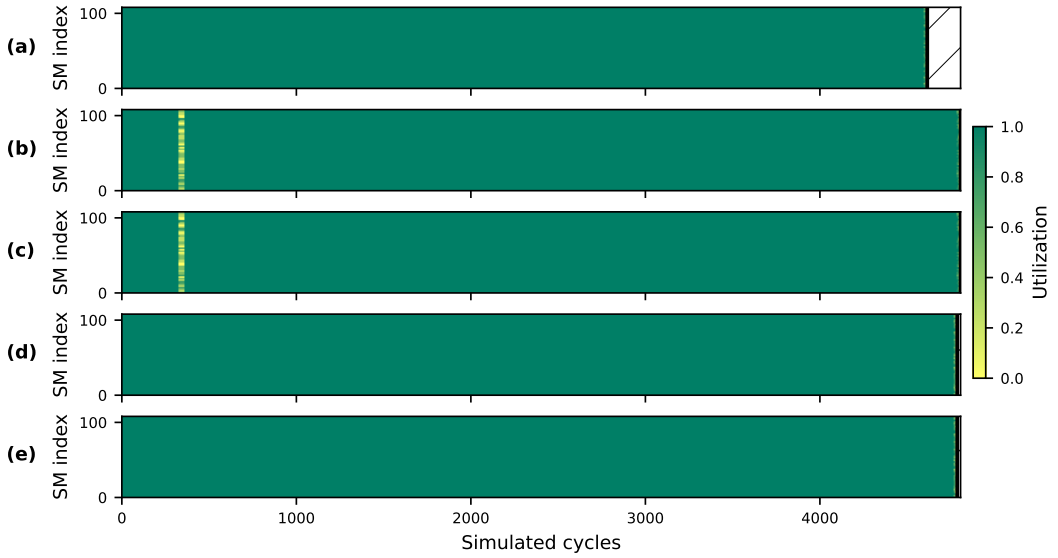

Figure 96: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,903 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 4{,}615$, $T/T^* = 1.002$ (slot), $1.00\times$; (b) $T = 4{,}806$, $T/T^* = 1.007$ (slot), $0.96\times$; (c) $T = 4{,}806$, $T/T^* = 1.007$ (slot), $0.96\times$; (d) $T = 4{,}787$, $T/T^* = 1.003$ (slot), $0.96\times$; (e) $T = 4{,}787$, $T/T^* = 1.003$ (slot), $0.96\times$.

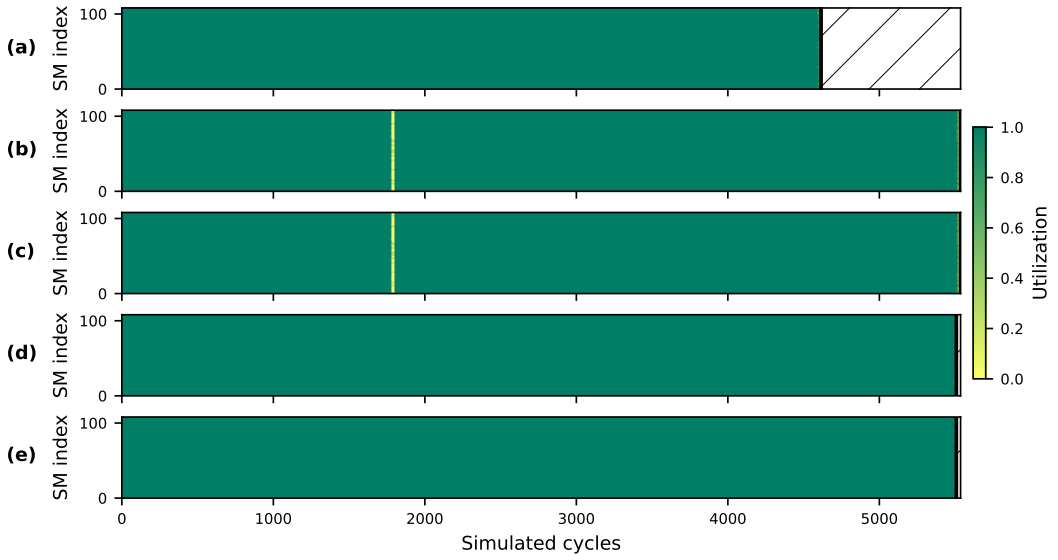

Figure 97: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,381 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 4{,}615$, $T/T^* = 1.002$ (slot), $1.00\times$; (b) $T = 5{,}536$, $T/T^* = 1.007$ (slot), $0.83\times$; (c) $T = 5{,}536$, $T/T^* = 1.007$ (slot), $0.83\times$; (d) $T = 5{,}508$, $T/T^* = 1.002$ (slot), $0.84\times$; (e) $T = 5{,}508$, $T/T^* = 1.002$ (slot), $0.84\times$.

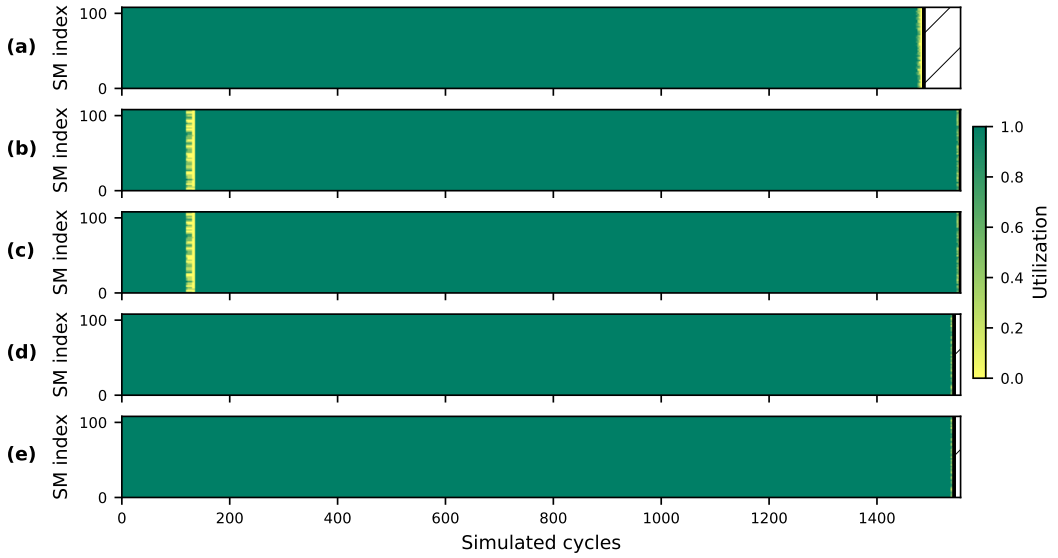

Figure 98: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}487$, $T/T^* = 1.008$ (slot), $1.00\times$; (b) $T = 1{,}555$, $T/T^* = 1.011$ (slot), $0.96\times$; (c) $T = 1{,}555$, $T/T^* = 1.011$ (slot), $0.96\times$; (d) $T = 1{,}543$, $T/T^* = 1.003$ (slot), $0.96\times$; (e) $T = 1{,}543$, $T/T^* = 1.003$ (slot), $0.96\times$.

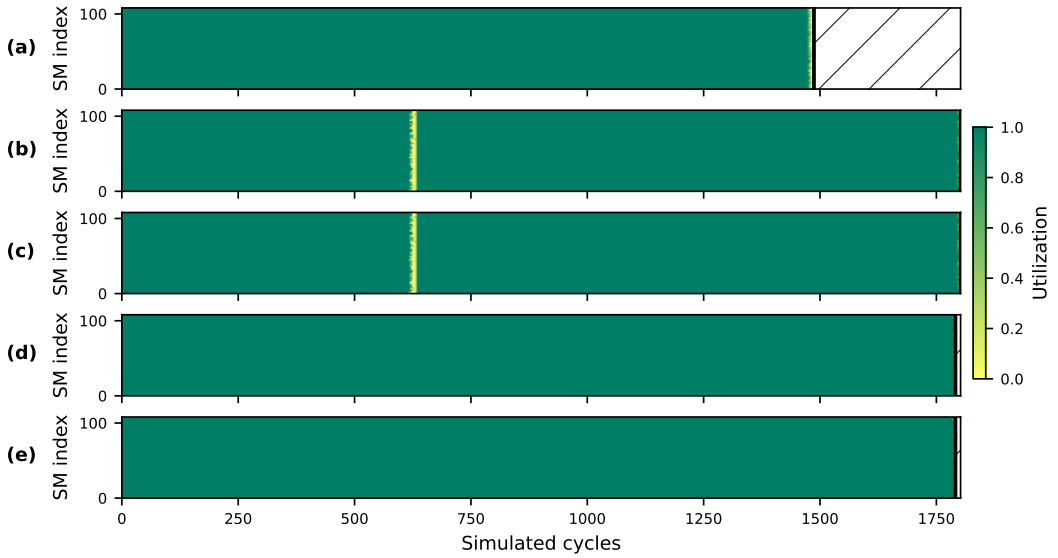

Figure 99: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}487$, $T/T^* = 1.008$ (slot), $1.00\times$; (b) $T = 1{,}802$, $T/T^* = 1.009$ (slot), $0.83\times$; (c) $T = 1{,}802$, $T/T^* = 1.009$ (slot), $0.83\times$; (d) $T = 1{,}791$, $T/T^* = 1.002$ (slot), $0.83\times$; (e) $T = 1{,}791$, $T/T^* = 1.002$ (slot), $0.83\times$.

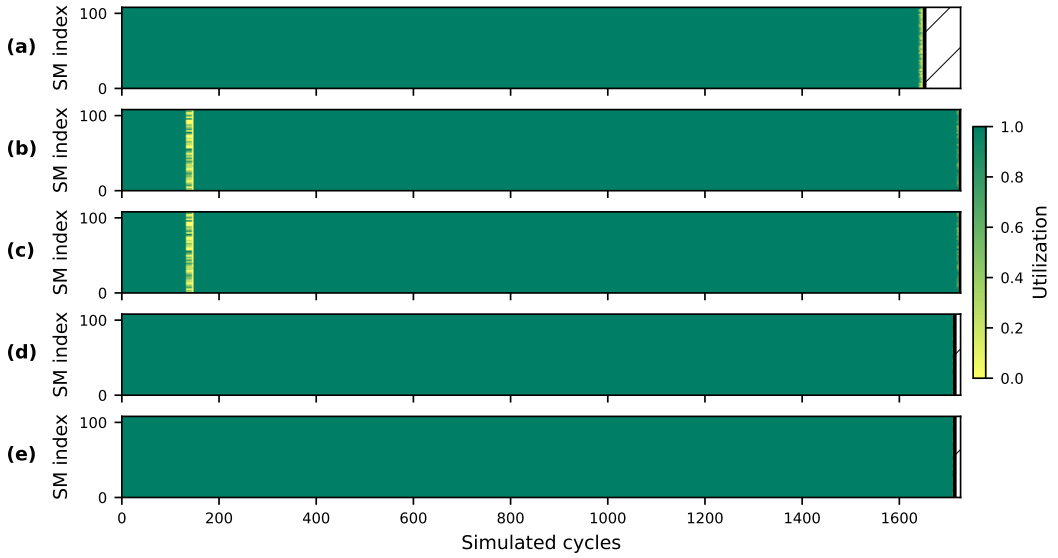

Figure 100: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,899 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}652$, $T/T^* = 1.007$ (slot), $1.00\times$; (b) $T = 1{,}726$, $T/T^* = 1.010$ (slot), $0.96\times$; (c) $T = 1{,}726$, $T/T^* = 1.010$ (slot), $0.96\times$; (d) $T = 1{,}714$, $T/T^* = 1.003$ (slot), $0.96\times$; (e) $T = 1{,}714$, $T/T^* = 1.003$ (slot), $0.96\times$.

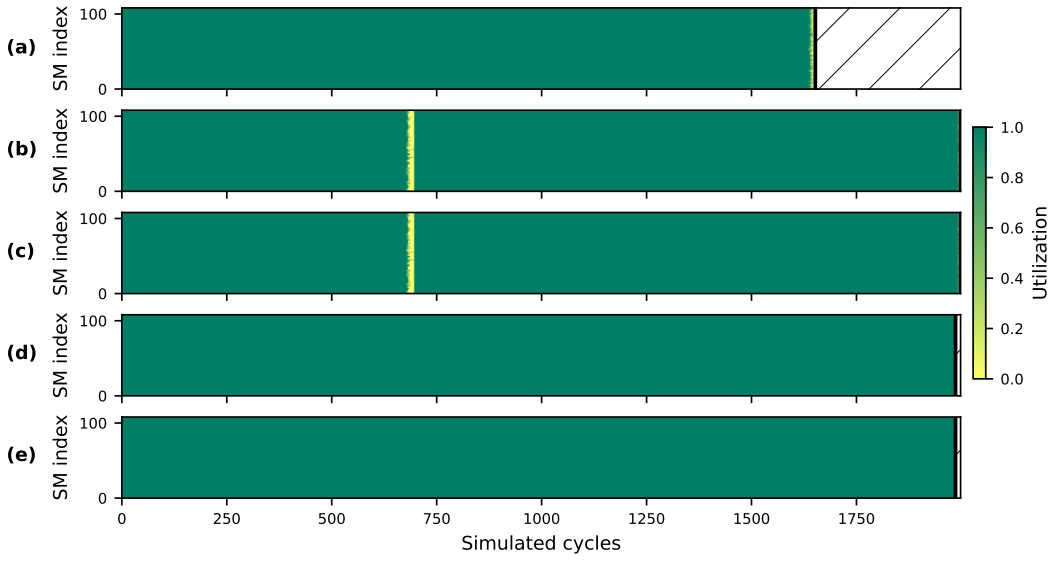

Figure 101: Per-SM occupancy over time for `city-roads-L` ($N = 142{,}257$ vertices, $E = 421{,}318$ edges, mean degree 3.0, maximum degree 10, skew $3\times$), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (26,384 of them). Edge slicing is declined on this graph: with a maximum degree of 10 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}652$, $T/T^* = 1.007$ (slot), $1.00\times$; (b) $T = 1{,}998$, $T/T^* = 1.008$ (slot), $0.83\times$; (c) $T = 1{,}998$, $T/T^* = 1.008$ (slot), $0.83\times$; (d) $T = 1{,}986$, $T/T^* = 1.002$ (slot), $0.83\times$; (e) $T = 1{,}986$, $T/T^* = 1.002$ (slot), $0.83\times$.

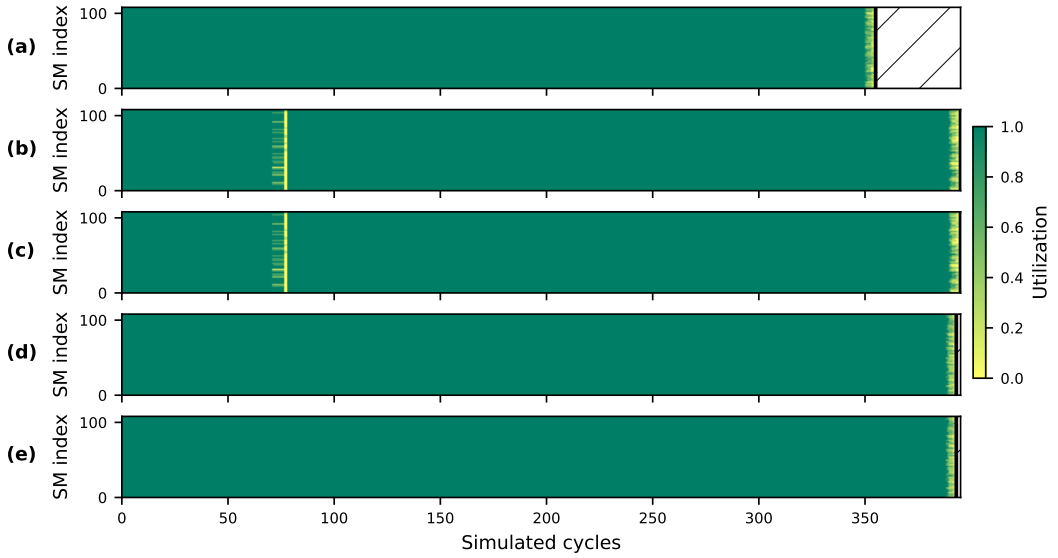

Figure 102: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 355$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (c) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (d) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$.

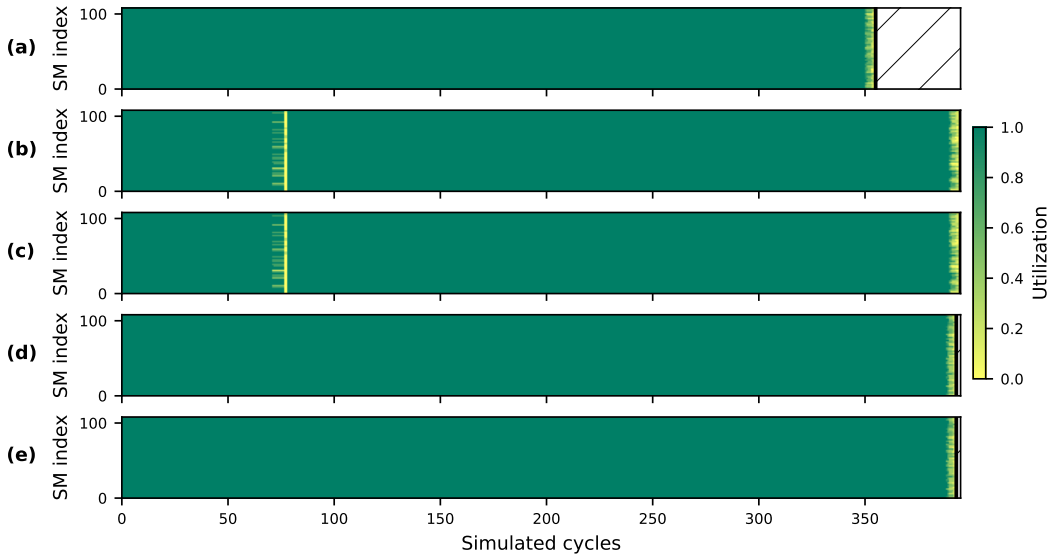

Figure 103: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 355$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (c) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (d) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$.

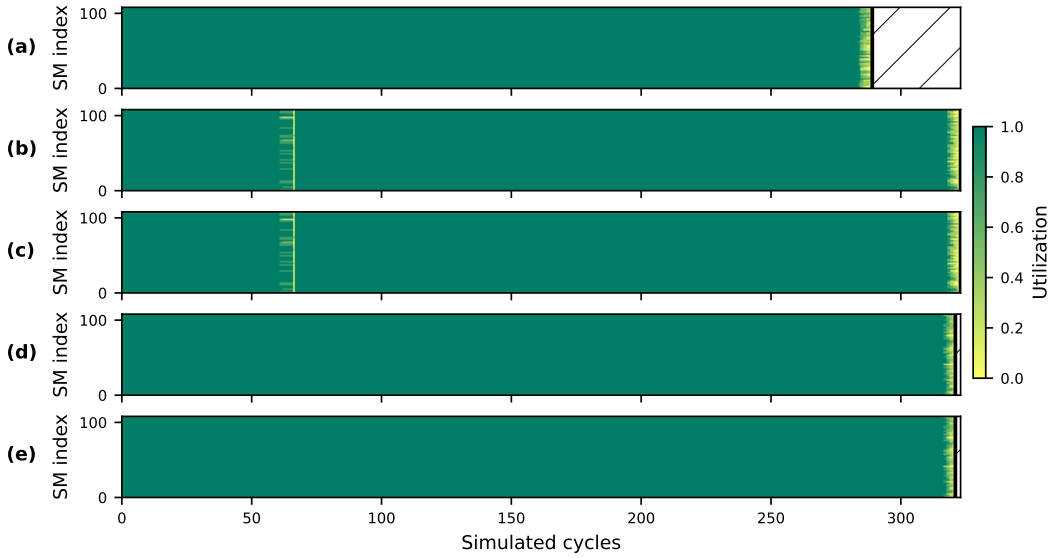

Figure 104: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 289$, $T/T^* = 1.012$ (slot), $1.00\times$; (b) $T = 323$, $T/T^* = 1.015$ (slot), $0.89\times$; (c) $T = 323$, $T/T^* = 1.015$ (slot), $0.89\times$; (d) $T = 321$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 321$, $T/T^* = 1.008$ (slot), $0.90\times$.

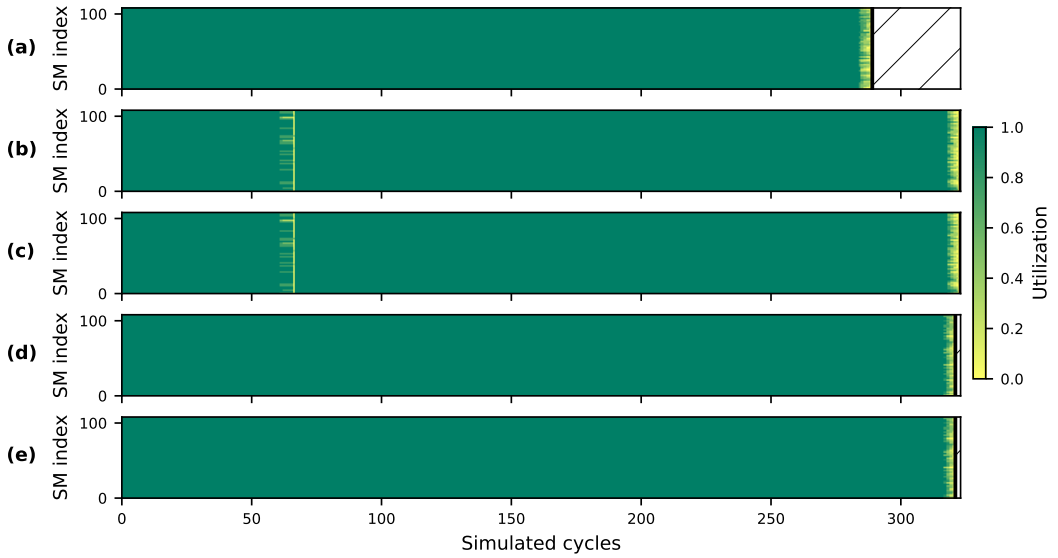

Figure 105: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 289$, $T/T^* = 1.012$ (slot), $1.00\times$; (b) $T = 323$, $T/T^* = 1.015$ (slot), $0.89\times$; (c) $T = 323$, $T/T^* = 1.015$ (slot), $0.89\times$; (d) $T = 321$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 321$, $T/T^* = 1.008$ (slot), $0.90\times$.

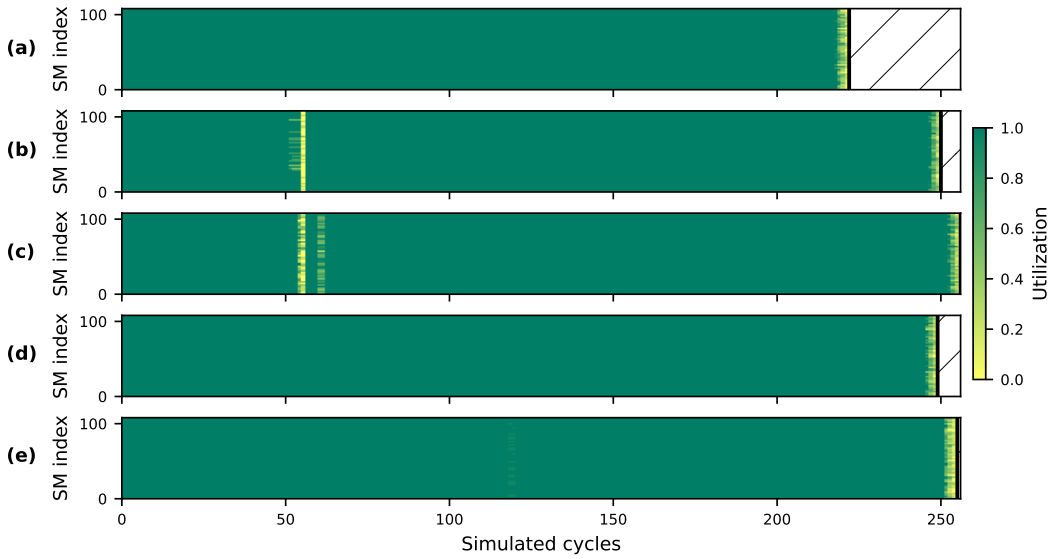

Figure 106: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,723 of them). Edge slices in (c) and (e) hold 3 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 222$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 250$, $T/T^* = 1.013$ (slot), $0.89\times$; (c) $T = 256$, $T/T^* = 1.014$ (slot), $0.87\times$; (d) $T = 249$, $T/T^* = 1.009$ (slot), $0.89\times$; (e) $T = 255$, $T/T^* = 1.010$ (slot), $0.87\times$.

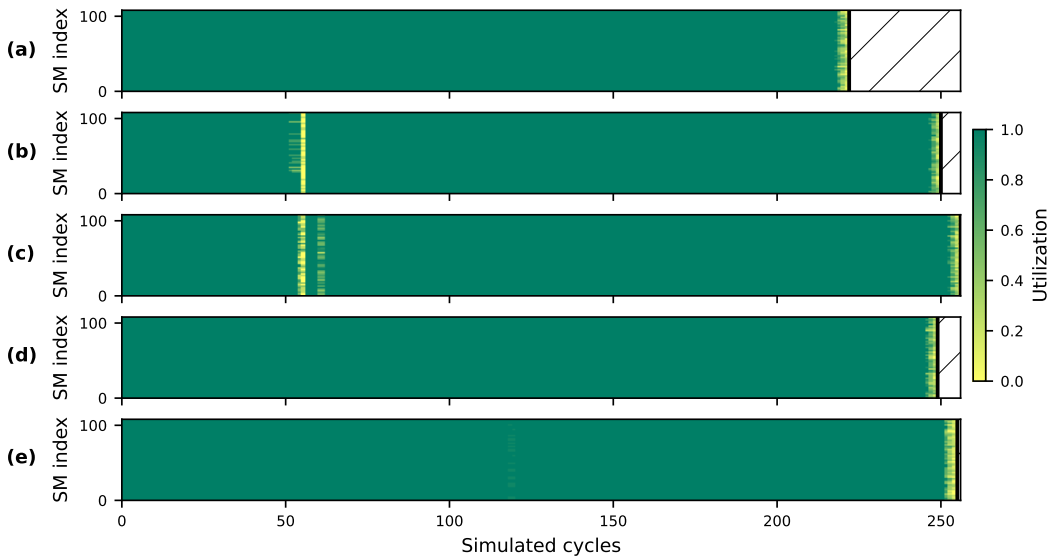

Figure 107: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,723 of them). Edge slices in (c) and (e) hold 3 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 222$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 250$, $T/T^* = 1.013$ (slot), $0.89\times$; (c) $T = 256$, $T/T^* = 1.014$ (slot), $0.87\times$; (d) $T = 249$, $T/T^* = 1.009$ (slot), $0.89\times$; (e) $T = 255$, $T/T^* = 1.010$ (slot), $0.87\times$.

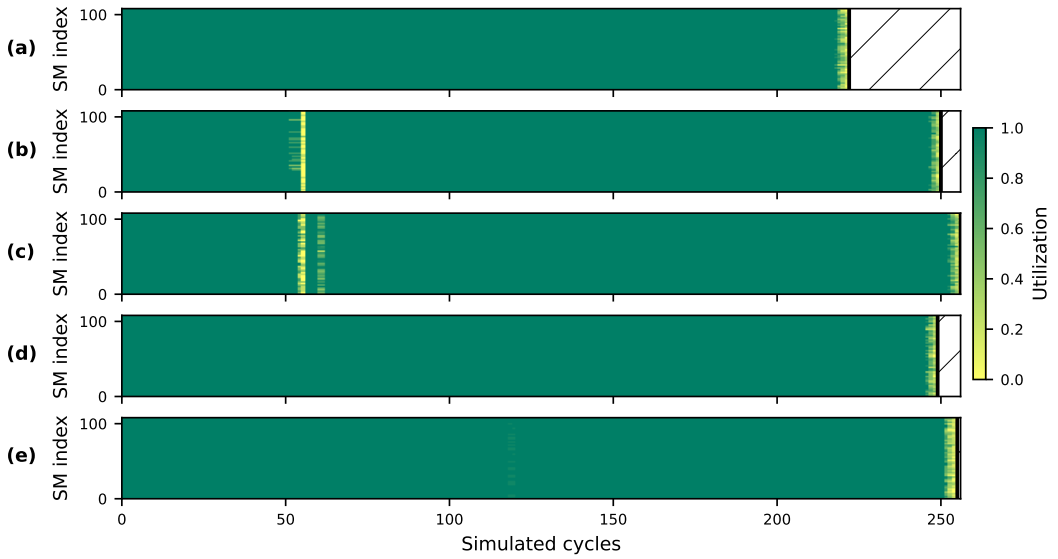

Figure 108: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,723 of them). Edge slices in (c) and (e) hold 3 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 222$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 250$, $T/T^* = 1.013$ (slot), $0.89\times$; (c) $T = 256$, $T/T^* = 1.014$ (slot), $0.87\times$; (d) $T = 249$, $T/T^* = 1.009$ (slot), $0.89\times$; (e) $T = 255$, $T/T^* = 1.010$ (slot), $0.87\times$.

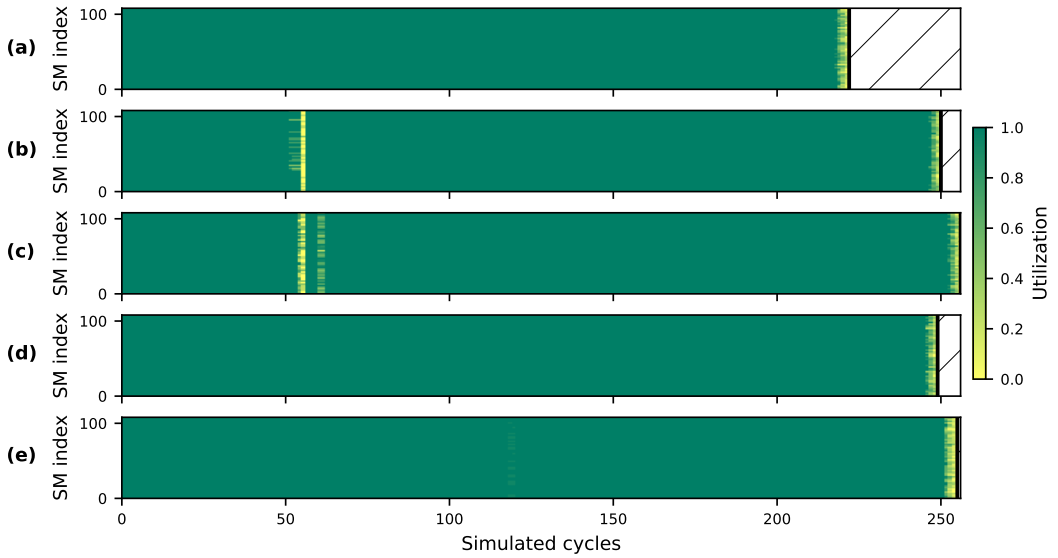

Figure 109: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,723 of them). Edge slices in (c) and (e) hold 3 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 222$, $T/T^* = 1.011$ (slot), $1.00\times$; (b) $T = 250$, $T/T^* = 1.013$ (slot), $0.89\times$; (c) $T = 256$, $T/T^* = 1.014$ (slot), $0.87\times$; (d) $T = 249$, $T/T^* = 1.009$ (slot), $0.89\times$; (e) $T = 255$, $T/T^* = 1.010$ (slot), $0.87\times$.

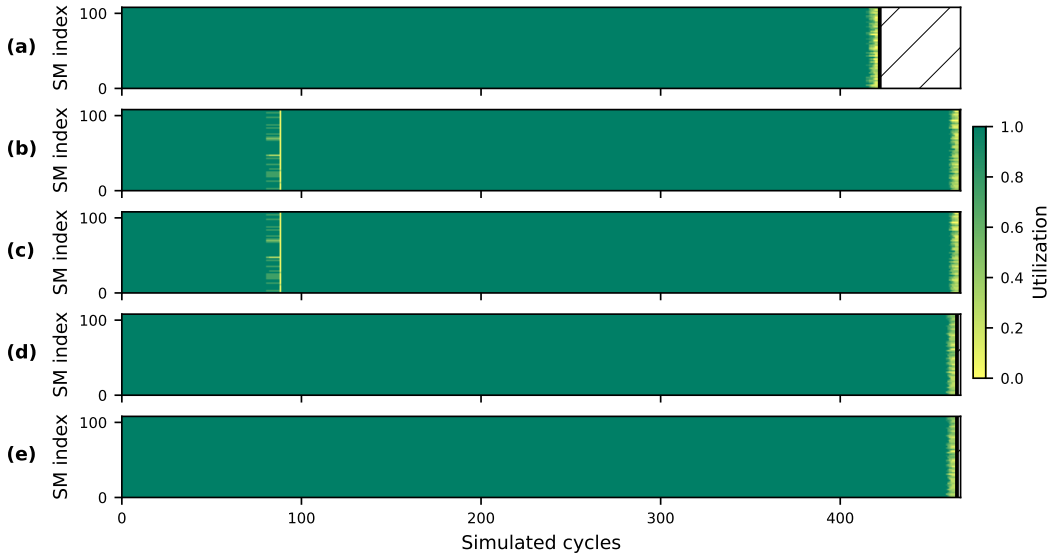

Figure 110: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 422$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 467$, $T/T^* = 1.012$ (slot), $0.90\times$; (c) $T = 467$, $T/T^* = 1.012$ (slot), $0.90\times$; (d) $T = 465$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 465$, $T/T^* = 1.008$ (slot), $0.91\times$.

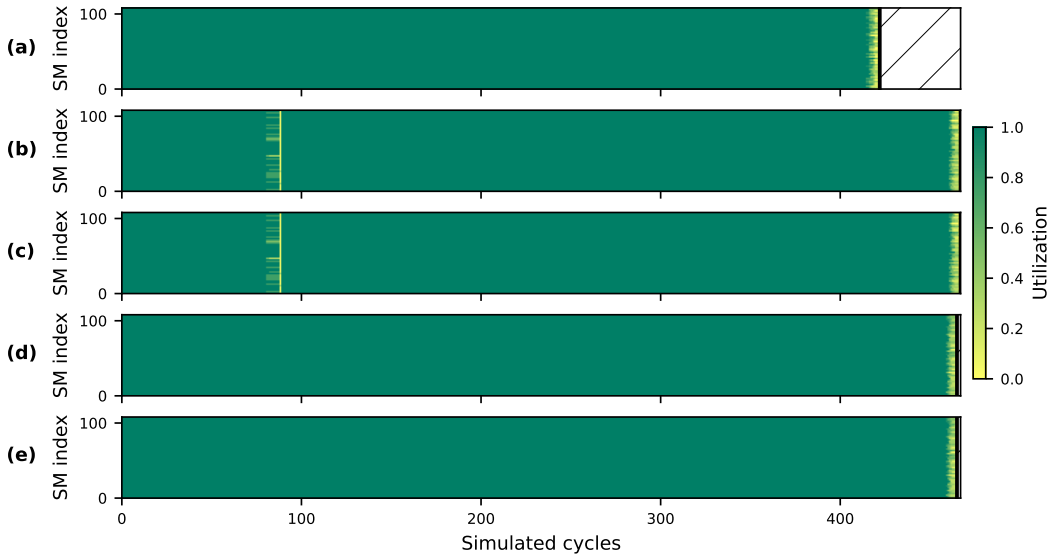

Figure 111: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 422$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 467$, $T/T^* = 1.012$ (slot), $0.90\times$; (c) $T = 467$, $T/T^* = 1.012$ (slot), $0.90\times$; (d) $T = 465$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 465$, $T/T^* = 1.008$ (slot), $0.91\times$.

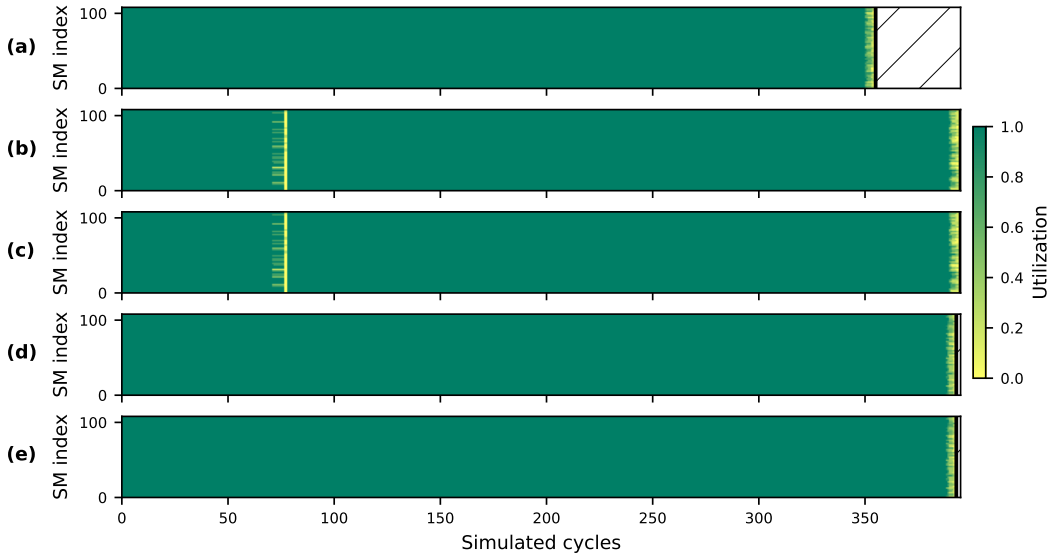

Figure 112: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 355$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (c) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (d) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$.

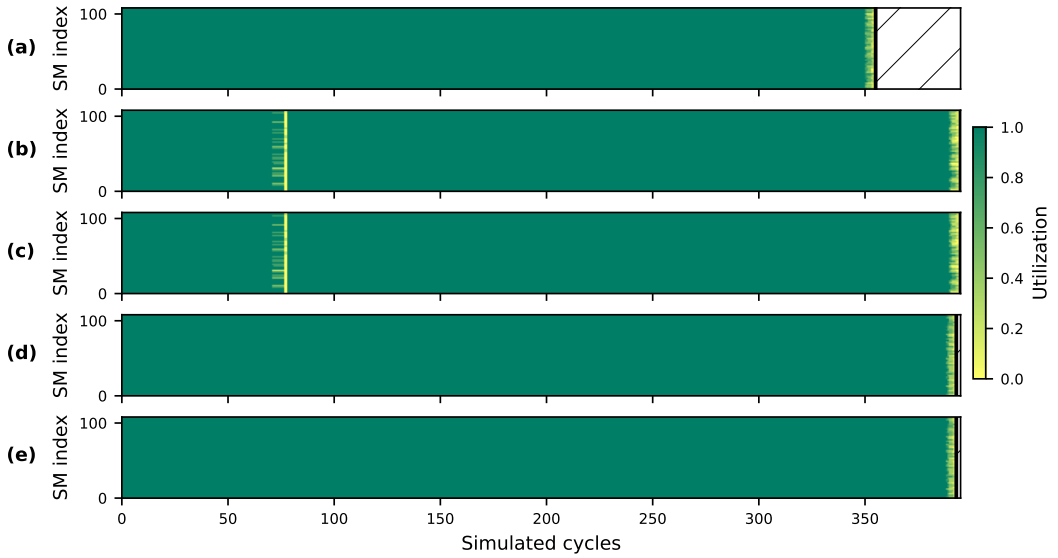

Figure 113: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 355$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (c) $T = 395$, $T/T^* = 1.013$ (slot), $0.90\times$; (d) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$; (e) $T = 393$, $T/T^* = 1.008$ (slot), $0.90\times$.

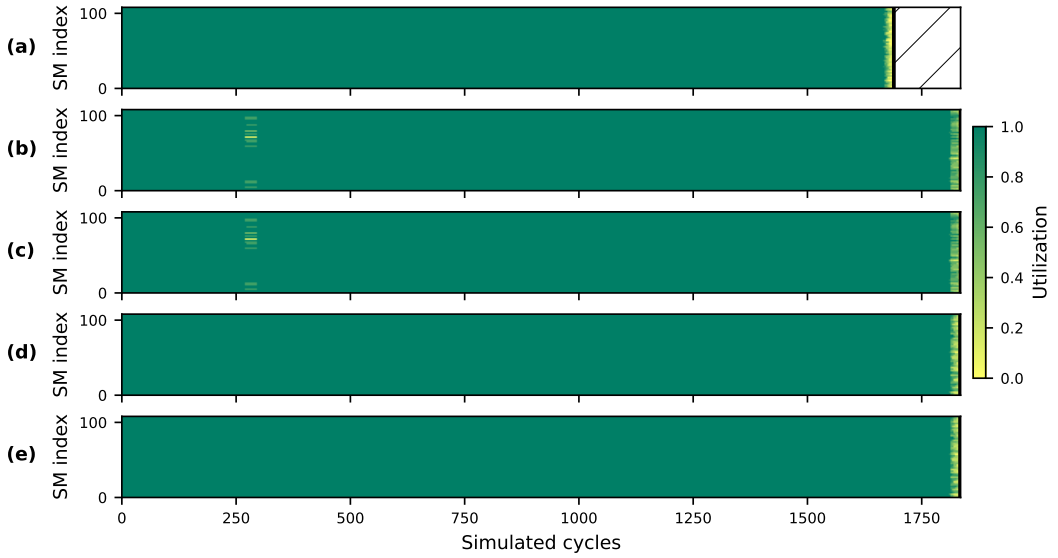

Figure 114: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,723 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}689$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 1{,}835$, $T/T^* = 1.008$ (slot), $0.92\times$; (c) $T = 1{,}835$, $T/T^* = 1.008$ (slot), $0.92\times$; (d) $T = 1{,}834$, $T/T^* = 1.007$ (slot), $0.92\times$; (e) $T = 1{,}834$, $T/T^* = 1.007$ (slot), $0.92\times$.

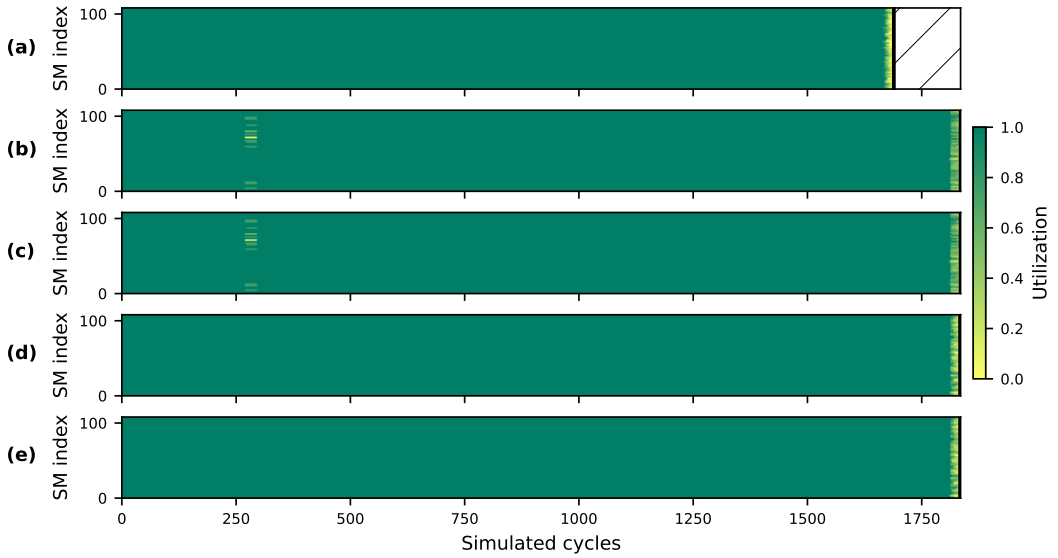

Figure 115: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,723 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}689$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 1{,}835$, $T/T^* = 1.008$ (slot), $0.92\times$; (c) $T = 1{,}835$, $T/T^* = 1.008$ (slot), $0.92\times$; (d) $T = 1{,}834$, $T/T^* = 1.007$ (slot), $0.92\times$; (e) $T = 1{,}834$, $T/T^* = 1.007$ (slot), $0.92\times$.

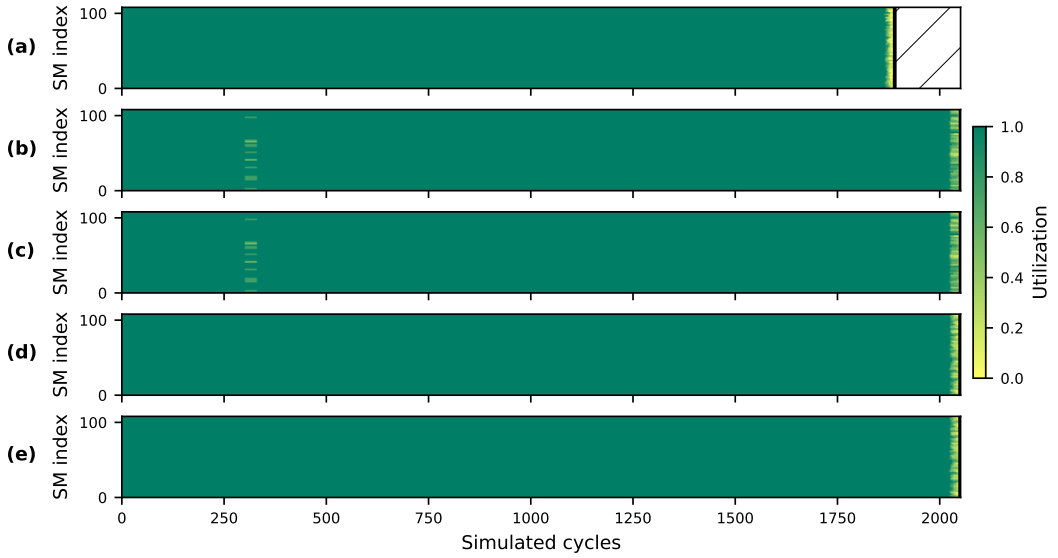

Figure 116: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,723 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}890$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 2{,}051$, $T/T^* = 1.008$ (slot), $0.92\times$; (c) $T = 2{,}051$, $T/T^* = 1.008$ (slot), $0.92\times$; (d) $T = 2{,}050$, $T/T^* = 1.007$ (slot), $0.92\times$; (e) $T = 2{,}050$, $T/T^* = 1.007$ (slot), $0.92\times$.

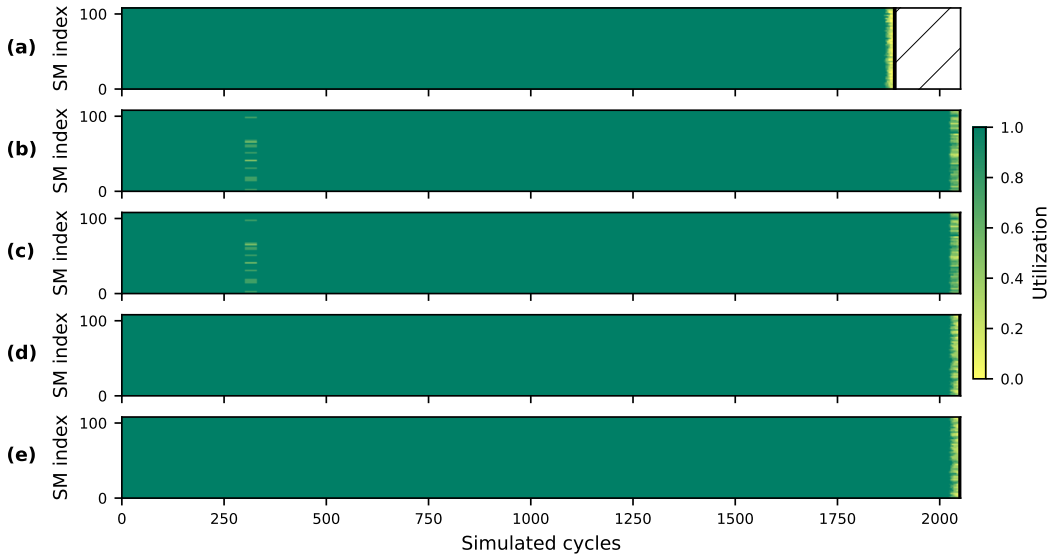

Figure 117: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,723 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}890$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 2{,}051$, $T/T^* = 1.008$ (slot), $0.92\times$; (c) $T = 2{,}051$, $T/T^* = 1.008$ (slot), $0.92\times$; (d) $T = 2{,}050$, $T/T^* = 1.007$ (slot), $0.92\times$; (e) $T = 2{,}050$, $T/T^* = 1.007$ (slot), $0.92\times$.

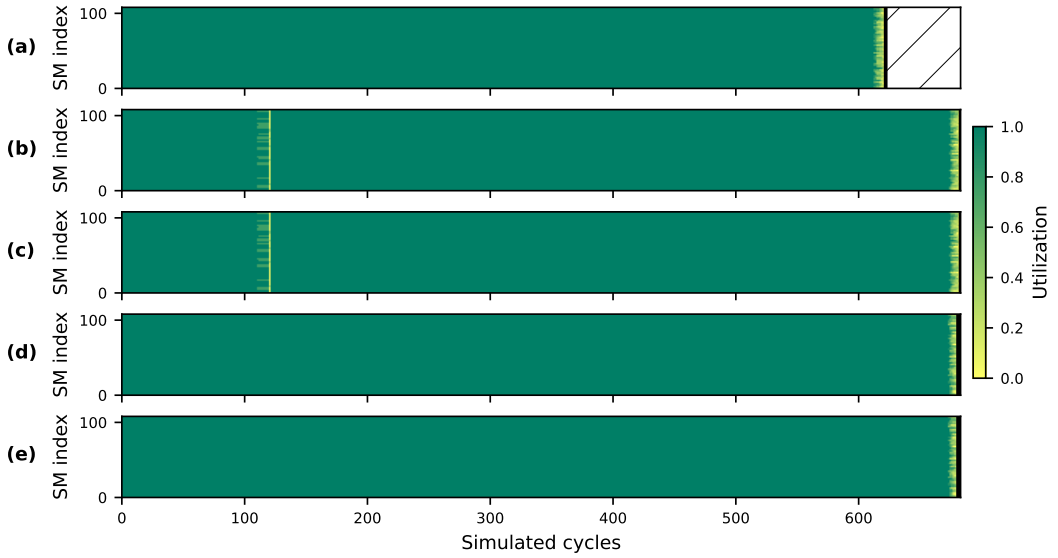

Figure 118: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 622$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 683$, $T/T^* = 1.011$ (slot), $0.91\times$; (c) $T = 683$, $T/T^* = 1.011$ (slot), $0.91\times$; (d) $T = 681$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 681$, $T/T^* = 1.008$ (slot), $0.91\times$.

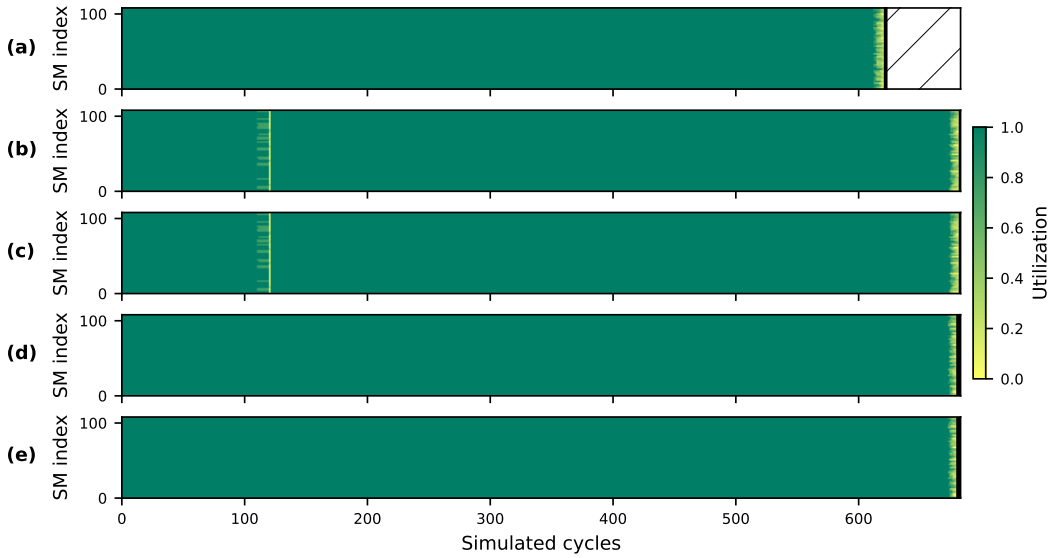

Figure 119: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 622$, $T/T^* = 1.010$ (slot), $1.00\times$; (b) $T = 683$, $T/T^* = 1.011$ (slot), $0.91\times$; (c) $T = 683$, $T/T^* = 1.011$ (slot), $0.91\times$; (d) $T = 681$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 681$, $T/T^* = 1.008$ (slot), $0.91\times$.

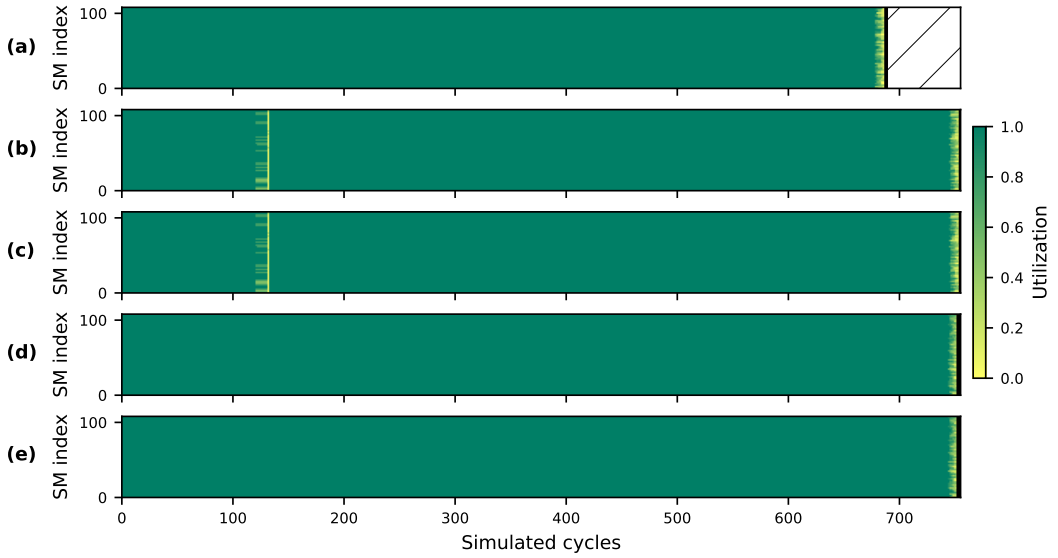

Figure 120: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 688$, $T/T^* = 1.009$ (slot), $1.00\times$; (b) $T = 755$, $T/T^* = 1.010$ (slot), $0.91\times$; (c) $T = 755$, $T/T^* = 1.010$ (slot), $0.91\times$; (d) $T = 753$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 753$, $T/T^* = 1.008$ (slot), $0.91\times$.

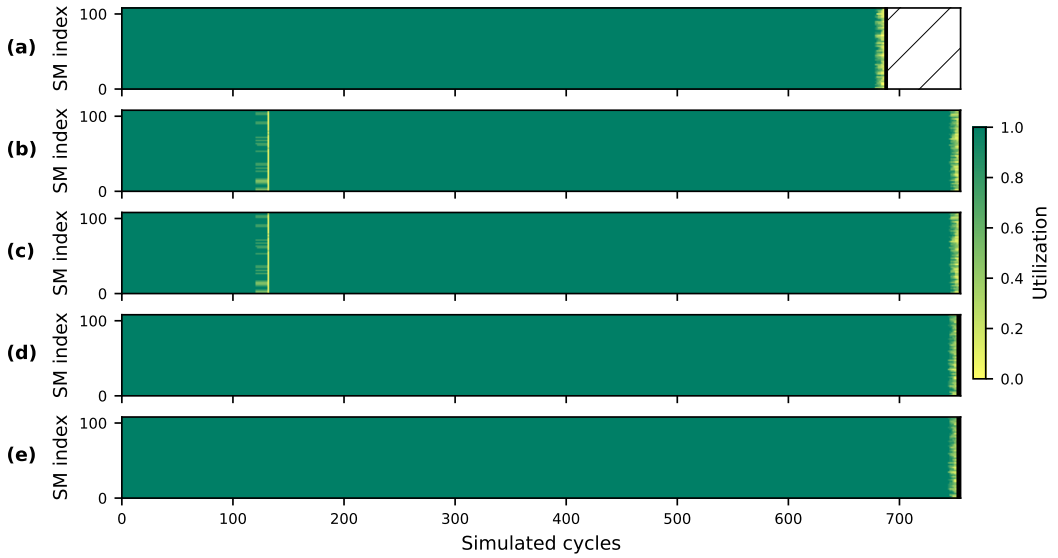

Figure 121: Per-SM occupancy over time for `city-roads-M` ($N = 57{,}073$ vertices, $E = 189{,}643$ edges, mean degree 3.3, maximum degree 7, skew $2\times$), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (4,705 of them). Edge slicing is declined on this graph: with a maximum degree of 7 against a per-block prologue of α, no slice size shortens the critical path, so (c) and (e) repeat (b) and (d). Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 688$, $T/T^* = 1.009$ (slot), $1.00\times$; (b) $T = 755$, $T/T^* = 1.010$ (slot), $0.91\times$; (c) $T = 755$, $T/T^* = 1.010$ (slot), $0.91\times$; (d) $T = 753$, $T/T^* = 1.008$ (slot), $0.91\times$; (e) $T = 753$, $T/T^* = 1.008$ (slot), $0.91\times$.

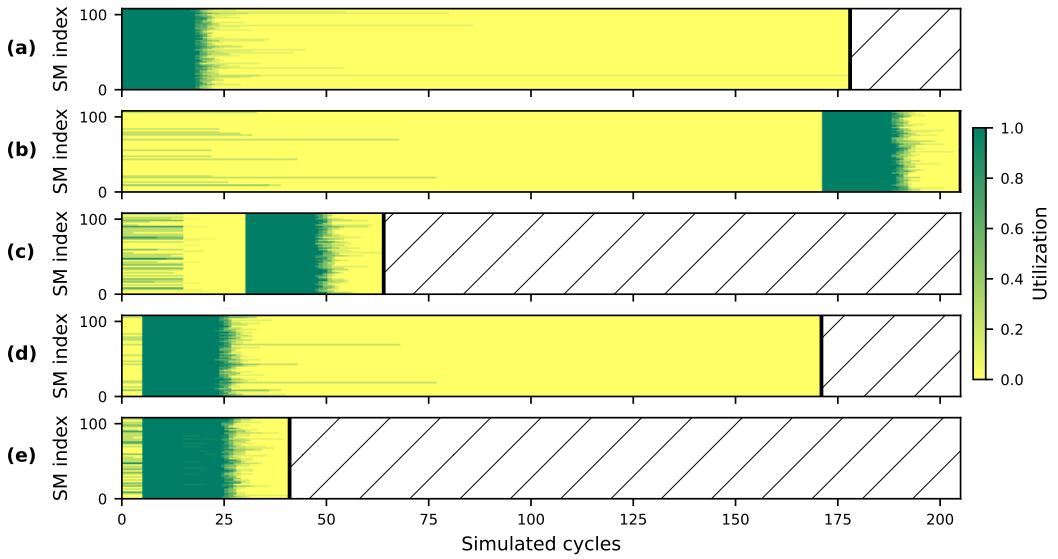

Figure 122: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 178$, $T/T^* = 1.041$ (critical path), $1.00\times$; (b) $T = 205$, $T/T^* = 1.199$ (critical path), $0.87\times$; (c) $T = 64$, $T/T^* = 2.738$ (slot), $2.78\times$; (d) $T = 171$, $T/T^* = 1.000$ (critical path), $1.04\times$; (e) $T = 41$, $T/T^* = 1.754$ (slot), $4.34\times$.

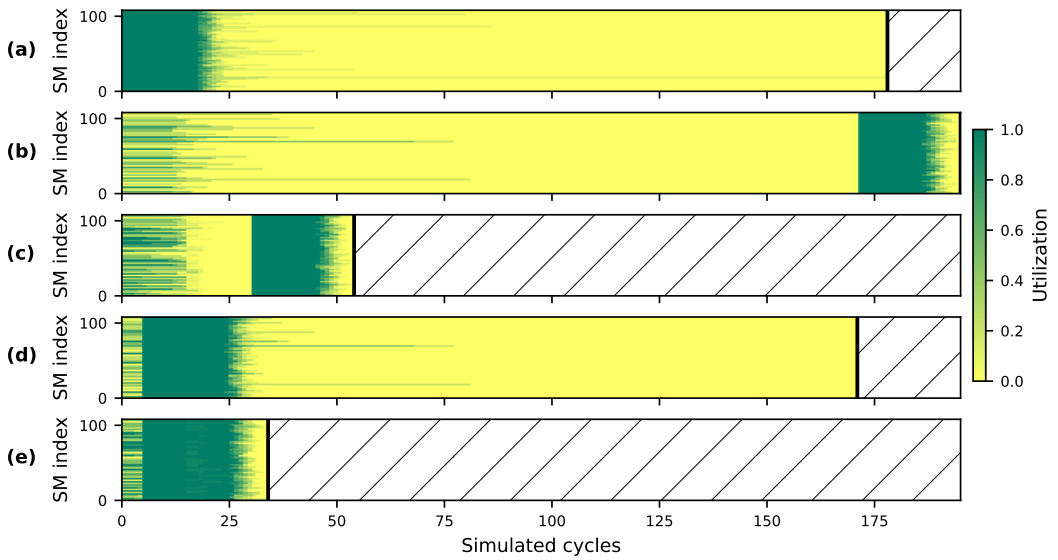

Figure 123: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 178$, $T/T^* = 1.041$ (critical path), $1.00\times$; (b) $T = 195$, $T/T^* = 1.140$ (critical path), $0.91\times$; (c) $T = 54$, $T/T^* = 2.094$ (slot), $3.30\times$; (d) $T = 171$, $T/T^* = 1.000$ (critical path), $1.04\times$; (e) $T = 34$, $T/T^* = 1.319$ (slot), $5.24\times$.

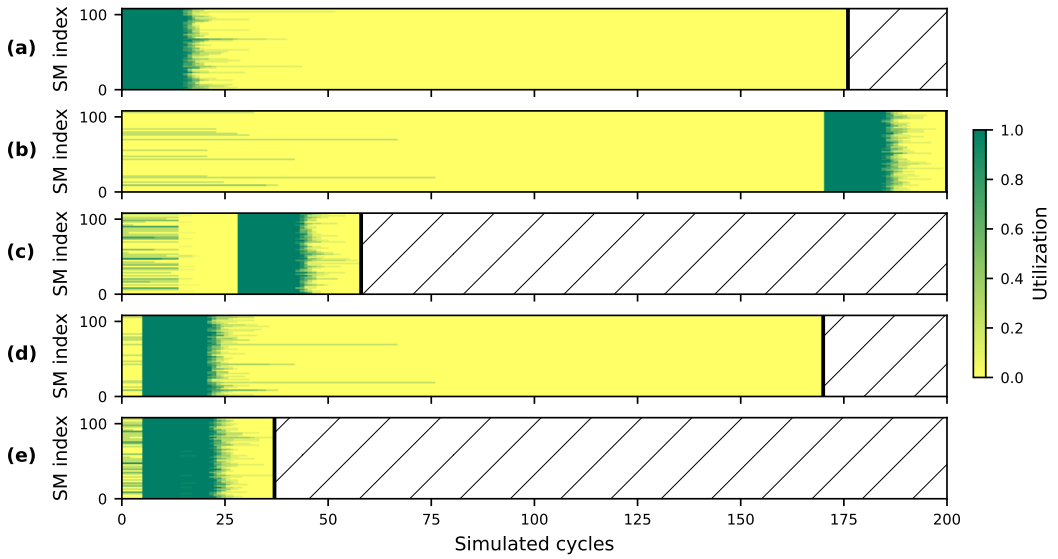

Figure 124: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 176$, $T/T^* = 1.035$ (critical path), $1.00\times$; (b) $T = 200$, $T/T^* = 1.176$ (critical path), $0.88\times$; (c) $T = 58$, $T/T^* = 2.896$ (slot), $3.03\times$; (d) $T = 170$, $T/T^* = 1.000$ (critical path), $1.04\times$; (e) $T = 37$, $T/T^* = 1.847$ (slot), $4.76\times$.

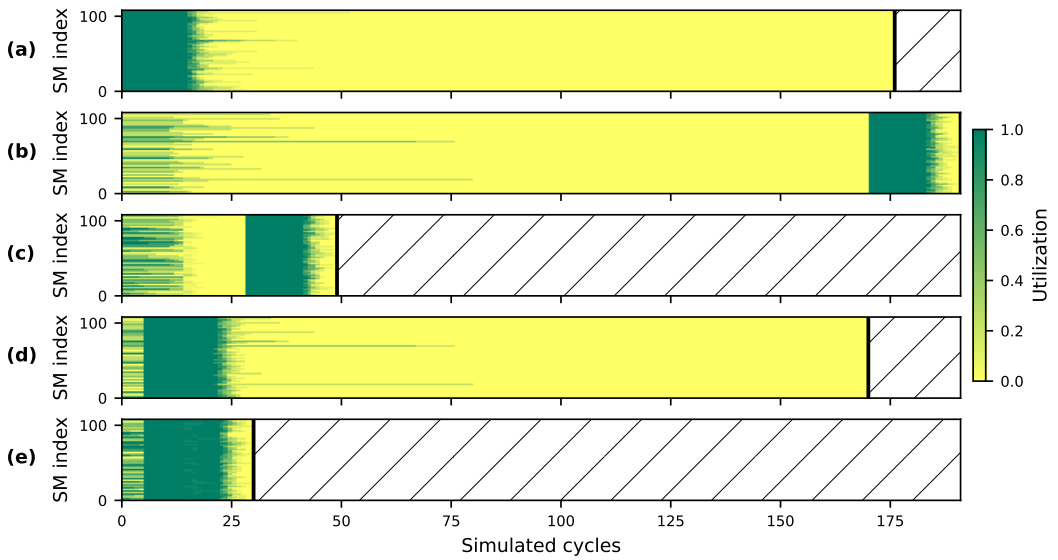

Figure 125: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 176$, $T/T^* = 1.035$ (critical path), $1.00\times$; (b) $T = 191$, $T/T^* = 1.124$ (critical path), $0.92\times$; (c) $T = 49$, $T/T^* = 2.212$ (slot), $3.59\times$; (d) $T = 170$, $T/T^* = 1.000$ (critical path), $1.04\times$; (e) $T = 30$, $T/T^* = 1.354$ (slot), $5.87\times$.

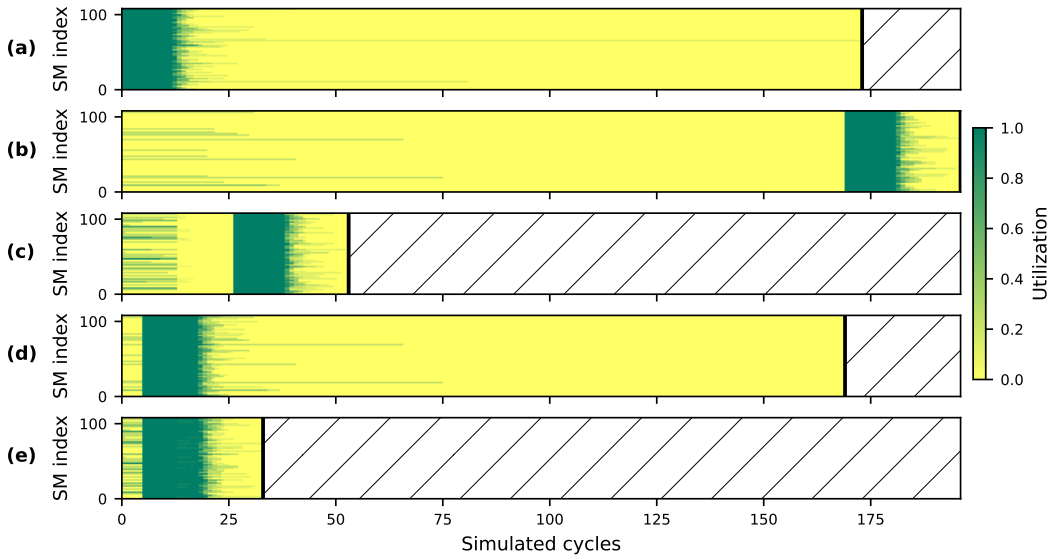

Figure 126: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 173$, $T/T^* = 1.024$ (critical path), $1.00\times$; (b) $T = 196$, $T/T^* = 1.160$ (critical path), $0.88\times$; (c) $T = 53$, $T/T^* = 2.789$ (critical path), $3.26\times$; (d) $T = 169$, $T/T^* = 1.000$ (critical path), $1.02\times$; (e) $T = 33$, $T/T^* = 1.737$ (critical path), $5.24\times$.

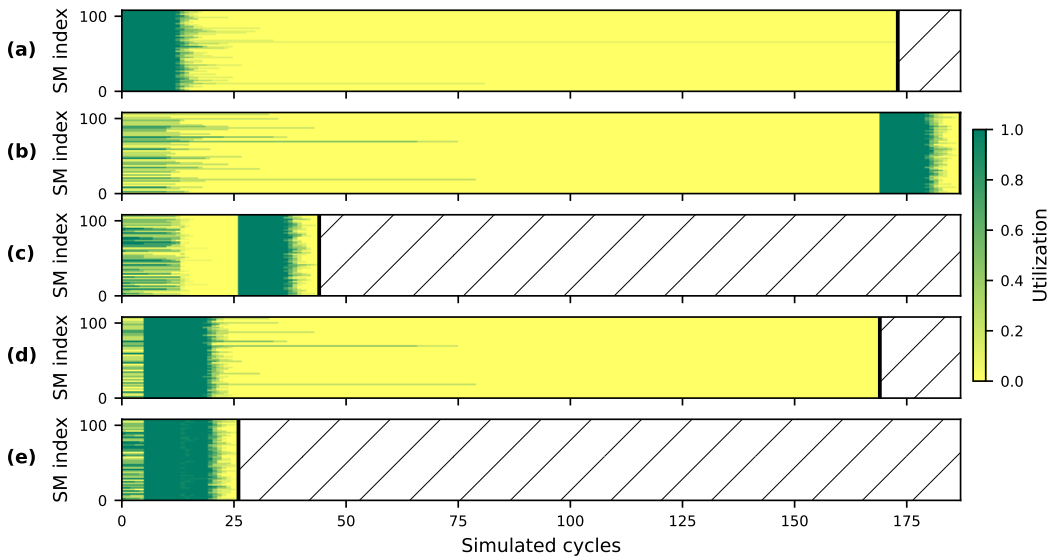

Figure 127: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 173$, $T/T^* = 1.024$ (critical path), $1.00\times$; (b) $T = 187$, $T/T^* = 1.107$ (critical path), $0.93\times$; (c) $T = 44$, $T/T^* = 2.375$ (slot), $3.93\times$; (d) $T = 169$, $T/T^* = 1.000$ (critical path), $1.02\times$; (e) $T = 26$, $T/T^* = 1.404$ (slot), $6.65\times$.

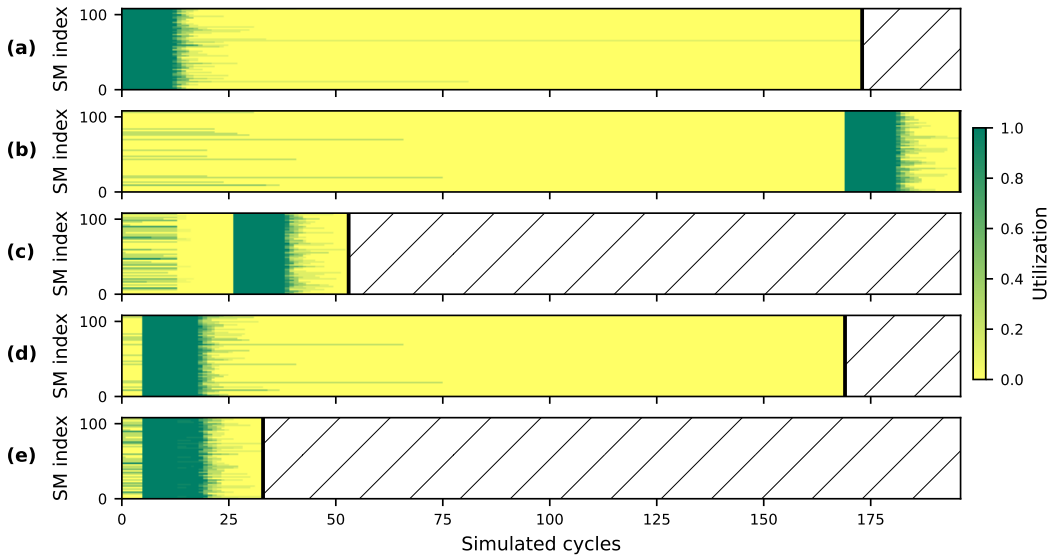

Figure 128: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 173$, $T/T^* = 1.024$ (critical path), $1.00\times$; (b) $T = 196$, $T/T^* = 1.160$ (critical path), $0.88\times$; (c) $T = 53$, $T/T^* = 2.789$ (critical path), $3.26\times$; (d) $T = 169$, $T/T^* = 1.000$ (critical path), $1.02\times$; (e) $T = 33$, $T/T^* = 1.737$ (critical path), $5.24\times$.

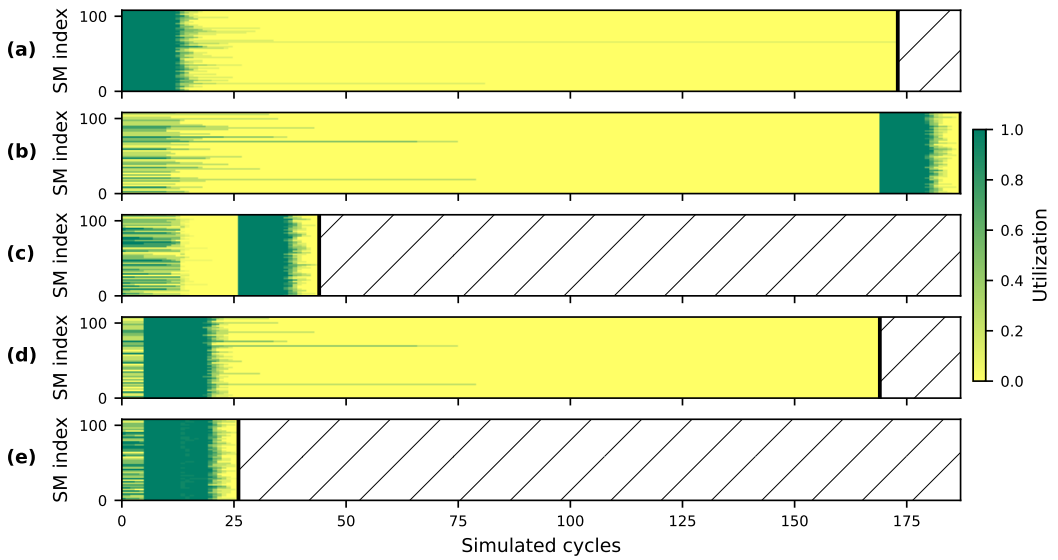

Figure 129: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 173$, $T/T^* = 1.024$ (critical path), $1.00\times$; (b) $T = 187$, $T/T^* = 1.107$ (critical path), $0.93\times$; (c) $T = 44$, $T/T^* = 2.375$ (slot), $3.93\times$; (d) $T = 169$, $T/T^* = 1.000$ (critical path), $1.02\times$; (e) $T = 26$, $T/T^* = 1.404$ (slot), $6.65\times$.

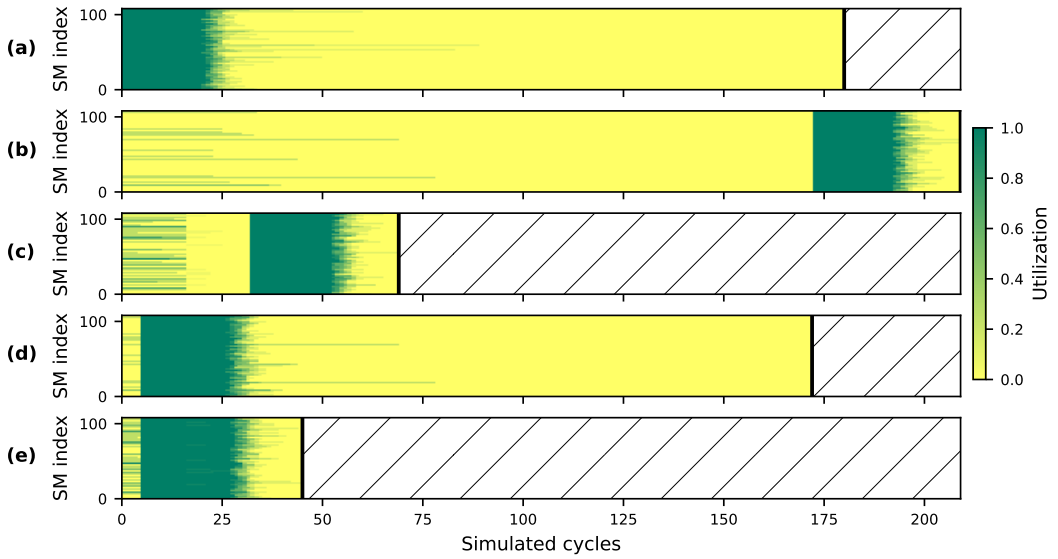

Figure 130: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 180$, $T/T^* = 1.047$ (critical path), $1.00\times$; (b) $T = 209$, $T/T^* = 1.215$ (critical path), $0.86\times$; (c) $T = 69$, $T/T^* = 2.583$ (slot), $2.61\times$; (d) $T = 172$, $T/T^* = 1.000$ (critical path), $1.05\times$; (e) $T = 45$, $T/T^* = 1.684$ (slot), $4.00\times$.

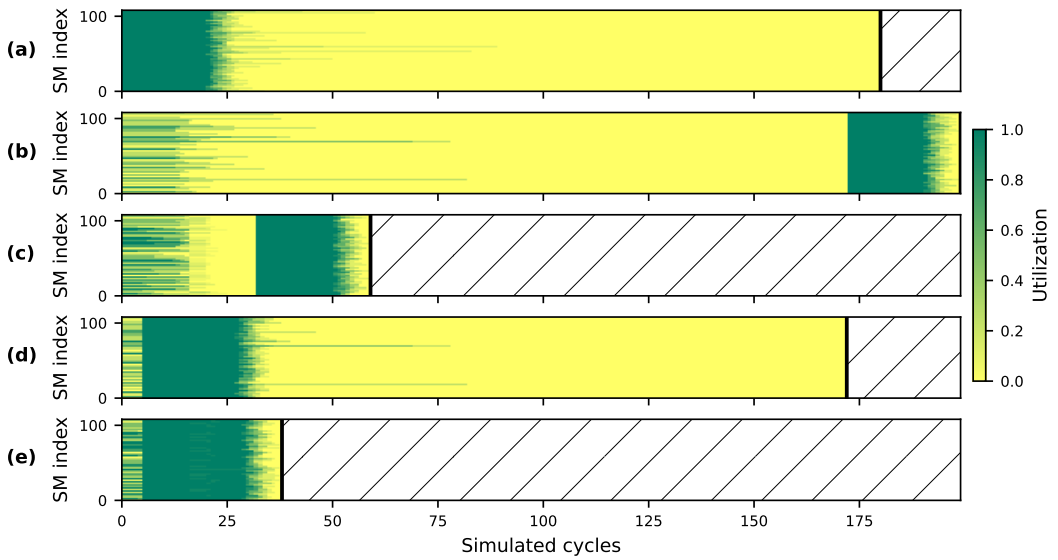

Figure 131: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 180$, $T/T^* = 1.047$ (critical path), $1.00\times$; (b) $T = 199$, $T/T^* = 1.157$ (critical path), $0.90\times$; (c) $T = 59$, $T/T^* = 2.006$ (slot), $3.05\times$; (d) $T = 172$, $T/T^* = 1.000$ (critical path), $1.05\times$; (e) $T = 38$, $T/T^* = 1.292$ (slot), $4.74\times$.

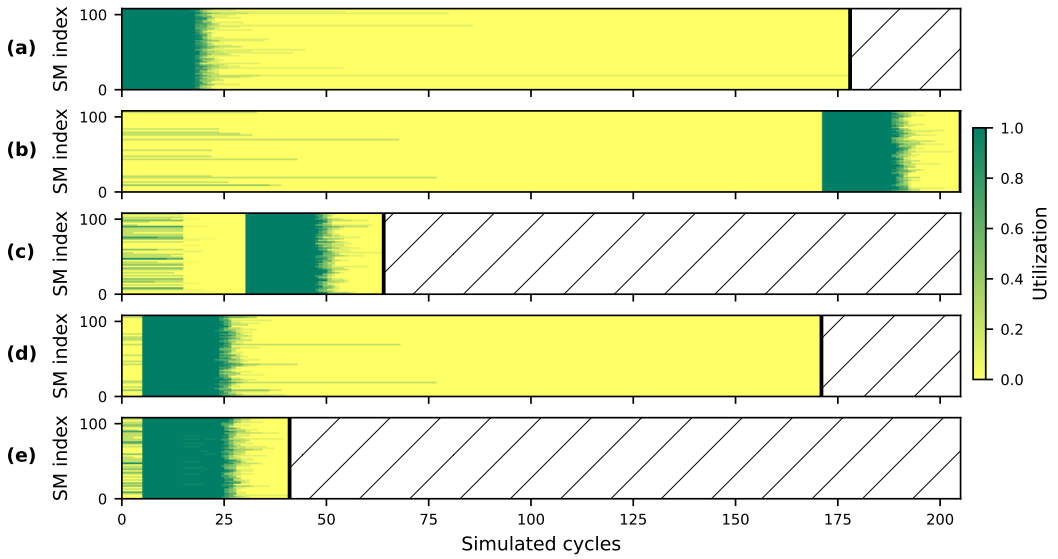

Figure 132: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 178$, $T/T^* = 1.041$ (critical path), 1.00×; (b) $T = 205$, $T/T^* = 1.199$ (critical path), 0.87×; (c) $T = 64$, $T/T^* = 2.738$ (slot), 2.78×; (d) $T = 171$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 41$, $T/T^* = 1.754$ (slot), 4.34×.

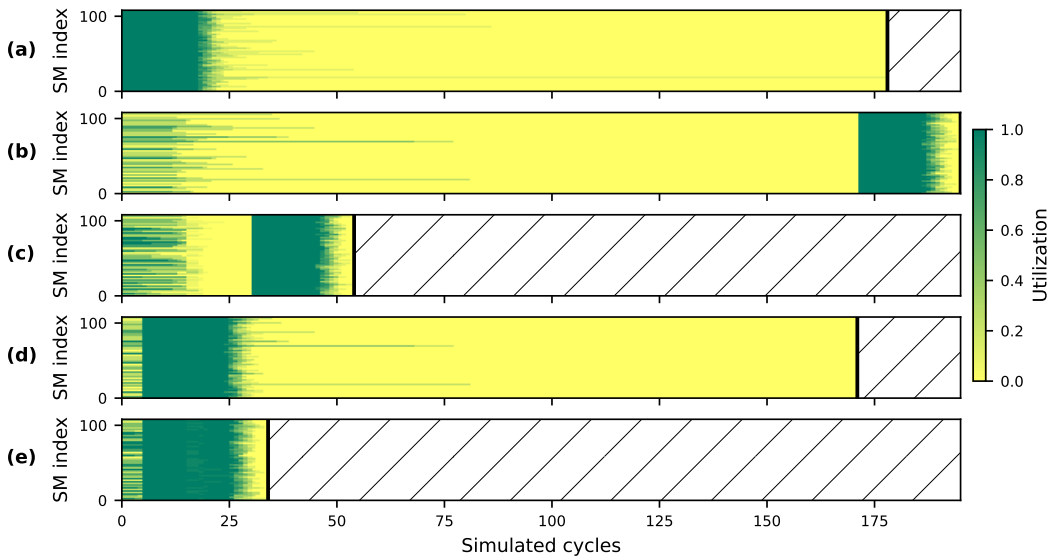

Figure 133: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 178$, $T/T^* = 1.041$ (critical path), 1.00×; (b) $T = 195$, $T/T^* = 1.140$ (critical path), 0.91×; (c) $T = 54$, $T/T^* = 2.094$ (slot), 3.30×; (d) $T = 171$, $T/T^* = 1.000$ (critical path), 1.04×; (e) $T = 34$, $T/T^* = 1.319$ (slot), 5.24×.

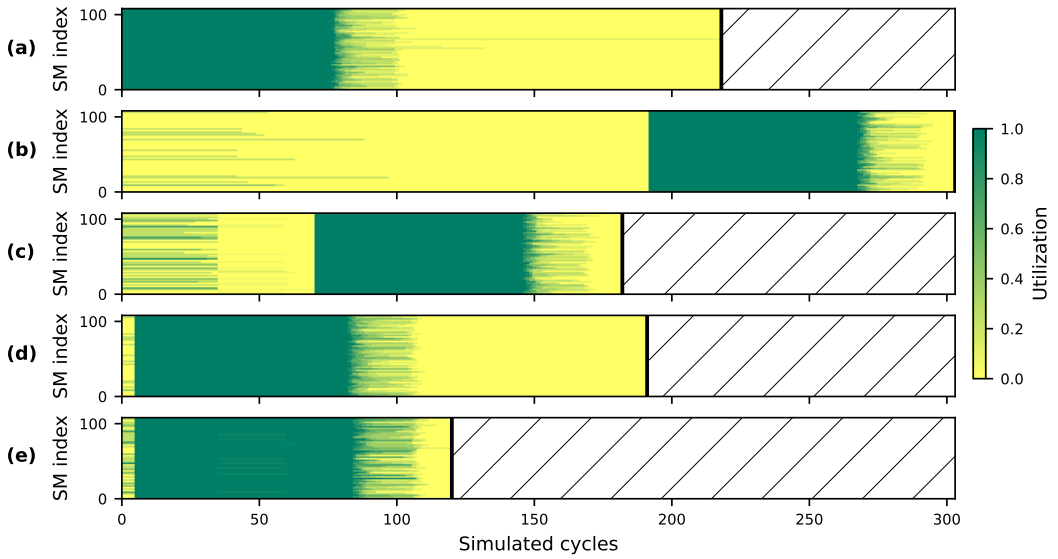

Figure 134: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 218$, $T/T^* = 1.141$ (critical path), $1.00\times$; (b) $T = 303$, $T/T^* = 1.586$ (critical path), $0.72\times$; (c) $T = 182$, $T/T^* = 2.016$ (slot), $1.20\times$; (d) $T = 191$, $T/T^* = 1.000$ (critical path), $1.14\times$; (e) $T = 120$, $T/T^* = 1.330$ (slot), $1.82\times$.

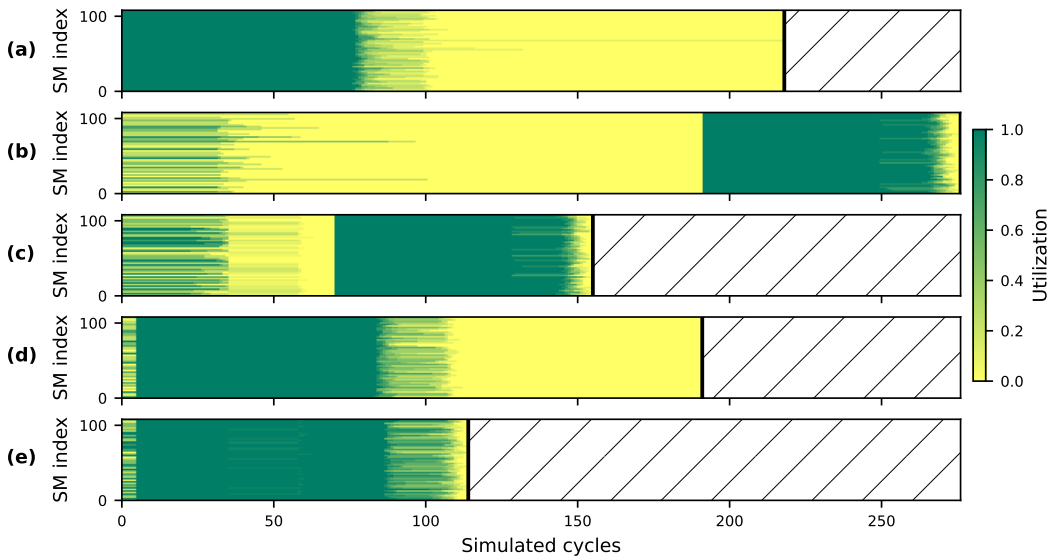

Figure 135: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 218$, $T/T^* = 1.141$ (critical path), $1.00\times$; (b) $T = 276$, $T/T^* = 1.445$ (critical path), $0.79\times$; (c) $T = 155$, $T/T^* = 1.575$ (slot), $1.41\times$; (d) $T = 191$, $T/T^* = 1.000$ (critical path), $1.14\times$; (e) $T = 114$, $T/T^* = 1.159$ (slot), $1.91\times$.

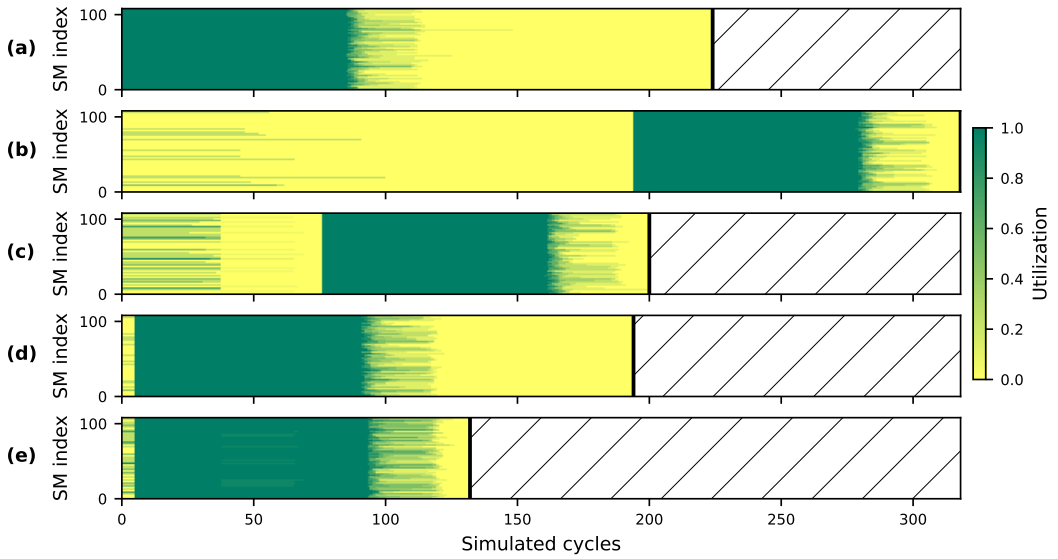

Figure 136: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 224$, $T/T^* = 1.155$ (critical path), $1.00\times$; (b) $T = 318$, $T/T^* = 1.639$ (critical path), $0.70\times$; (c) $T = 200$, $T/T^* = 1.994$ (slot), $1.12\times$; (d) $T = 194$, $T/T^* = 1.000$ (critical path), $1.15\times$; (e) $T = 132$, $T/T^* = 1.316$ (slot), $1.70\times$.

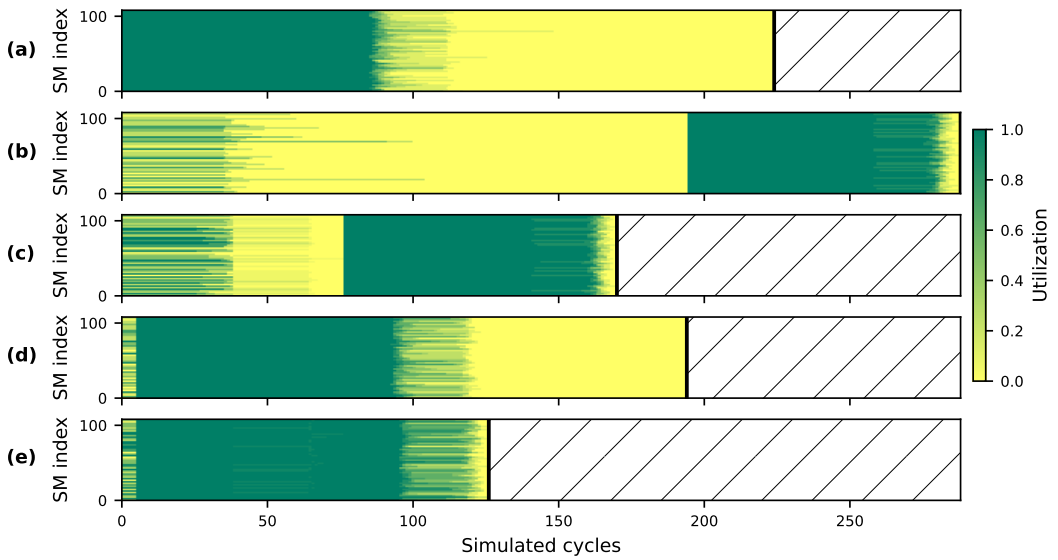

Figure 137: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew $35\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 224$, $T/T^* = 1.155$ (critical path), $1.00\times$; (b) $T = 288$, $T/T^* = 1.485$ (critical path), $0.78\times$; (c) $T = 170$, $T/T^* = 1.556$ (slot), $1.32\times$; (d) $T = 194$, $T/T^* = 1.000$ (critical path), $1.15\times$; (e) $T = 126$, $T/T^* = 1.153$ (slot), $1.78\times$.

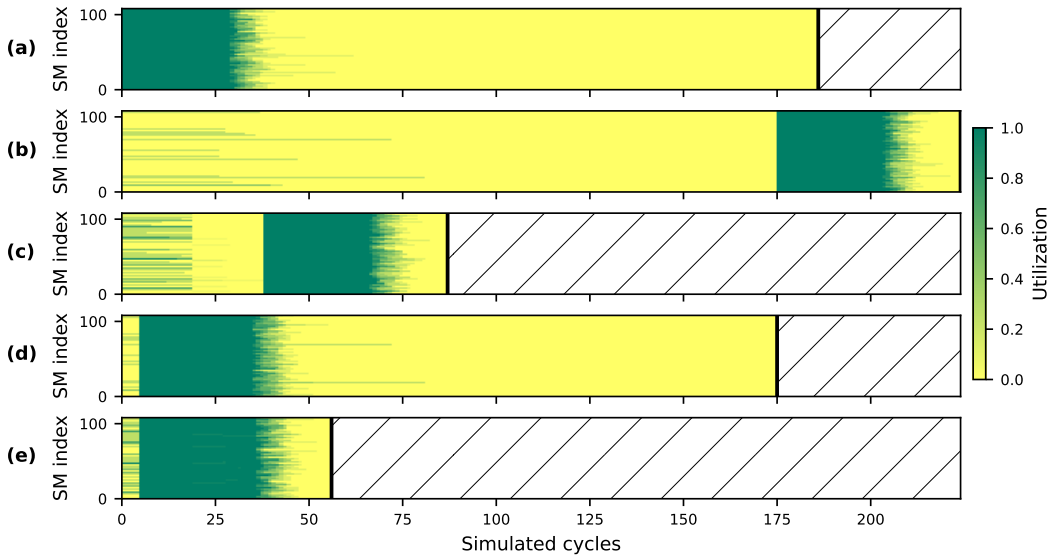

Figure 138: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 186$, $T/T^* = 1.063$ (critical path), 1.00×; (b) $T = 224$, $T/T^* = 1.280$ (critical path), 0.83×; (c) $T = 87$, $T/T^* = 2.367$ (slot), 2.14×; (d) $T = 175$, $T/T^* = 1.000$ (critical path), 1.06×; (e) $T = 56$, $T/T^* = 1.524$ (slot), 3.32×.

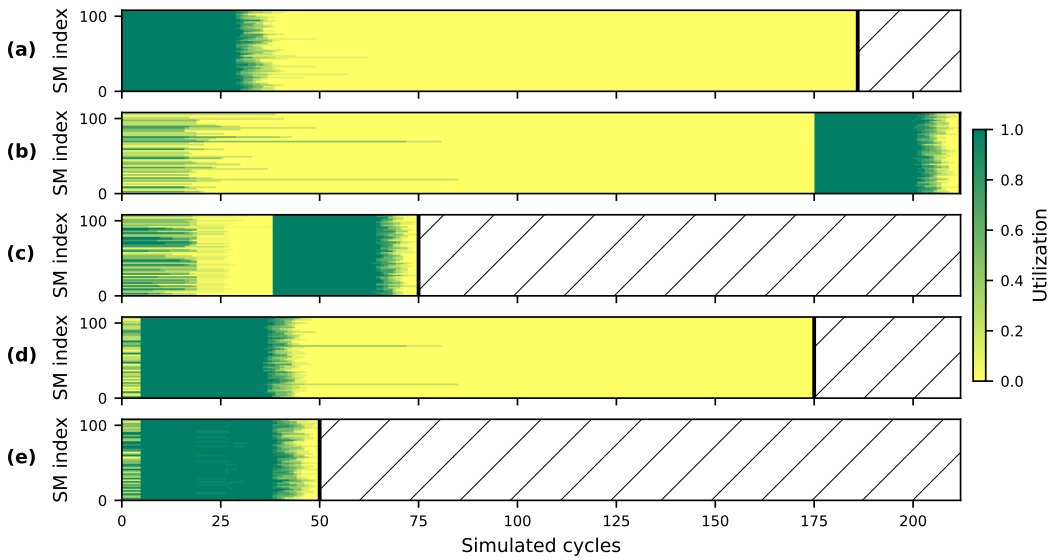

Figure 139: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 186$, $T/T^* = 1.063$ (critical path), 1.00×; (b) $T = 212$, $T/T^* = 1.211$ (critical path), 0.88×; (c) $T = 75$, $T/T^* = 1.861$ (slot), 2.48×; (d) $T = 175$, $T/T^* = 1.000$ (critical path), 1.06×; (e) $T = 50$, $T/T^* = 1.241$ (slot), 3.72×.

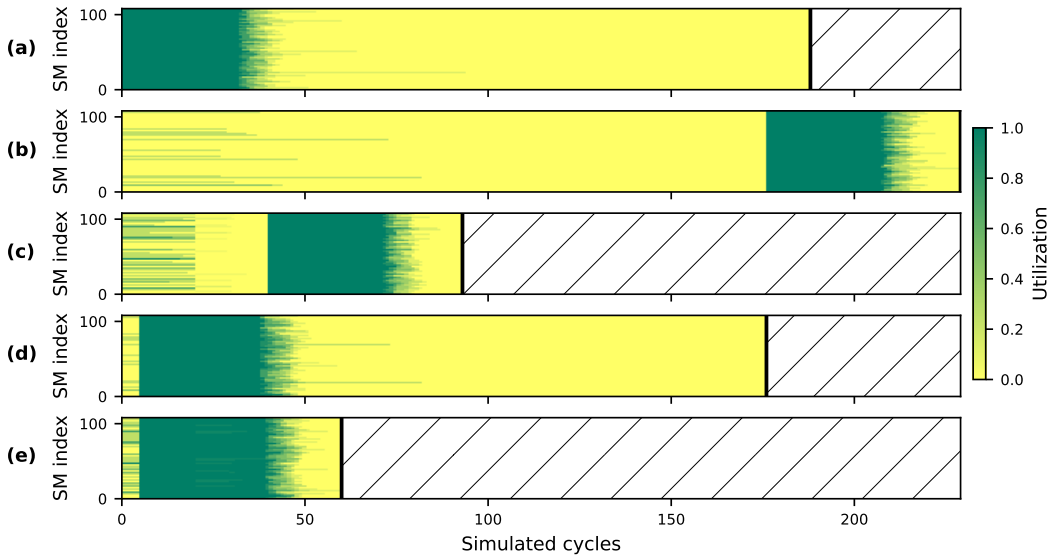

Figure 140: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 188$, $T/T^* = 1.068$ (critical path), 1.00×; (b) $T = 229$, $T/T^* = 1.301$ (critical path), 0.82×; (c) $T = 93$, $T/T^* = 2.320$ (slot), 2.02×; (d) $T = 176$, $T/T^* = 1.000$ (critical path), 1.07×; (e) $T = 60$, $T/T^* = 1.496$ (slot), 3.13×.

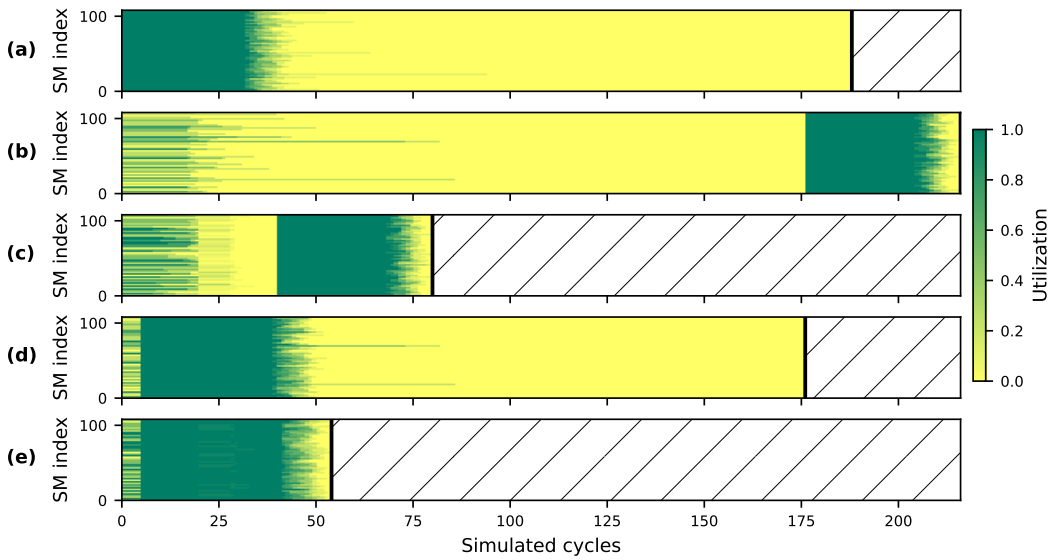

Figure 141: Per-SM occupancy over time for `cora` ($N = 2{,}708$ vertices, $E = 13{,}264$ edges, mean degree 4.9, maximum degree 169, skew 35×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (147 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 188$, $T/T^* = 1.068$ (critical path), 1.00×; (b) $T = 216$, $T/T^* = 1.227$ (critical path), 0.87×; (c) $T = 80$, $T/T^* = 1.821$ (slot), 2.35×; (d) $T = 176$, $T/T^* = 1.000$ (critical path), 1.07×; (e) $T = 54$, $T/T^* = 1.229$ (slot), 3.48×.

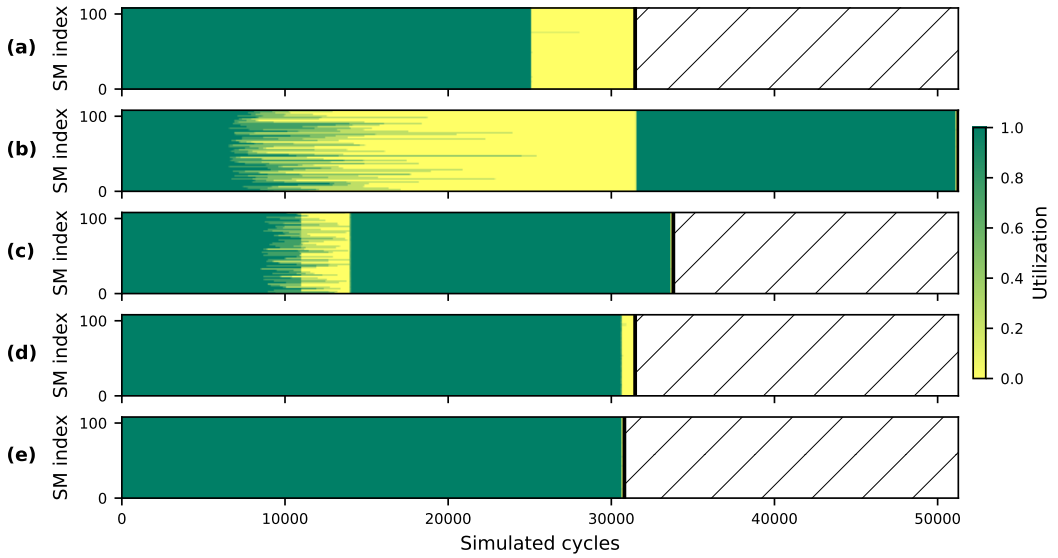

Figure 142: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}268$, $T/T^* = 1.630$ (critical path), 0.61×; (c) $T = 33{,}801$, $T/T^* = 1.108$ (slot), 0.93×; (d) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}801$, $T/T^* = 1.010$ (slot), 1.02×.

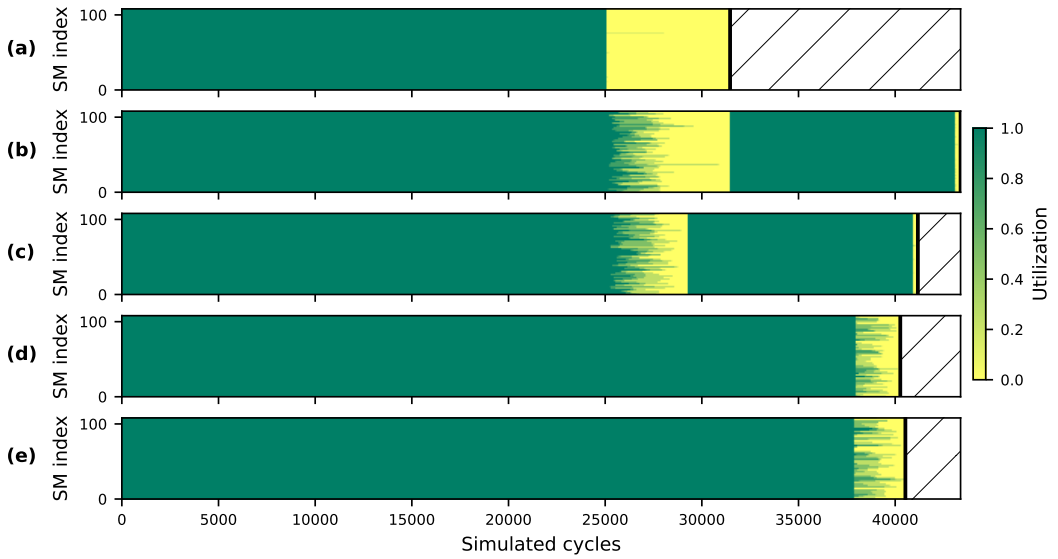

Figure 143: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}382$, $T/T^* = 1.130$ (slot), 0.73×; (c) $T = 41{,}173$, $T/T^* = 1.073$ (slot), 0.76×; (d) $T = 40{,}264$, $T/T^* = 1.049$ (slot), 0.78×; (e) $T = 40{,}528$, $T/T^* = 1.056$ (slot), 0.78×.

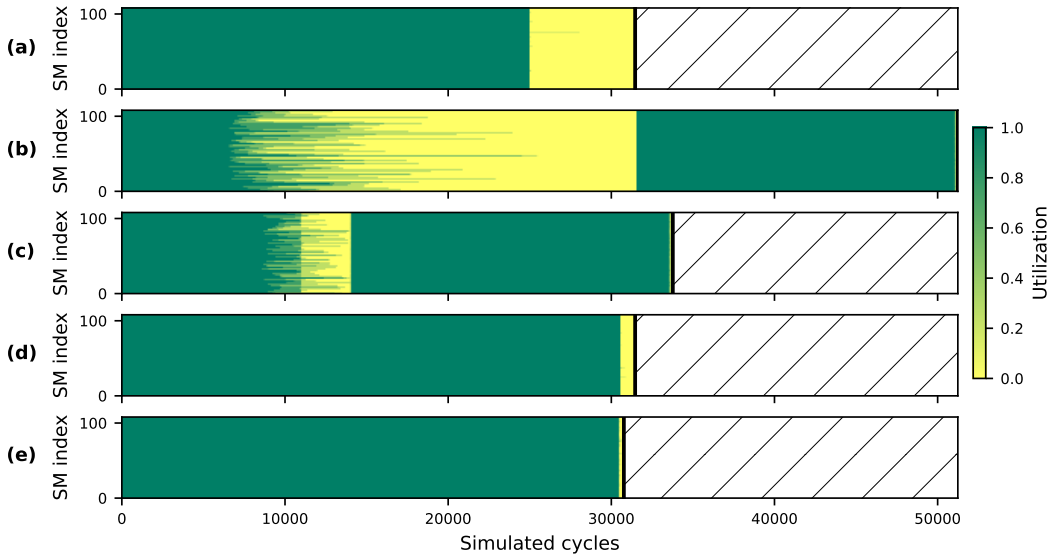

Figure 144: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}460$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}238$, $T/T^* = 1.629$ (critical path), 0.61×; (c) $T = 33{,}768$, $T/T^* = 1.109$ (slot), 0.93×; (d) $T = 31{,}460$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}768$, $T/T^* = 1.011$ (slot), 1.02×.

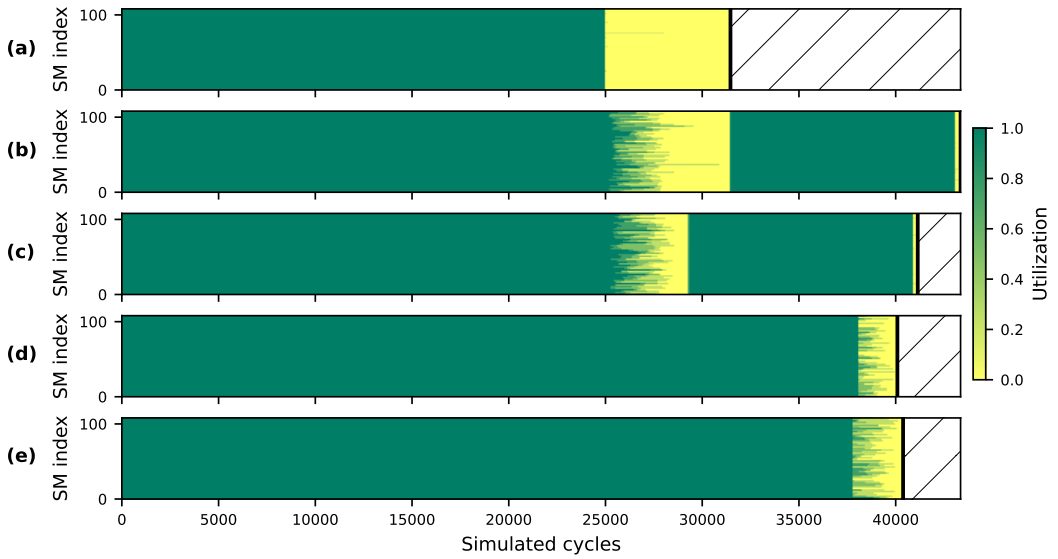

Figure 145: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}460$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}354$, $T/T^* = 1.131$ (slot), 0.73×; (c) $T = 41{,}140$, $T/T^* = 1.073$ (slot), 0.76×; (d) $T = 40{,}088$, $T/T^* = 1.046$ (slot), 0.78×; (e) $T = 40{,}383$, $T/T^* = 1.054$ (slot), 0.78×.

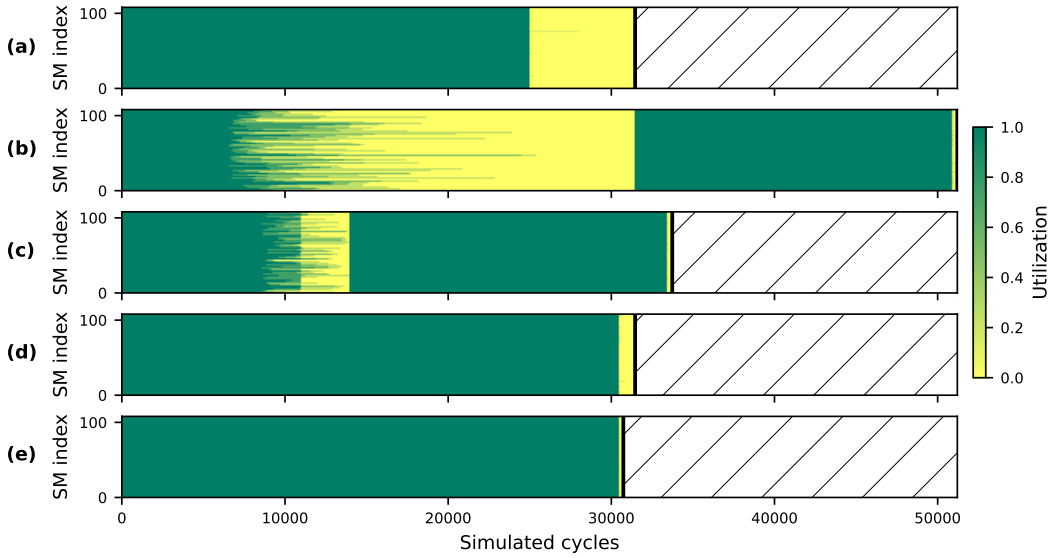

Figure 146: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}207$, $T/T^* = 1.628$ (critical path), 0.61×; (c) $T = 33{,}734$, $T/T^* = 1.110$ (slot), 0.93×; (d) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}736$, $T/T^* = 1.011$ (slot), 1.02×.

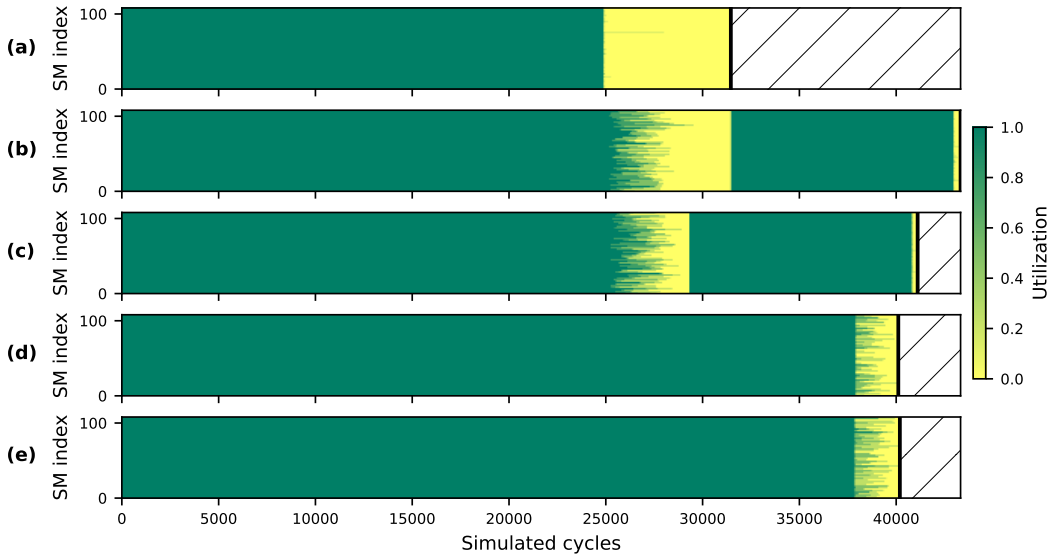

Figure 147: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}326$, $T/T^* = 1.132$ (slot), 0.73×; (c) $T = 41{,}108$, $T/T^* = 1.074$ (slot), 0.77×; (d) $T = 40{,}110$, $T/T^* = 1.048$ (slot), 0.78×; (e) $T = 40{,}190$, $T/T^* = 1.050$ (slot), 0.78×.

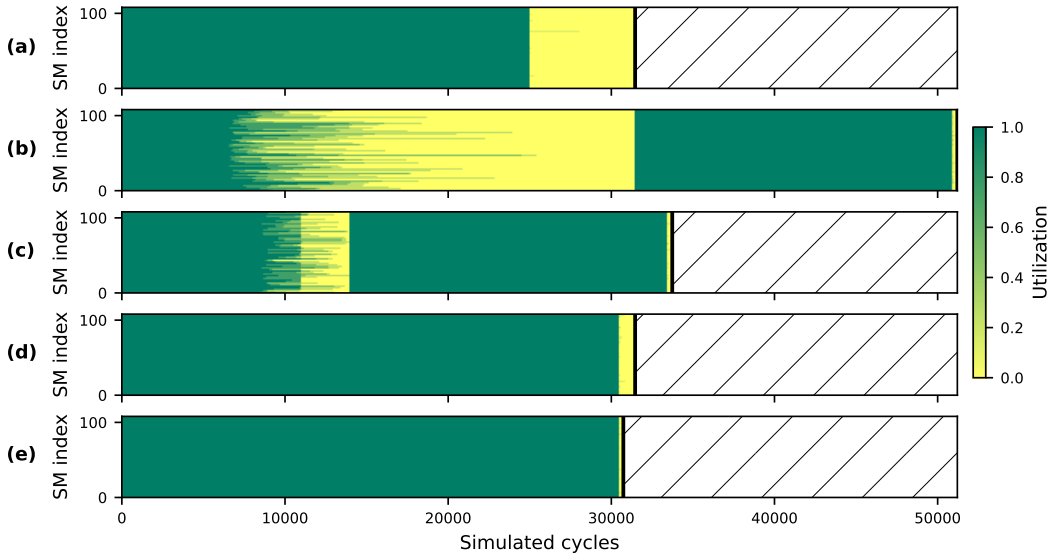

Figure 148: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}207$, $T/T^* = 1.628$ (critical path), 0.61×; (c) $T = 33{,}734$, $T/T^* = 1.110$ (slot), 0.93×; (d) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}736$, $T/T^* = 1.011$ (slot), 1.02×.

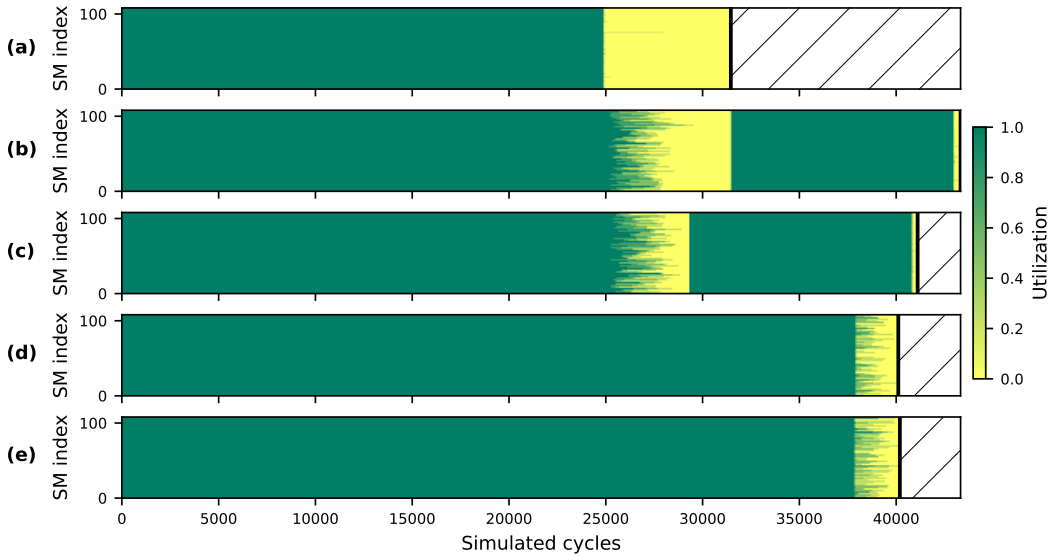

Figure 149: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}459$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}326$, $T/T^* = 1.132$ (slot), 0.73×; (c) $T = 41{,}108$, $T/T^* = 1.074$ (slot), 0.77×; (d) $T = 40{,}110$, $T/T^* = 1.048$ (slot), 0.78×; (e) $T = 40{,}190$, $T/T^* = 1.050$ (slot), 0.78×.

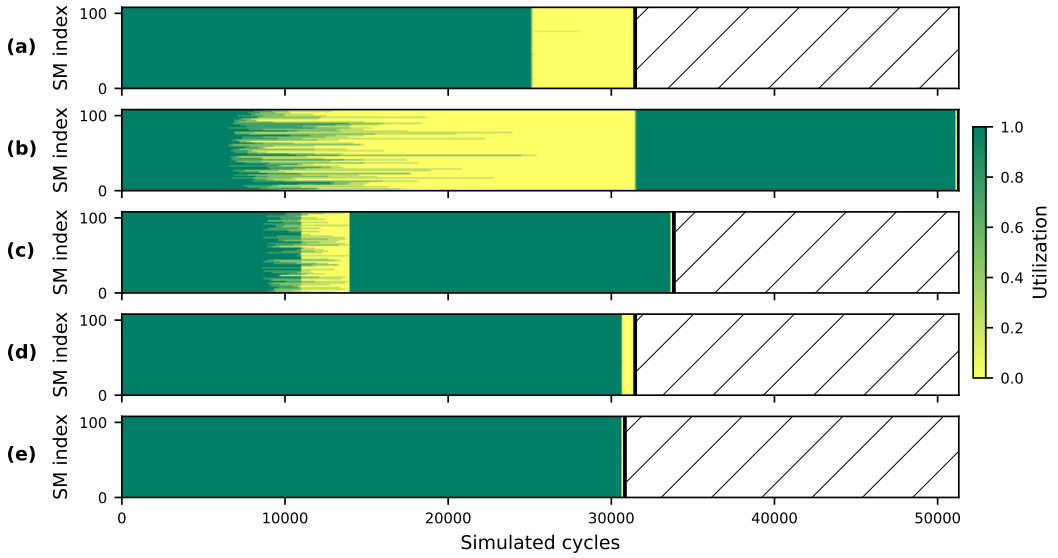

Figure 150: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}462$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}299$, $T/T^* = 1.631$ (critical path), 0.61×; (c) $T = 33{,}835$, $T/T^* = 1.107$ (slot), 0.93×; (d) $T = 31{,}462$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}833$, $T/T^* = 1.009$ (slot), 1.02×.

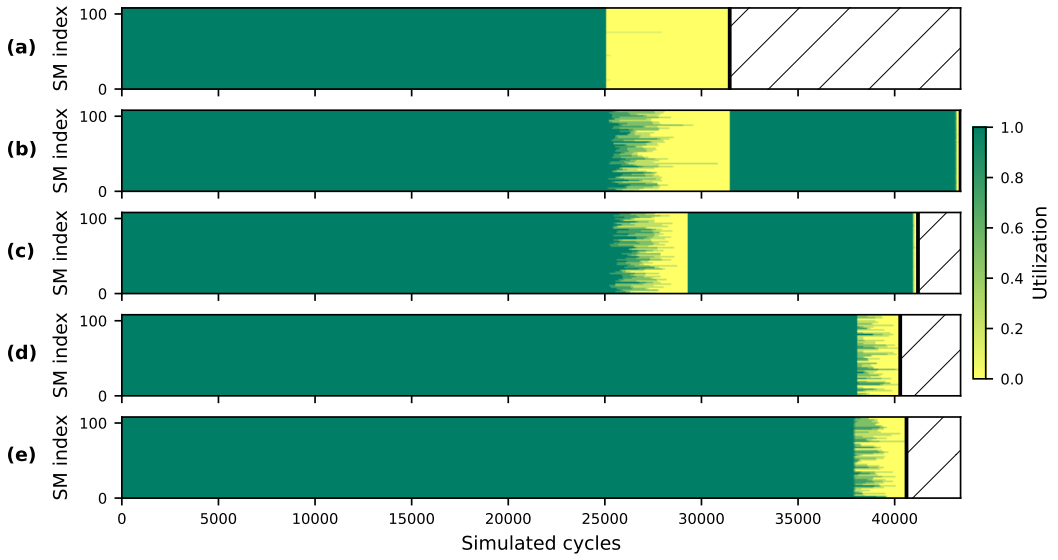

Figure 151: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}462$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}411$, $T/T^* = 1.129$ (slot), 0.72×; (c) $T = 41{,}207$, $T/T^* = 1.072$ (slot), 0.76×; (d) $T = 40{,}288$, $T/T^* = 1.048$ (slot), 0.78×; (e) $T = 40{,}613$, $T/T^* = 1.056$ (slot), 0.77×.

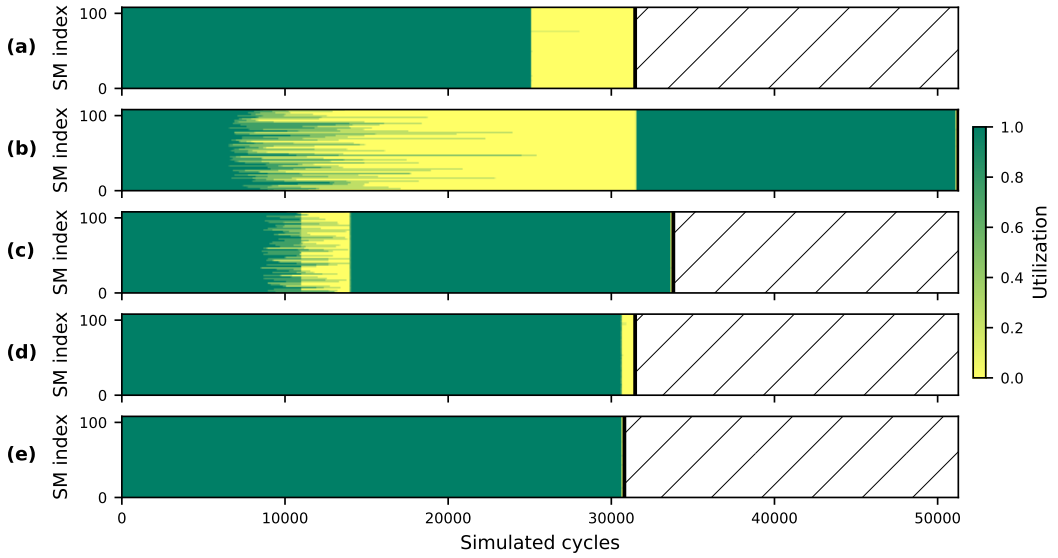

Figure 152: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}268$, $T/T^* = 1.630$ (critical path), 0.61×; (c) $T = 33{,}801$, $T/T^* = 1.108$ (slot), 0.93×; (d) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}801$, $T/T^* = 1.010$ (slot), 1.02×.

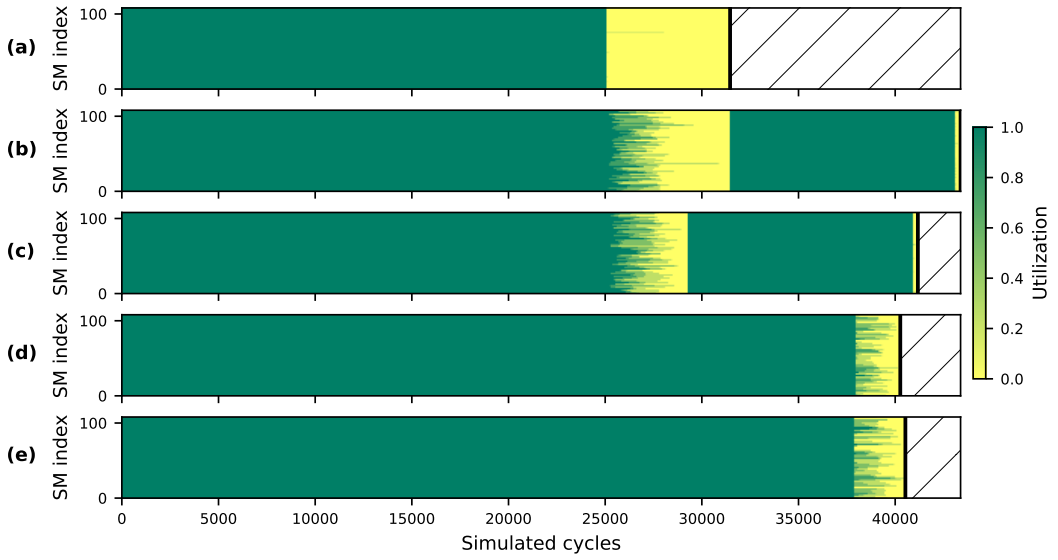

Figure 153: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}461$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}382$, $T/T^* = 1.130$ (slot), 0.73×; (c) $T = 41{,}173$, $T/T^* = 1.073$ (slot), 0.76×; (d) $T = 40{,}264$, $T/T^* = 1.049$ (slot), 0.78×; (e) $T = 40{,}528$, $T/T^* = 1.056$ (slot), 0.78×.

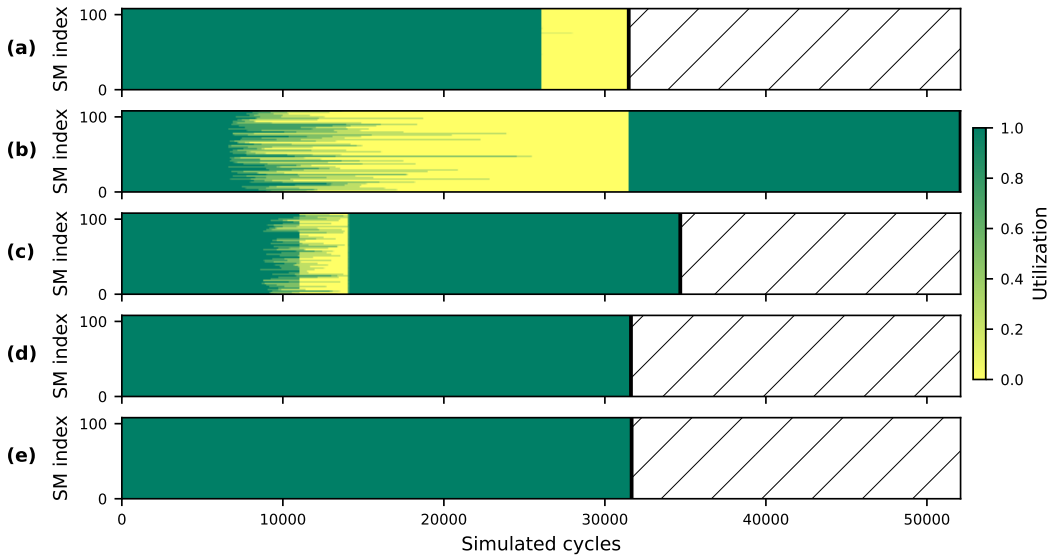

Figure 154: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}481$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 52{,}090$, $T/T^* = 1.649$ (slot), 0.60×; (c) $T = 34{,}683$, $T/T^* = 1.097$ (slot), 0.91×; (d) $T = 31{,}620$, $T/T^* = 1.001$ (slot), 1.00×; (e) $T = 31{,}660$, $T/T^* = 1.001$ (slot), 0.99×.

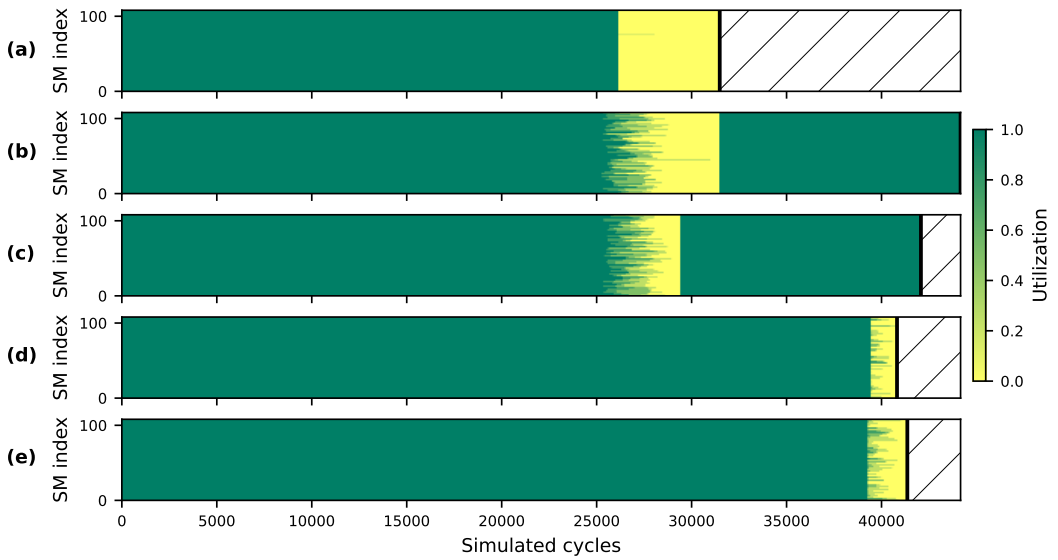

Figure 155: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}481$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 44{,}162$, $T/T^* = 1.118$ (slot), 0.71×; (c) $T = 42{,}075$, $T/T^* = 1.064$ (slot), 0.75×; (d) $T = 40{,}816$, $T/T^* = 1.033$ (slot), 0.77×; (e) $T = 41{,}359$, $T/T^* = 1.046$ (slot), 0.76×.

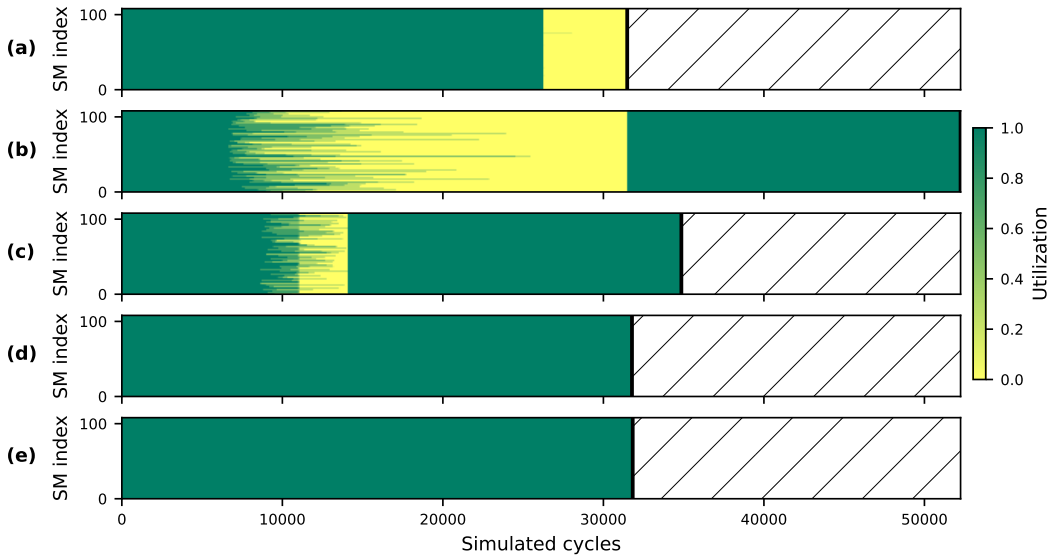

Figure 156: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}484$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 52{,}251$, $T/T^* = 1.646$ (slot), 0.60×; (c) $T = 34{,}857$, $T/T^* = 1.096$ (slot), 0.90×; (d) $T = 31{,}781$, $T/T^* = 1.001$ (slot), 0.99×; (e) $T = 31{,}826$, $T/T^* = 1.001$ (slot), 0.99×.

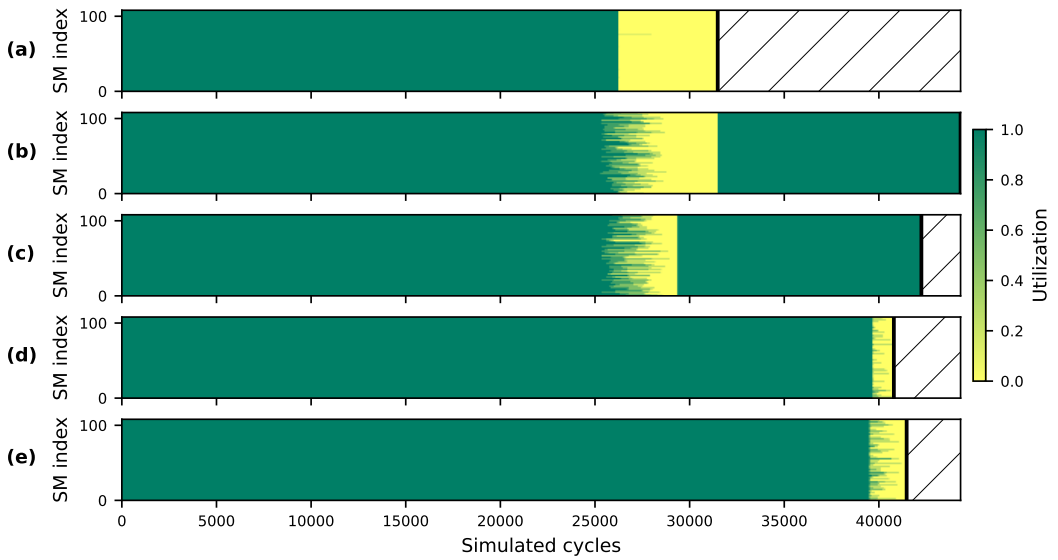

Figure 157: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}484$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 44{,}316$, $T/T^* = 1.117$ (slot), 0.71×; (c) $T = 42{,}246$, $T/T^* = 1.064$ (slot), 0.75×; (d) $T = 40{,}791$, $T/T^* = 1.028$ (slot), 0.77×; (e) $T = 41{,}467$, $T/T^* = 1.044$ (slot), 0.76×.

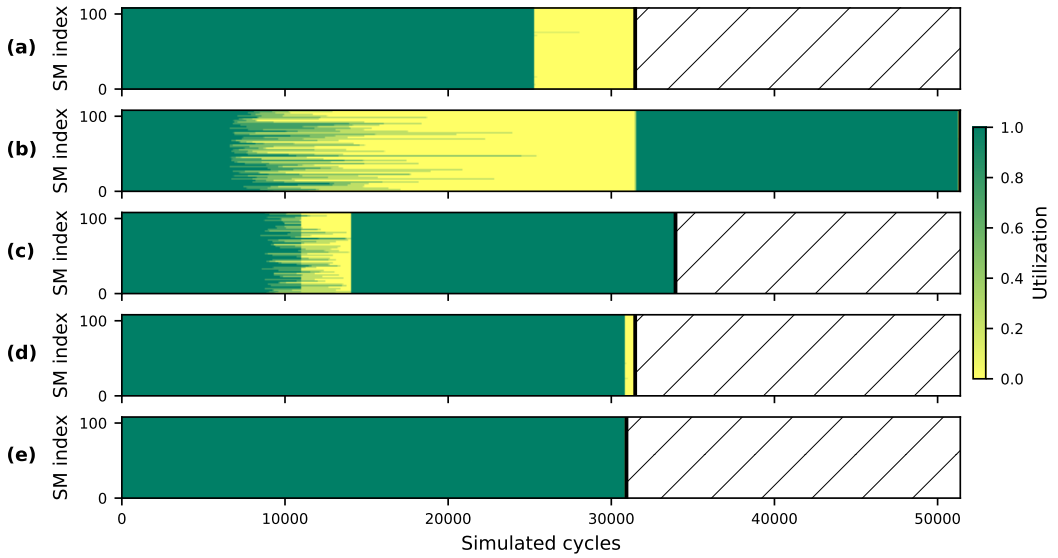

Figure 158: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}465$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}391$, $T/T^* = 1.633$ (critical path), 0.61×; (c) $T = 33{,}936$, $T/T^* = 1.104$ (slot), 0.93×; (d) $T = 31{,}465$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}931$, $T/T^* = 1.007$ (slot), 1.02×.

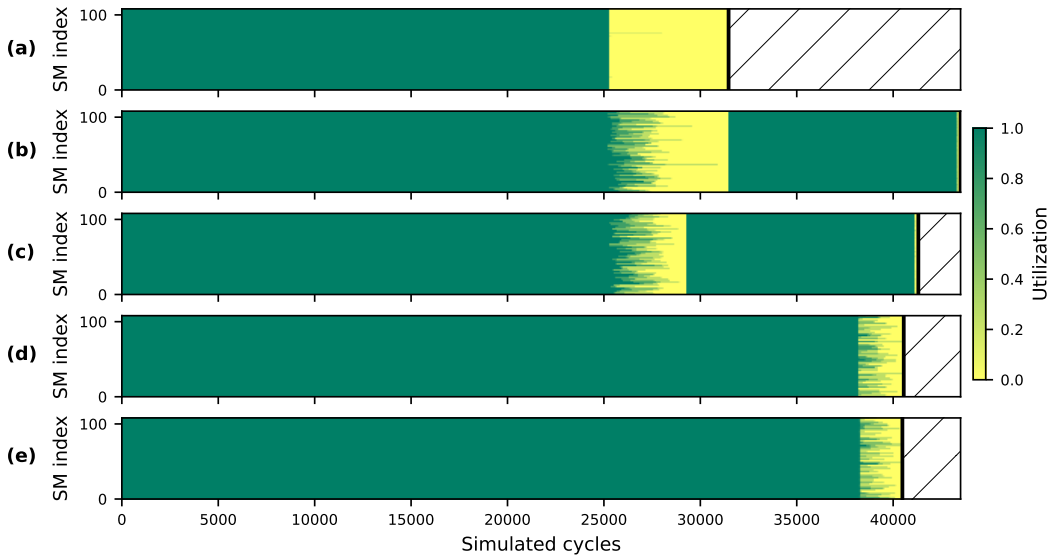

Figure 159: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}465$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}496$, $T/T^* = 1.127$ (slot), 0.72×; (c) $T = 41{,}307$, $T/T^* = 1.070$ (slot), 0.76×; (d) $T = 40{,}549$, $T/T^* = 1.050$ (slot), 0.78×; (e) $T = 40{,}479$, $T/T^* = 1.048$ (slot), 0.78×.

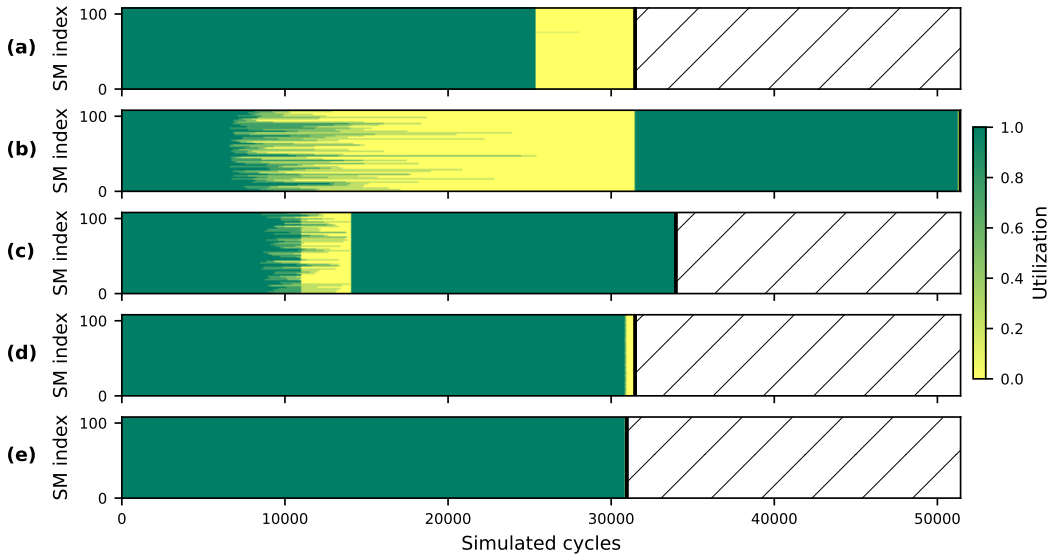

Figure 160: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (466 of them). Edge slices in (c) and (e) hold 5,494 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}466$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 51{,}421$, $T/T^* = 1.634$ (critical path), 0.61×; (c) $T = 33{,}969$, $T/T^* = 1.104$ (slot), 0.93×; (d) $T = 31{,}466$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 30{,}963$, $T/T^* = 1.006$ (slot), 1.02×.

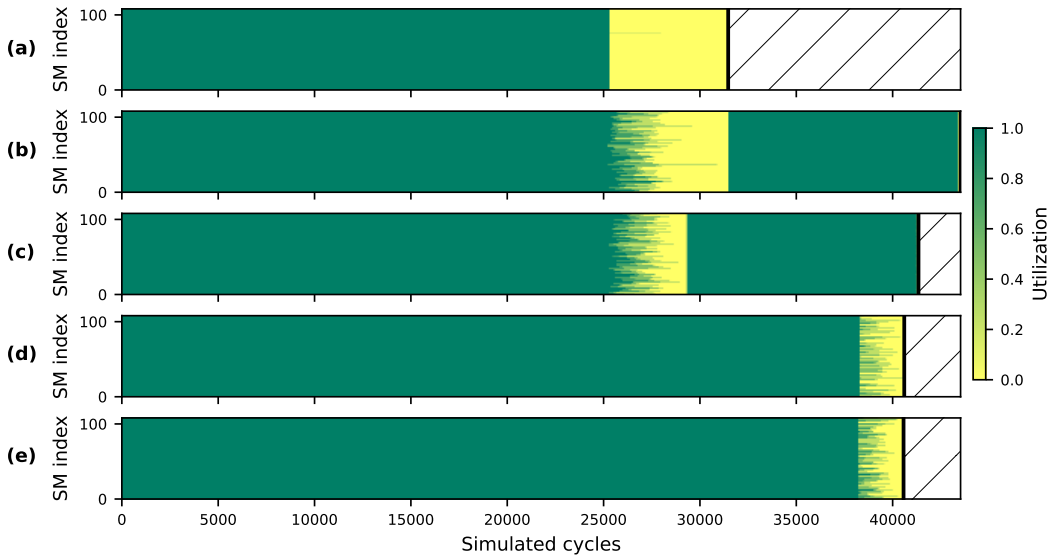

Figure 161: Per-SM occupancy over time for `hm-categories` ($N = 46{,}563$ vertices, $E = 21{,}508{,}553$ edges, mean degree 461.9, maximum degree 31,459, skew 68×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (2,329 of them). Edge slices in (c) and (e) hold 13,375 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 31{,}466$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 43{,}525$, $T/T^* = 1.126$ (slot), 0.72×; (c) $T = 41{,}341$, $T/T^* = 1.069$ (slot), 0.76×; (d) $T = 40{,}603$, $T/T^* = 1.050$ (slot), 0.77×; (e) $T = 40{,}566$, $T/T^* = 1.049$ (slot), 0.78×.

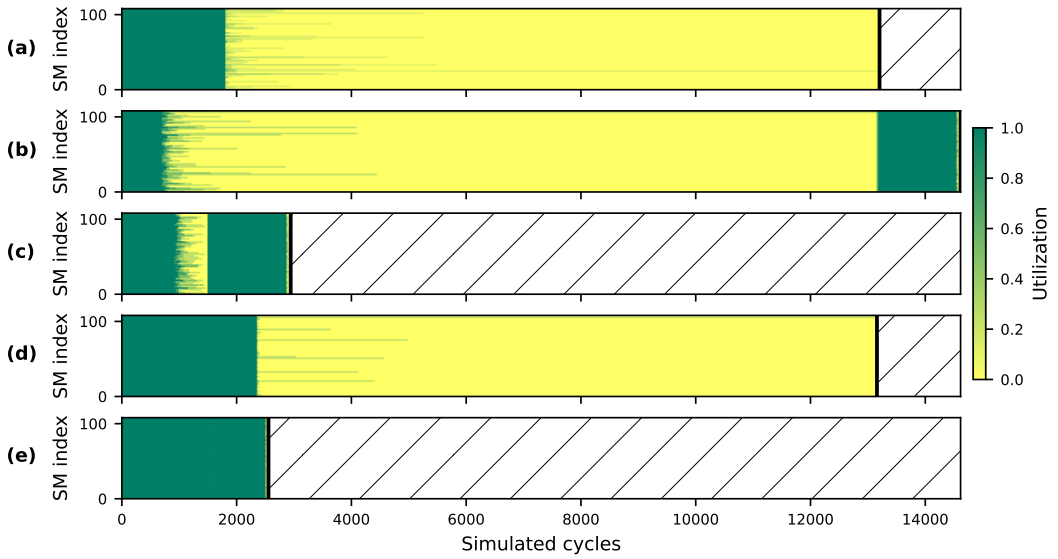

Figure 162: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}203$, $T/T^* = 1.003$ (critical path), 1.00×; (b) $T = 14{,}615$, $T/T^* = 1.111$ (critical path), 0.90×; (c) $T = 2{,}942$, $T/T^* = 1.182$ (slot), 4.49×; (d) $T = 13{,}158$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}555$, $T/T^* = 1.027$ (slot), 5.17×.

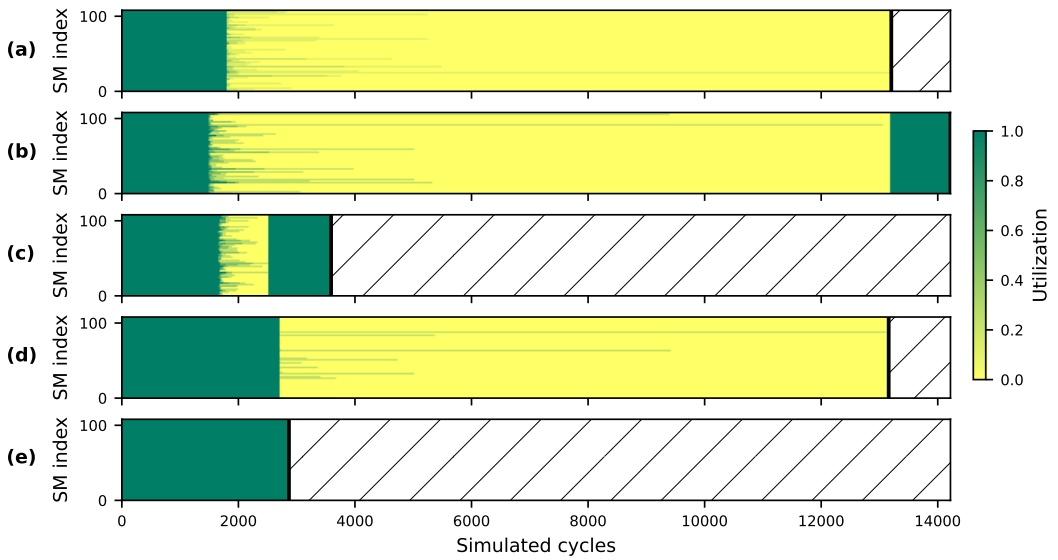

Figure 163: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}203$, $T/T^* = 1.003$ (critical path), 1.00×; (b) $T = 14{,}218$, $T/T^* = 1.081$ (critical path), 0.93×; (c) $T = 3{,}590$, $T/T^* = 1.260$ (slot), 3.68×; (d) $T = 13{,}158$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}867$, $T/T^* = 1.006$ (slot), 4.61×.

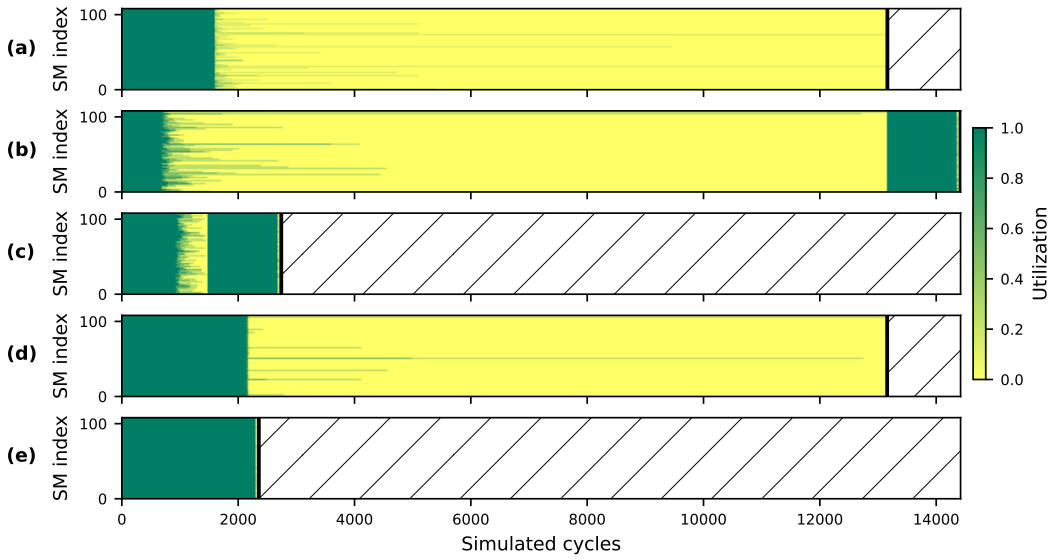

Figure 164: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}161$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 14{,}419$, $T/T^* = 1.096$ (critical path), 0.91×; (c) $T = 2{,}741$, $T/T^* = 1.197$ (slot), 4.80×; (d) $T = 13{,}157$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}355$, $T/T^* = 1.029$ (slot), 5.59×.

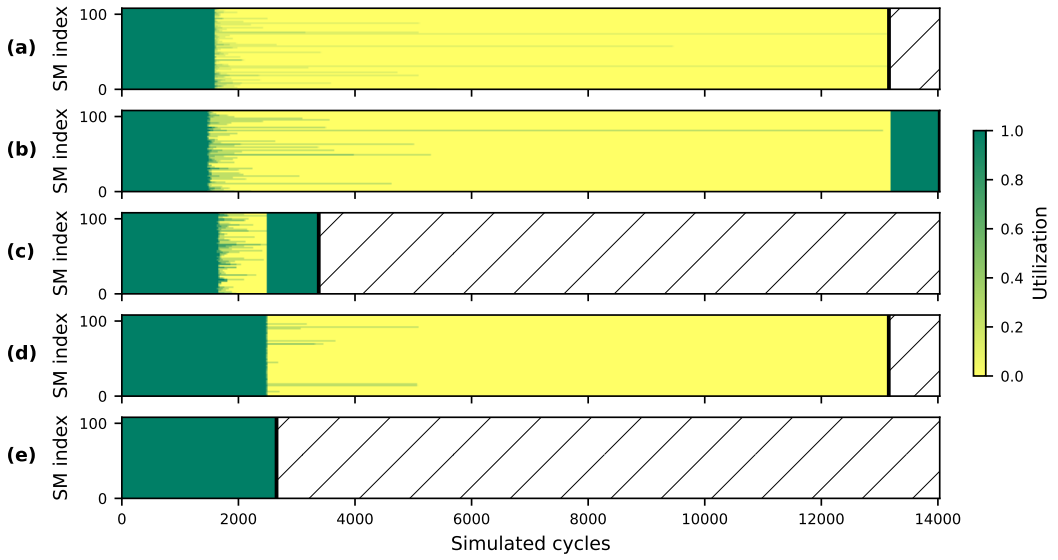

Figure 165: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}161$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 14{,}031$, $T/T^* = 1.066$ (critical path), 0.94×; (c) $T = 3{,}378$, $T/T^* = 1.281$ (slot), 3.90×; (d) $T = 13{,}157$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}654$, $T/T^* = 1.006$ (slot), 4.96×.

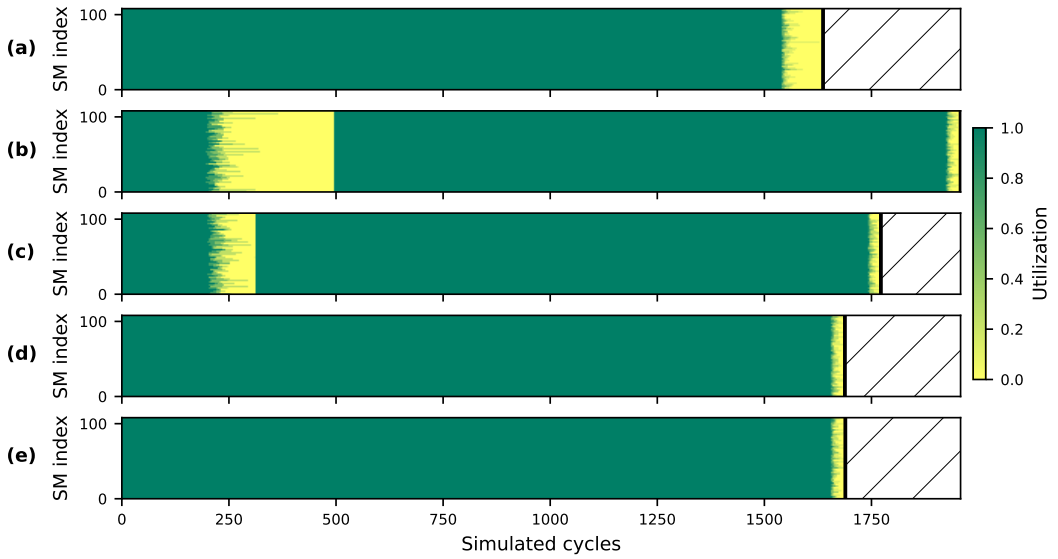

Figure 166: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,911 of them). Edge slices in (c) and (e) hold 114 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}637$, $T/T^* = 1.059$ (slot), $1.00\times$; (b) $T = 1{,}958$, $T/T^* = 1.180$ (slot), $0.84\times$; (c) $T = 1{,}772$, $T/T^* = 1.067$ (slot), $0.92\times$; (d) $T = 1{,}688$, $T/T^* = 1.017$ (slot), $0.97\times$; (e) $T = 1{,}689$, $T/T^* = 1.017$ (slot), $0.97\times$.

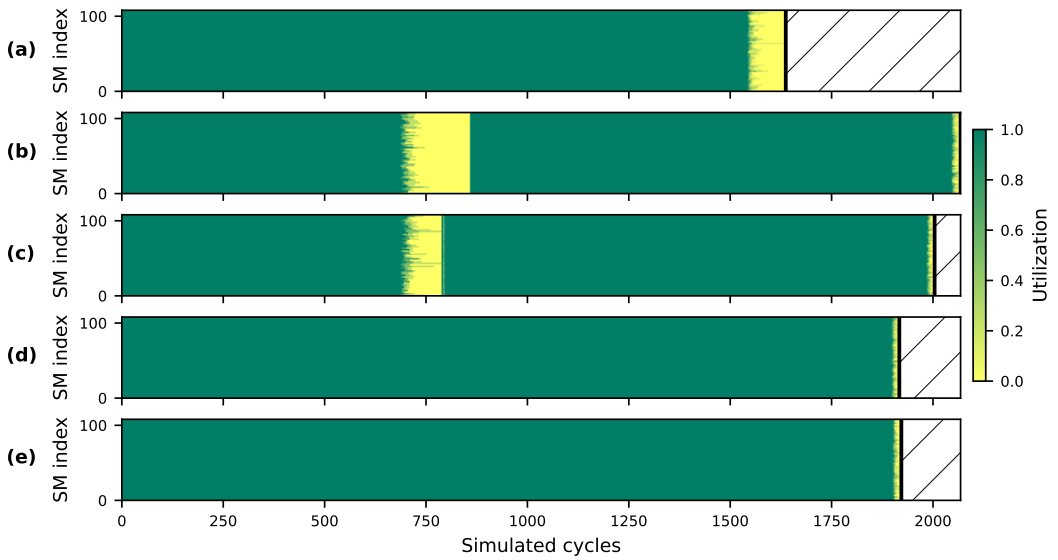

Figure 167: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,945 of them). Edge slices in (c) and (e) hold 218 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}637$, $T/T^* = 1.059$ (slot), $1.00\times$; (b) $T = 2{,}068$, $T/T^* = 1.089$ (slot), $0.79\times$; (c) $T = 2{,}004$, $T/T^* = 1.052$ (slot), $0.82\times$; (d) $T = 1{,}917$, $T/T^* = 1.009$ (slot), $0.85\times$; (e) $T = 1{,}922$, $T/T^* = 1.009$ (slot), $0.85\times$.

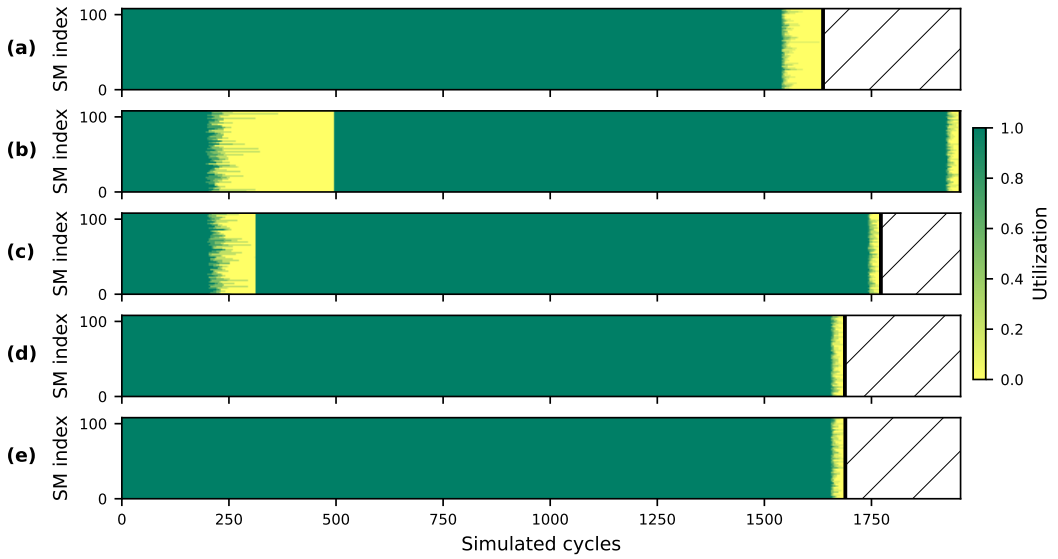

Figure 168: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,911 of them). Edge slices in (c) and (e) hold 114 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}637$, $T/T^* = 1.059$ (slot), $1.00\times$; (b) $T = 1{,}958$, $T/T^* = 1.180$ (slot), $0.84\times$; (c) $T = 1{,}772$, $T/T^* = 1.067$ (slot), $0.92\times$; (d) $T = 1{,}688$, $T/T^* = 1.017$ (slot), $0.97\times$; (e) $T = 1{,}689$, $T/T^* = 1.017$ (slot), $0.97\times$.

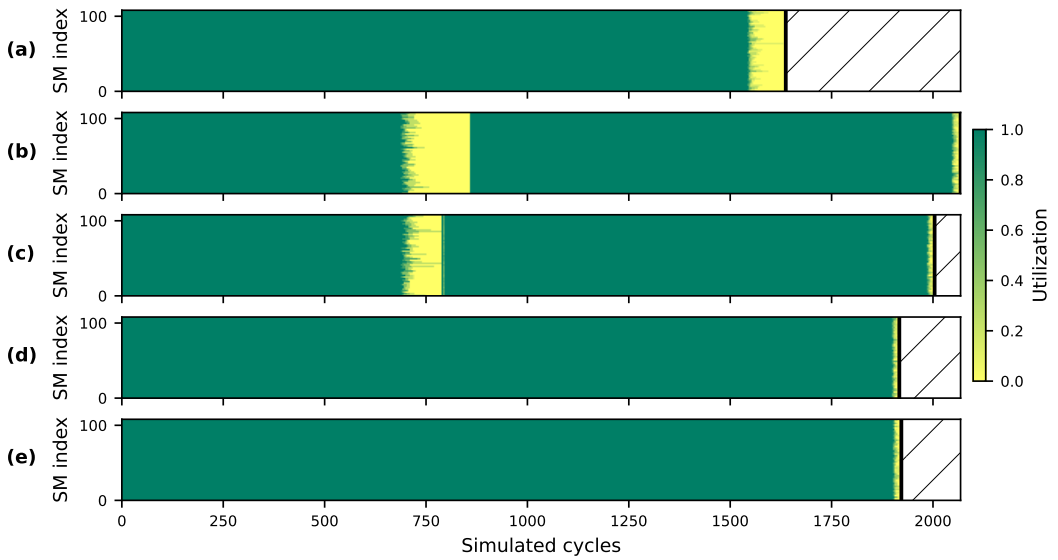

Figure 169: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,945 of them). Edge slices in (c) and (e) hold 218 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 1{,}637$, $T/T^* = 1.059$ (slot), $1.00\times$; (b) $T = 2{,}068$, $T/T^* = 1.089$ (slot), $0.79\times$; (c) $T = 2{,}004$, $T/T^* = 1.052$ (slot), $0.82\times$; (d) $T = 1{,}917$, $T/T^* = 1.009$ (slot), $0.85\times$; (e) $T = 1{,}922$, $T/T^* = 1.009$ (slot), $0.85\times$.

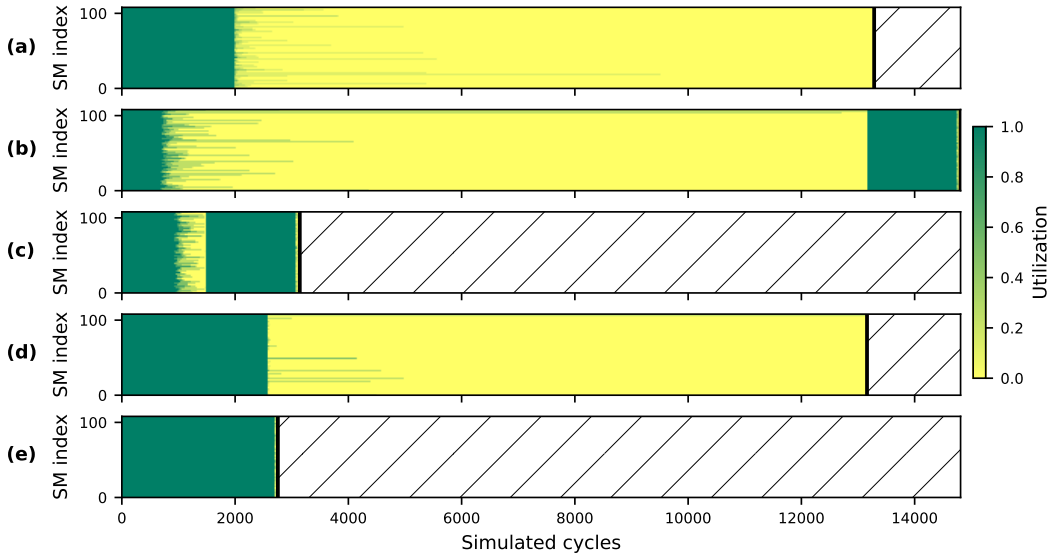

Figure 170: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}285$, $T/T^* = 1.010$ (critical path), 1.00×; (b) $T = 14{,}811$, $T/T^* = 1.126$ (critical path), 0.90×; (c) $T = 3{,}142$, $T/T^* = 1.169$ (slot), 4.23×; (d) $T = 13{,}159$, $T/T^* = 1.000$ (critical path), 1.01×; (e) $T = 2{,}755$, $T/T^* = 1.025$ (slot), 4.82×.

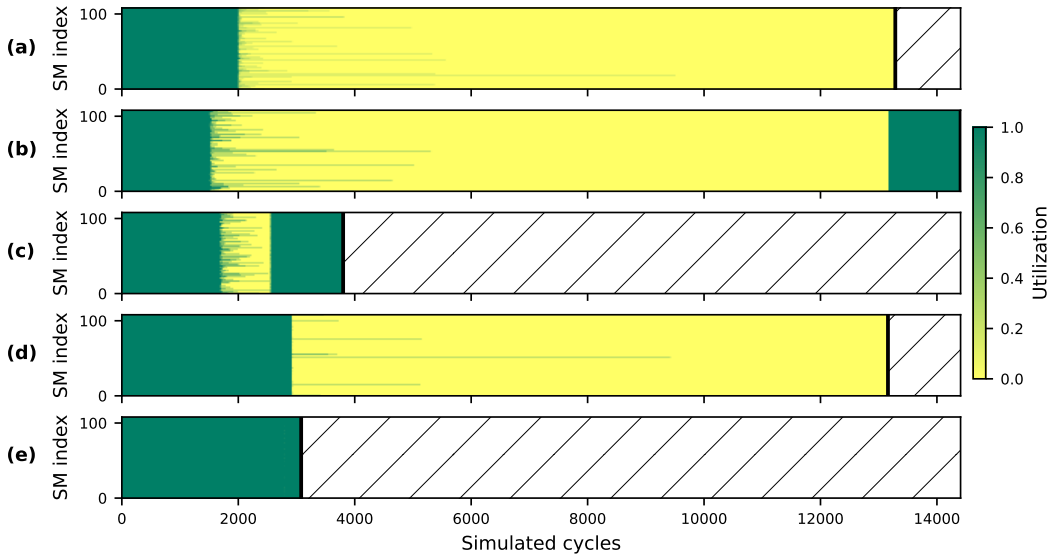

Figure 171: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}285$, $T/T^* = 1.010$ (critical path), 1.00×; (b) $T = 14{,}406$, $T/T^* = 1.095$ (critical path), 0.92×; (c) $T = 3{,}801$, $T/T^* = 1.242$ (slot), 3.50×; (d) $T = 13{,}159$, $T/T^* = 1.000$ (critical path), 1.01×; (e) $T = 3{,}080$, $T/T^* = 1.006$ (slot), 4.31×.

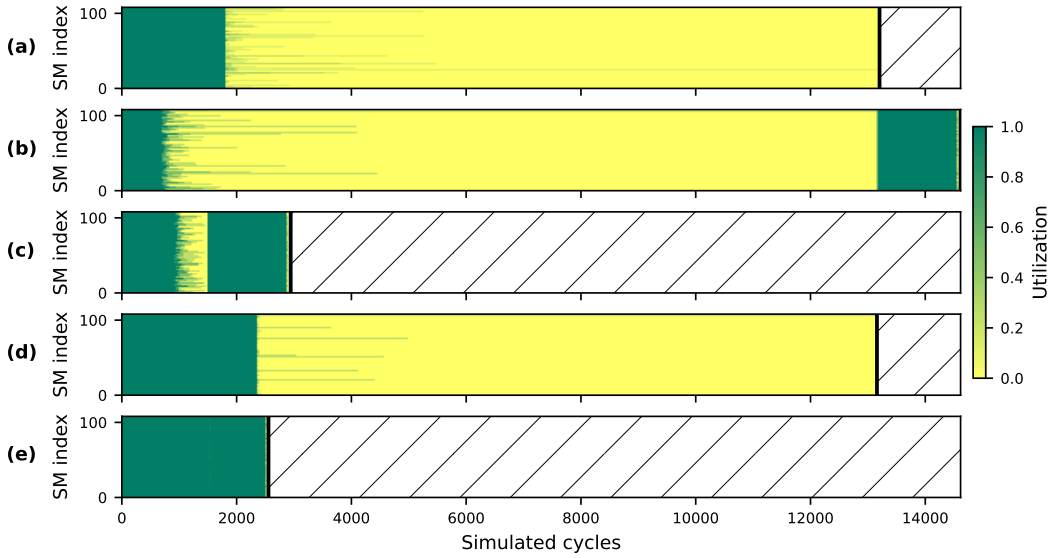

Figure 172: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}203$, $T/T^* = 1.003$ (critical path), 1.00×; (b) $T = 14{,}615$, $T/T^* = 1.111$ (critical path), 0.90×; (c) $T = 2{,}942$, $T/T^* = 1.182$ (slot), 4.49×; (d) $T = 13{,}158$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}555$, $T/T^* = 1.027$ (slot), 5.17×.

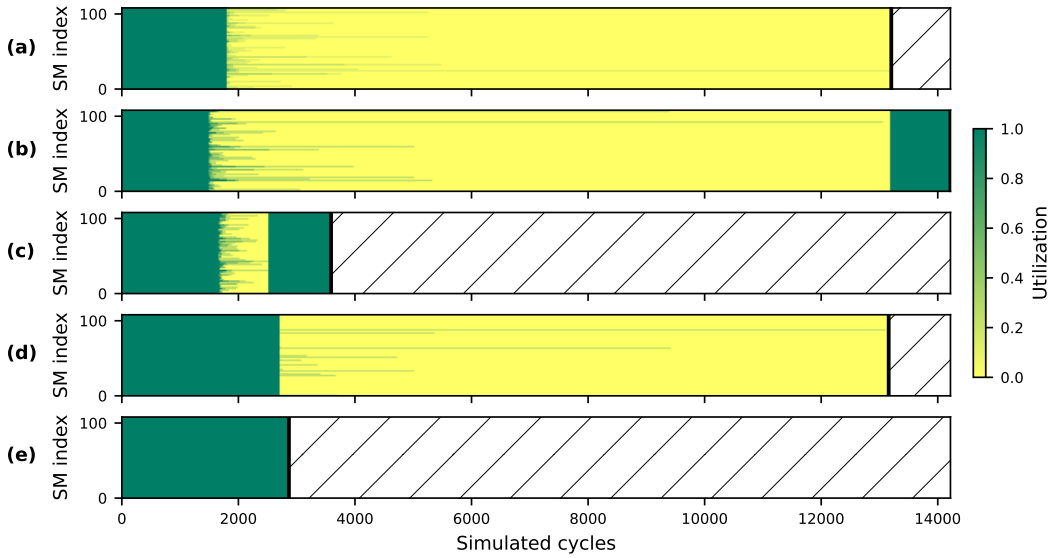

Figure 173: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}203$, $T/T^* = 1.003$ (critical path), 1.00×; (b) $T = 14{,}218$, $T/T^* = 1.081$ (critical path), 0.93×; (c) $T = 3{,}590$, $T/T^* = 1.260$ (slot), 3.68×; (d) $T = 13{,}158$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 2{,}867$, $T/T^* = 1.006$ (slot), 4.61×.

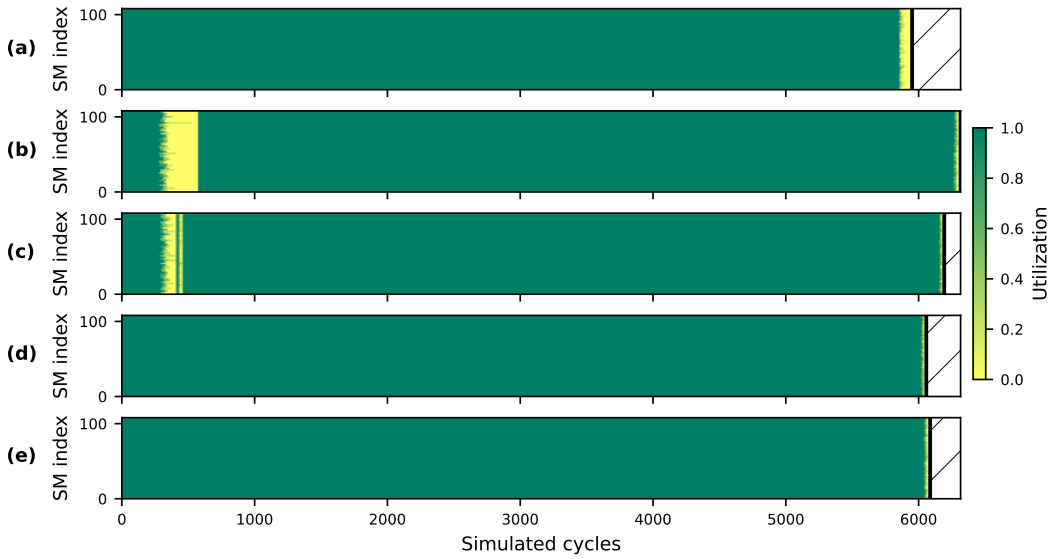

Figure 174: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,911 of them). Edge slices in (c) and (e) hold 114 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 5{,}951$, $T/T^* = 1.016$ (slot), $1.00\times$; (b) $T = 6{,}316$, $T/T^* = 1.049$ (slot), $0.94\times$; (c) $T = 6{,}193$, $T/T^* = 1.024$ (slot), $0.96\times$; (d) $T = 6{,}058$, $T/T^* = 1.006$ (slot), $0.98\times$; (e) $T = 6{,}087$, $T/T^* = 1.006$ (slot), $0.98\times$.

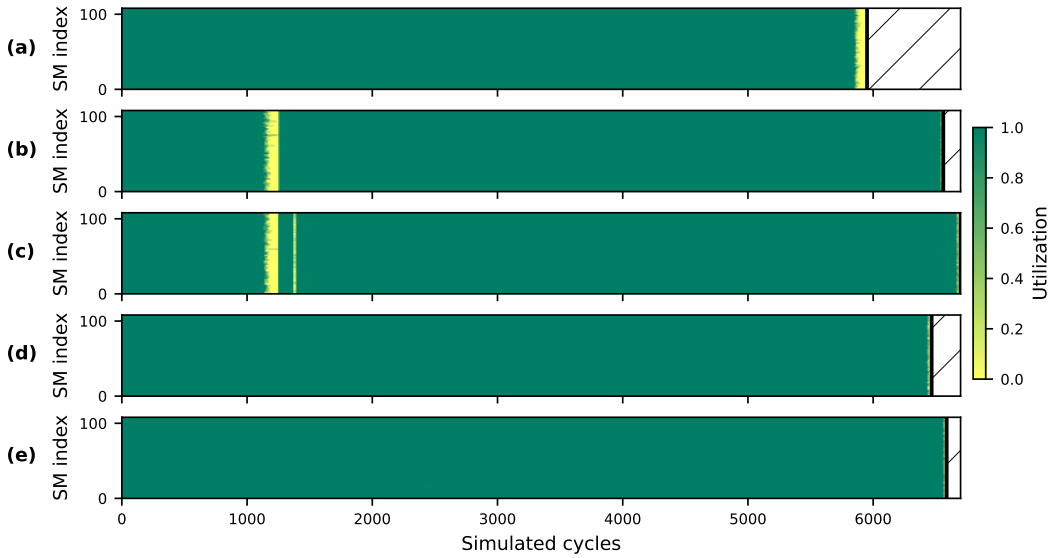

Figure 175: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,945 of them). Edge slices in (c) and (e) hold 218 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 5{,}951$, $T/T^* = 1.016$ (slot), $1.00\times$; (b) $T = 6{,}560$, $T/T^* = 1.019$ (slot), $0.91\times$; (c) $T = 6{,}698$, $T/T^* = 1.021$ (slot), $0.89\times$; (d) $T = 6{,}467$, $T/T^* = 1.004$ (slot), $0.92\times$; (e) $T = 6{,}587$, $T/T^* = 1.004$ (slot), $0.90\times$.

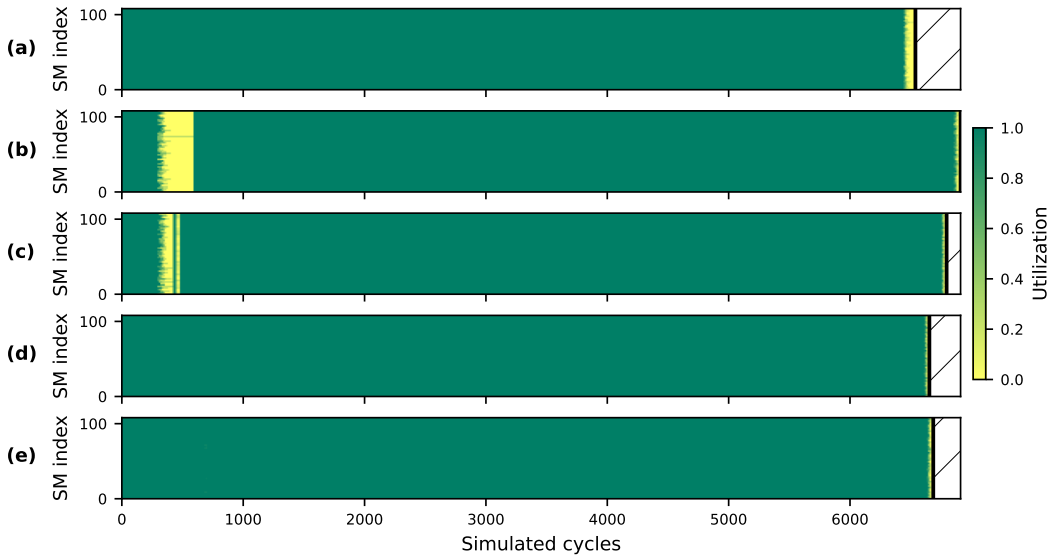

Figure 176: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,911 of them). Edge slices in (c) and (e) hold 114 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 6{,}539$, $T/T^* = 1.014$ (slot), $1.00\times$; (b) $T = 6{,}911$, $T/T^* = 1.045$ (slot), $0.95\times$; (c) $T = 6{,}796$, $T/T^* = 1.023$ (slot), $0.96\times$; (d) $T = 6{,}654$, $T/T^* = 1.006$ (slot), $0.98\times$; (e) $T = 6{,}686$, $T/T^* = 1.006$ (slot), $0.98\times$.

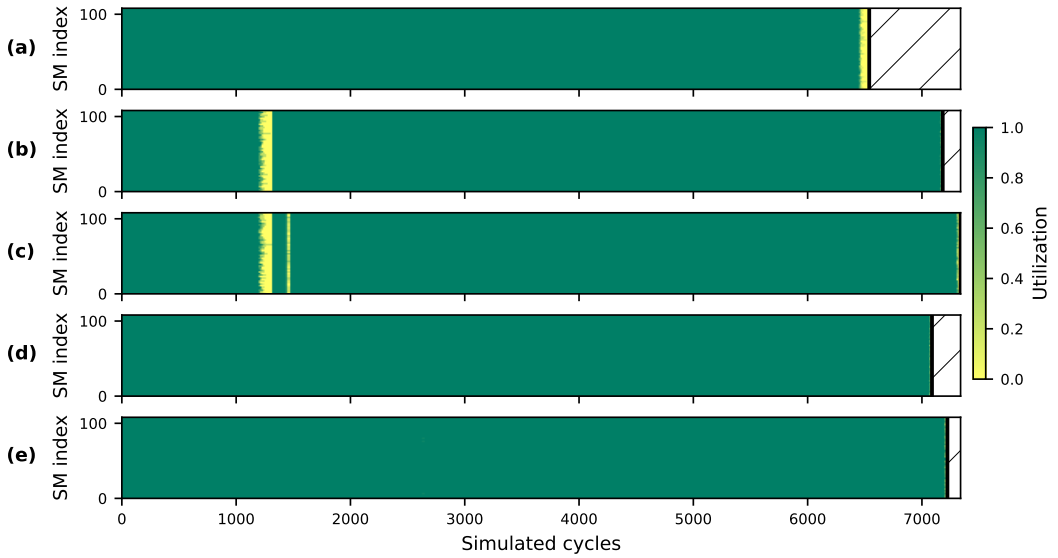

Figure 177: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 437, skew $55\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,945 of them). Edge slices in (c) and (e) hold 218 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 6{,}539$, $T/T^* = 1.014$ (slot), $1.00\times$; (b) $T = 7{,}182$, $T/T^* = 1.018$ (slot), $0.91\times$; (c) $T = 7{,}338$, $T/T^* = 1.020$ (slot), $0.89\times$; (d) $T = 7{,}088$, $T/T^* = 1.004$ (slot), $0.92\times$; (e) $T = 7{,}223$, $T/T^* = 1.004$ (slot), $0.91\times$.

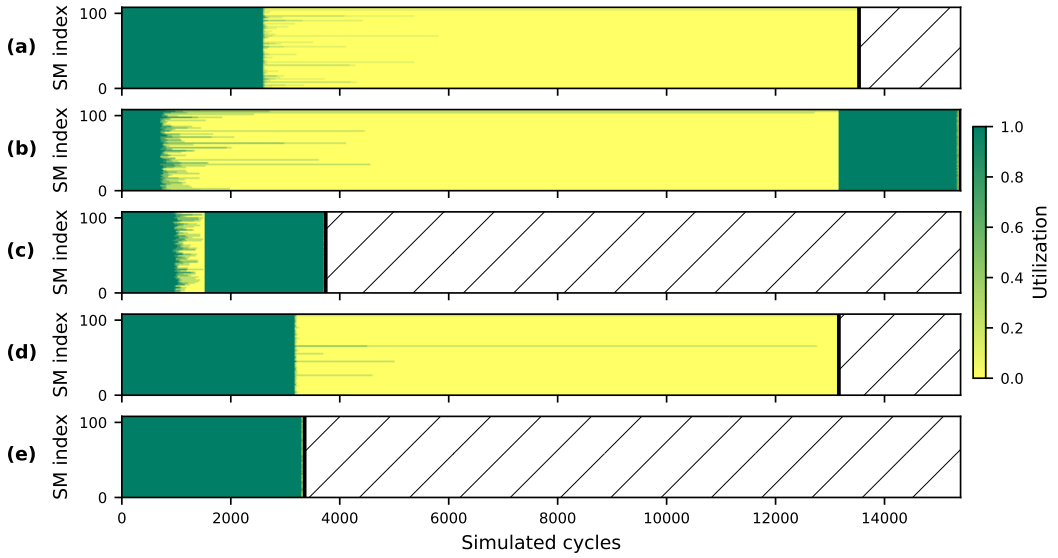

Figure 178: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}532$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 15{,}396$, $T/T^* = 1.170$ (critical path), 0.88×; (c) $T = 3{,}742$, $T/T^* = 1.138$ (slot), 3.62×; (d) $T = 13{,}162$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}355$, $T/T^* = 1.020$ (slot), 4.03×.

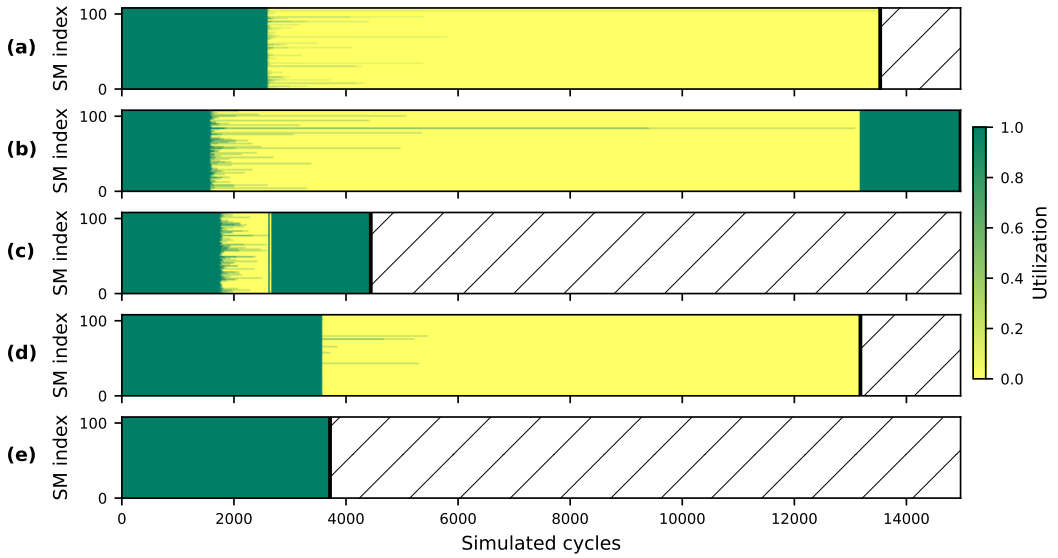

Figure 179: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}532$, $T/T^* = 1.028$ (critical path), 1.00×; (b) $T = 14{,}966$, $T/T^* = 1.137$ (critical path), 0.90×; (c) $T = 4{,}442$, $T/T^* = 1.202$ (slot), 3.05×; (d) $T = 13{,}179$, $T/T^* = 1.001$ (critical path), 1.03×; (e) $T = 3{,}715$, $T/T^* = 1.005$ (slot), 3.64×.

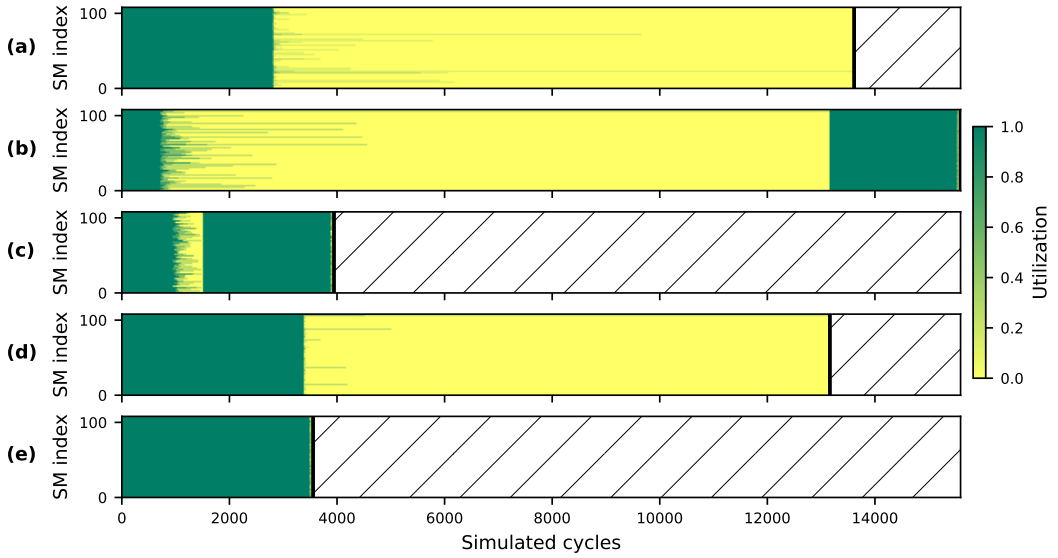

Figure 180: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,715 of them). Edge slices in (c) and (e) hold 543 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}613$, $T/T^* = 1.034$ (critical path), 1.00×; (b) $T = 15{,}592$, $T/T^* = 1.185$ (critical path), 0.87×; (c) $T = 3{,}944$, $T/T^* = 1.131$ (slot), 3.45×; (d) $T = 13{,}163$, $T/T^* = 1.000$ (critical path), 1.03×; (e) $T = 3{,}555$, $T/T^* = 1.019$ (slot), 3.83×.

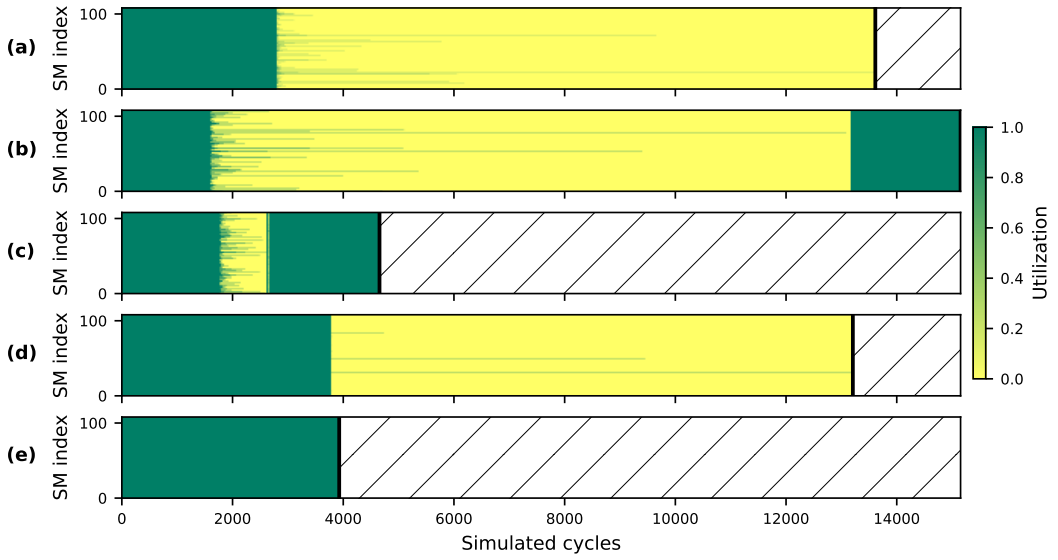

Figure 181: Per-SM occupancy over time for `ogbn-arxiv` ($N = 169{,}343$ vertices, $E = 1{,}335{,}586$ edges, mean degree 7.9, maximum degree 13,156, skew 1668×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,814 of them). Edge slices in (c) and (e) hold 875 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 13{,}613$, $T/T^* = 1.034$ (critical path), 1.00×; (b) $T = 15{,}153$, $T/T^* = 1.151$ (critical path), 0.90×; (c) $T = 4{,}655$, $T/T^* = 1.191$ (slot), 2.92×; (d) $T = 13{,}207$, $T/T^* = 1.003$ (critical path), 1.03×; (e) $T = 3{,}927$, $T/T^* = 1.005$ (slot), 3.47×.

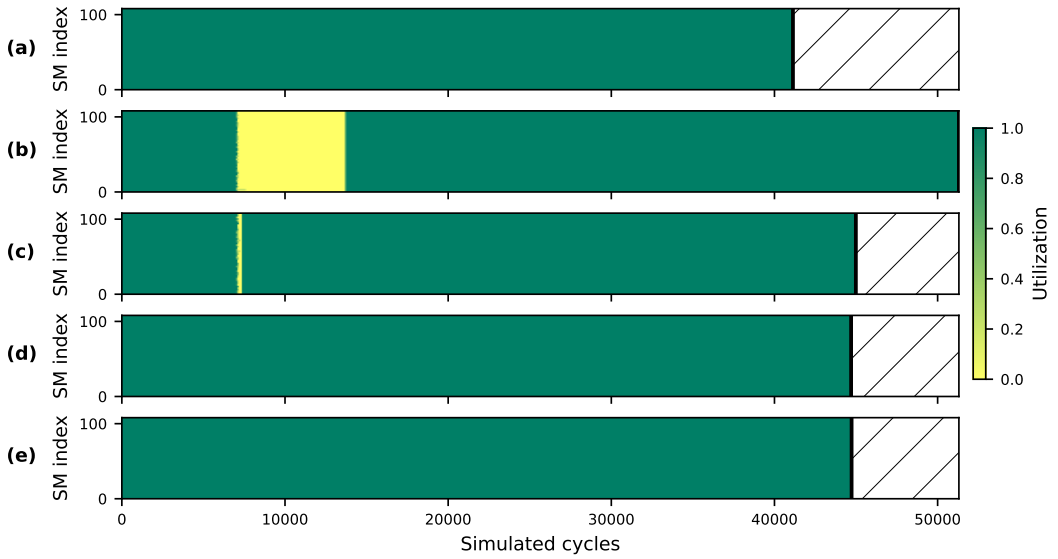

Figure 182: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 41{,}133$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 51{,}304$, $T/T^* = 1.148$ (slot), 0.80×; (c) $T = 44{,}988$, $T/T^* = 1.006$ (slot), 0.91×; (d) $T = 44{,}698$, $T/T^* = 1.000$ (slot), 0.92×; (e) $T = 44{,}727$, $T/T^* = 1.000$ (slot), 0.92×.

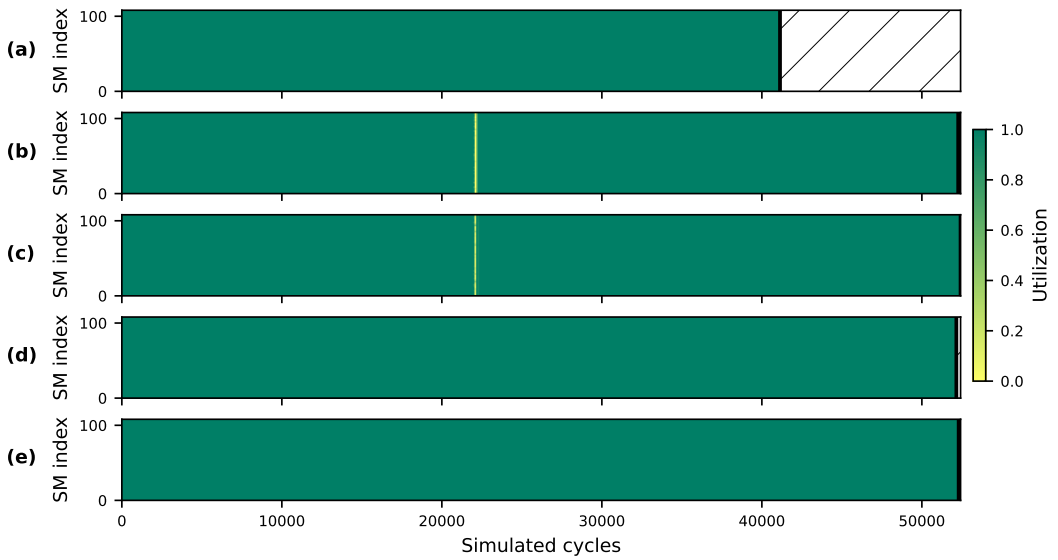

Figure 183: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 41{,}133$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 52{,}271$, $T/T^* = 1.003$ (slot), 0.79×; (c) $T = 52{,}418$, $T/T^* = 1.003$ (slot), 0.78×; (d) $T = 52{,}156$, $T/T^* = 1.000$ (slot), 0.79×; (e) $T = 52{,}300$, $T/T^* = 1.000$ (slot), 0.79×.

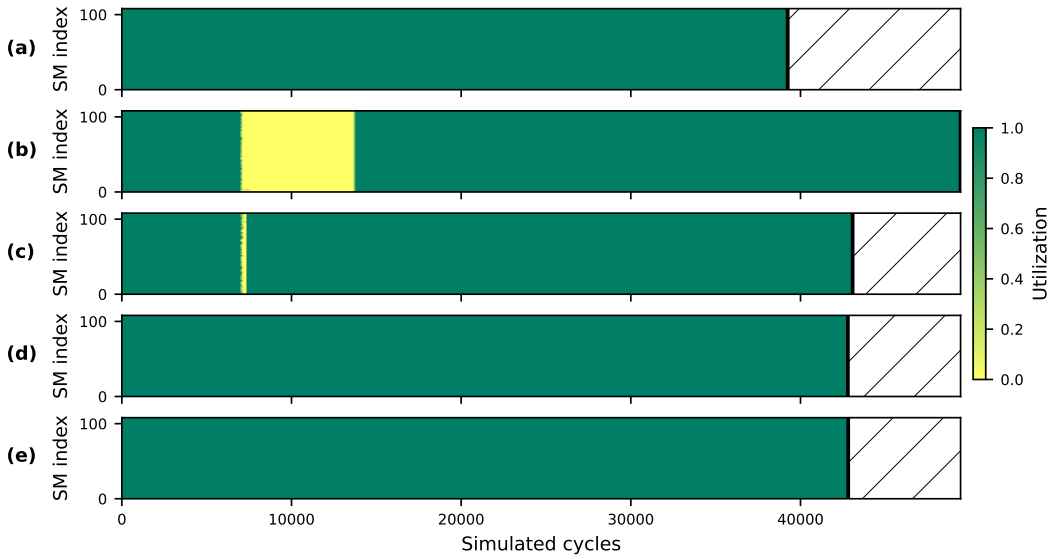

Figure 184: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 39{,}245$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 49{,}435$, $T/T^* = 1.156$ (slot), 0.79×; (c) $T = 43{,}071$, $T/T^* = 1.007$ (slot), 0.91×; (d) $T = 42{,}791$, $T/T^* = 1.001$ (slot), 0.92×; (e) $T = 42{,}811$, $T/T^* = 1.001$ (slot), 0.92×.

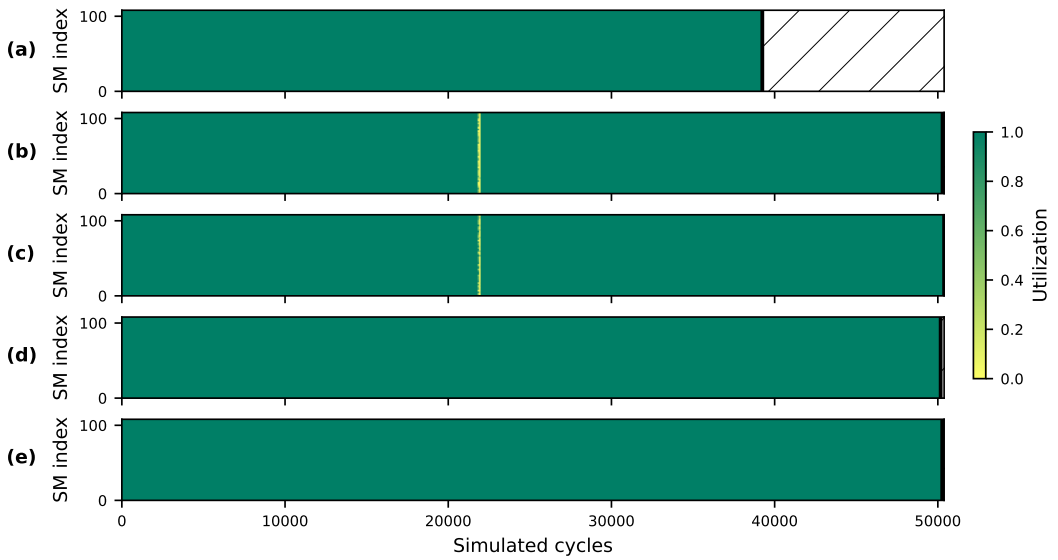

Figure 185: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 39{,}245$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 50{,}287$, $T/T^* = 1.003$ (slot), 0.78×; (c) $T = 50{,}385$, $T/T^* = 1.003$ (slot), 0.78×; (d) $T = 50{,}172$, $T/T^* = 1.000$ (slot), 0.78×; (e) $T = 50{,}268$, $T/T^* = 1.000$ (slot), 0.78×.

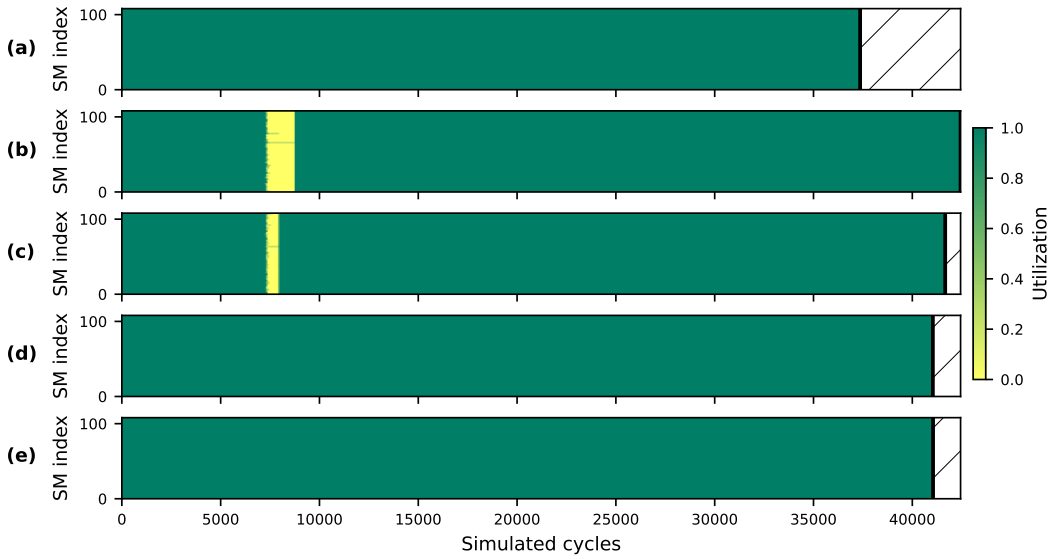

Figure 186: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,462 of them). Edge slices in (c) and (e) hold 3,681 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 37{,}359$, $T/T^* = 1.001$ (slot), $1.00\times$; (b) $T = 42{,}442$, $T/T^* = 1.035$ (slot), $0.88\times$; (c) $T = 41{,}664$, $T/T^* = 1.016$ (slot), $0.90\times$; (d) $T = 41{,}040$, $T/T^* = 1.001$ (slot), $0.91\times$; (e) $T = 41{,}050$, $T/T^* = 1.001$ (slot), $0.91\times$.

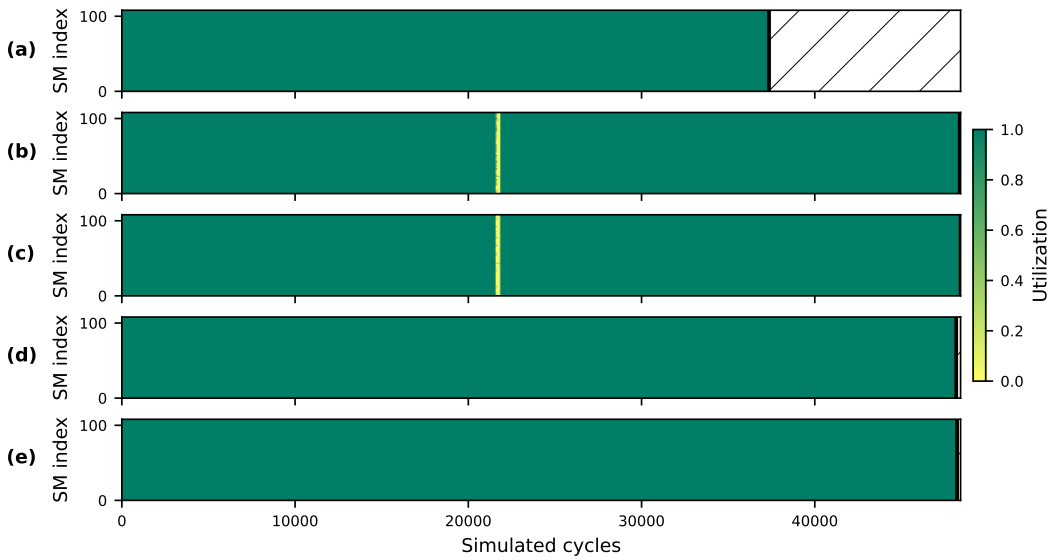

Figure 187: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,842 of them). Edge slices in (c) and (e) hold 4,382 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 37{,}359$, $T/T^* = 1.001$ (slot), $1.00\times$; (b) $T = 48{,}366$, $T/T^* = 1.005$ (slot), $0.77\times$; (c) $T = 48{,}415$, $T/T^* = 1.005$ (slot), $0.77\times$; (d) $T = 48{,}165$, $T/T^* = 1.001$ (slot), $0.78\times$; (e) $T = 48{,}214$, $T/T^* = 1.001$ (slot), $0.77\times$.

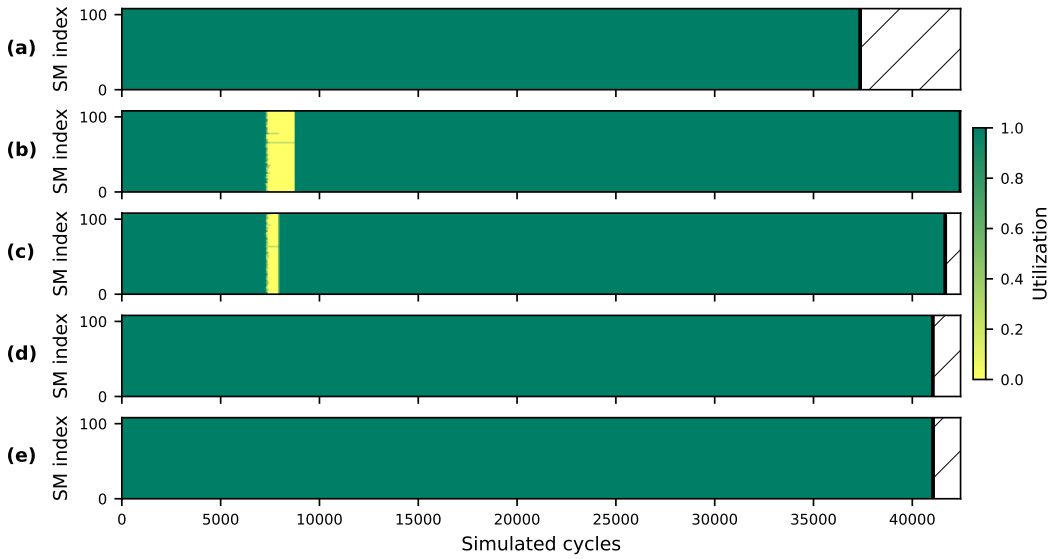

Figure 188: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,462 of them). Edge slices in (c) and (e) hold 3,681 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 37{,}359$, $T/T^* = 1.001$ (slot), $1.00\times$; (b) $T = 42{,}442$, $T/T^* = 1.035$ (slot), $0.88\times$; (c) $T = 41{,}664$, $T/T^* = 1.016$ (slot), $0.90\times$; (d) $T = 41{,}040$, $T/T^* = 1.001$ (slot), $0.91\times$; (e) $T = 41{,}050$, $T/T^* = 1.001$ (slot), $0.91\times$.

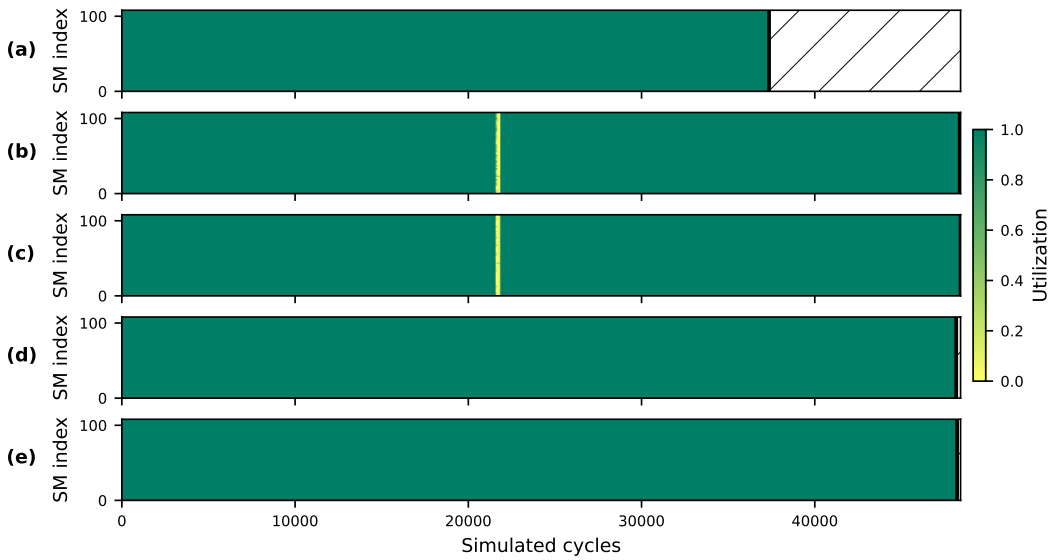

Figure 189: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,842 of them). Edge slices in (c) and (e) hold 4,382 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 37{,}359$, $T/T^* = 1.001$ (slot), $1.00\times$; (b) $T = 48{,}366$, $T/T^* = 1.005$ (slot), $0.77\times$; (c) $T = 48{,}415$, $T/T^* = 1.005$ (slot), $0.77\times$; (d) $T = 48{,}165$, $T/T^* = 1.001$ (slot), $0.78\times$; (e) $T = 48{,}214$, $T/T^* = 1.001$ (slot), $0.77\times$.

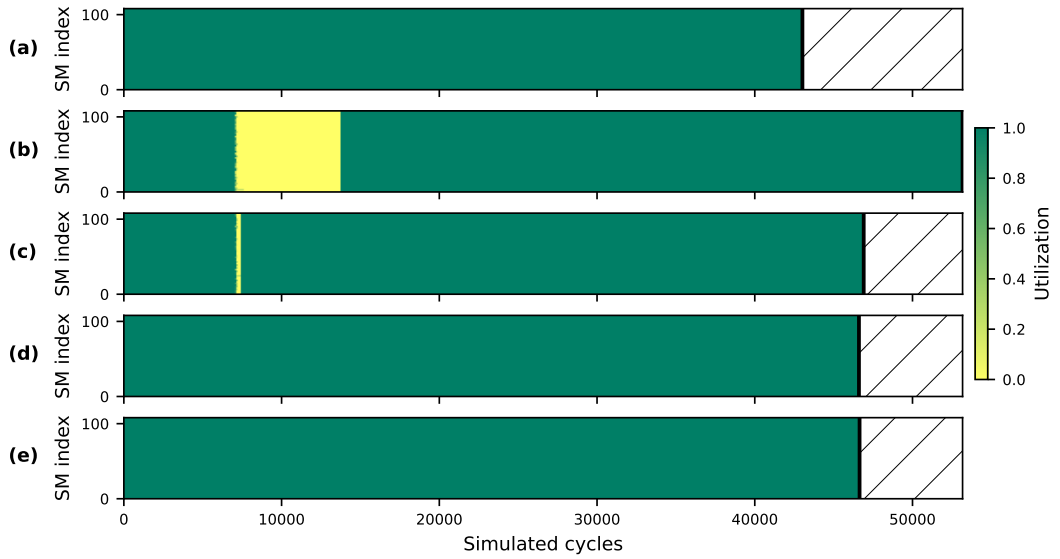

Figure 190: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}021$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 53{,}174$, $T/T^* = 1.141$ (slot), 0.81×; (c) $T = 46{,}906$, $T/T^* = 1.006$ (slot), 0.92×; (d) $T = 46{,}605$, $T/T^* = 1.000$ (slot), 0.92×; (e) $T = 46{,}644$, $T/T^* = 1.000$ (slot), 0.92×.

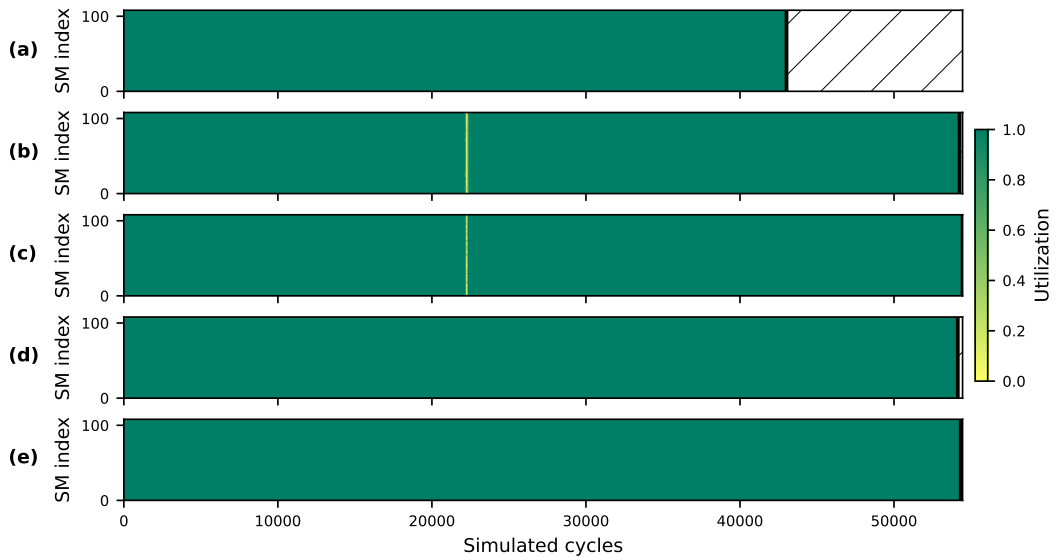

Figure 191: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}021$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 54{,}255$, $T/T^* = 1.002$ (slot), 0.79×; (c) $T = 54{,}451$, $T/T^* = 1.003$ (slot), 0.79×; (d) $T = 54{,}140$, $T/T^* = 1.000$ (slot), 0.79×; (e) $T = 54{,}332$, $T/T^* = 1.000$ (slot), 0.79×.

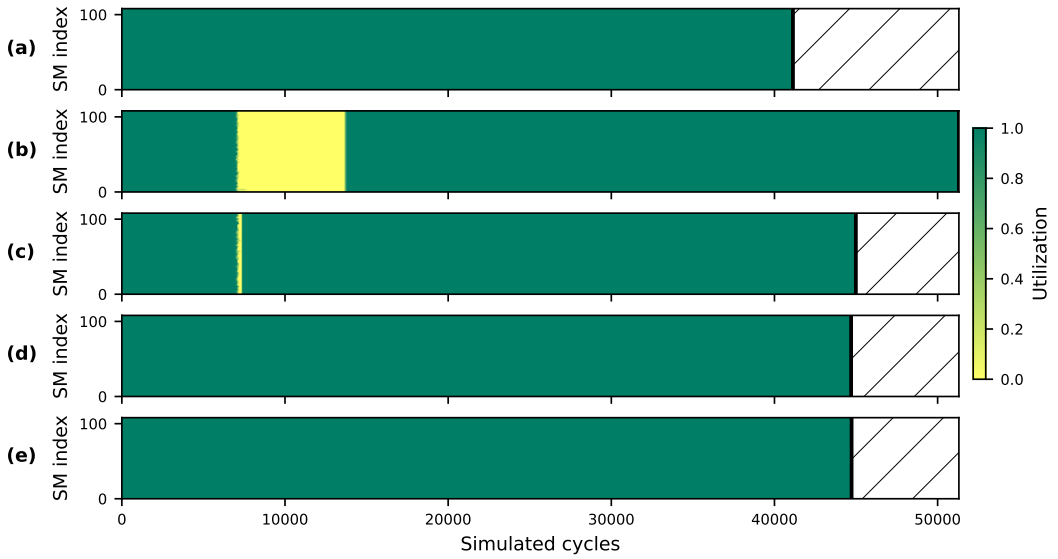

Figure 192: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 41{,}133$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 51{,}304$, $T/T^* = 1.148$ (slot), 0.80×; (c) $T = 44{,}988$, $T/T^* = 1.006$ (slot), 0.91×; (d) $T = 44{,}698$, $T/T^* = 1.000$ (slot), 0.92×; (e) $T = 44{,}727$, $T/T^* = 1.000$ (slot), 0.92×.

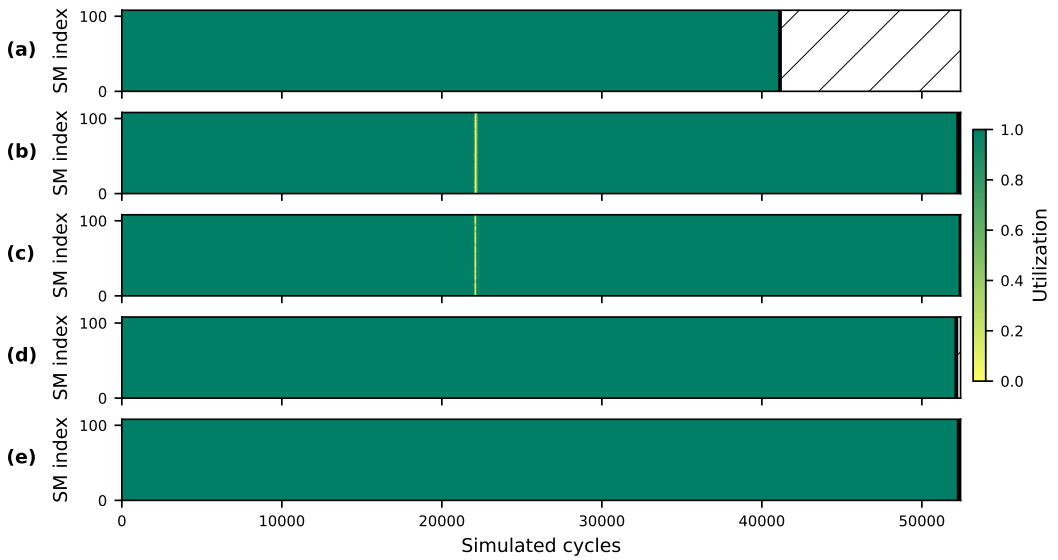

Figure 193: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 41{,}133$, $T/T^* = 1.001$ (slot), 1.00×; (b) $T = 52{,}271$, $T/T^* = 1.003$ (slot), 0.79×; (c) $T = 52{,}418$, $T/T^* = 1.003$ (slot), 0.78×; (d) $T = 52{,}156$, $T/T^* = 1.000$ (slot), 0.79×; (e) $T = 52{,}300$, $T/T^* = 1.000$ (slot), 0.79×.

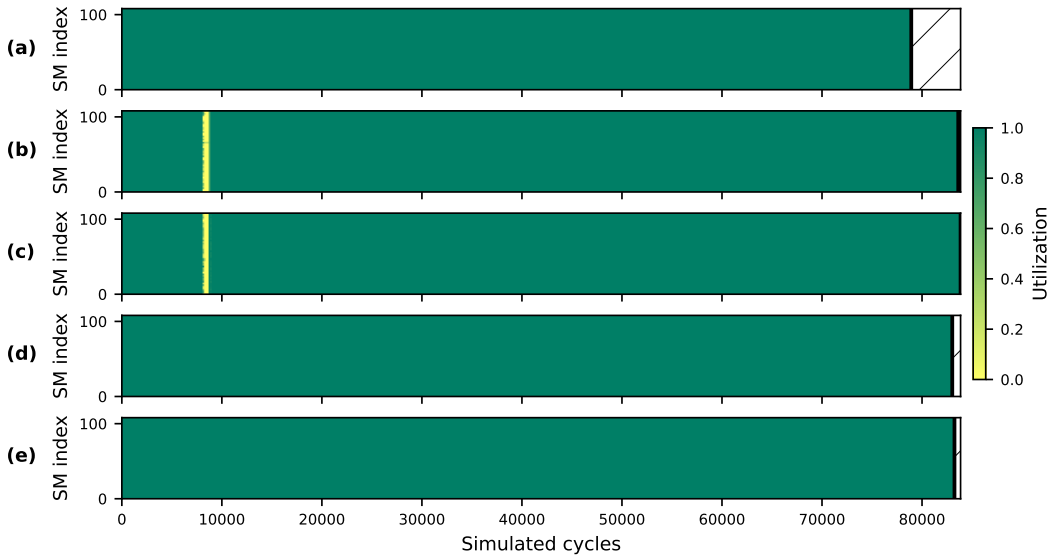

Figure 194: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,462 of them). Edge slices in (c) and (e) hold 3,681 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 78{,}924$, $T/T^* = 1.000$ (slot), $1.00\times$; (b) $T = 83{,}622$, $T/T^* = 1.007$ (slot), $0.94\times$; (c) $T = 83{,}853$, $T/T^* = 1.008$ (slot), $0.94\times$; (d) $T = 83{,}024$, $T/T^* = 1.000$ (slot), $0.95\times$; (e) $T = 83{,}244$, $T/T^* = 1.000$ (slot), $0.95\times$.

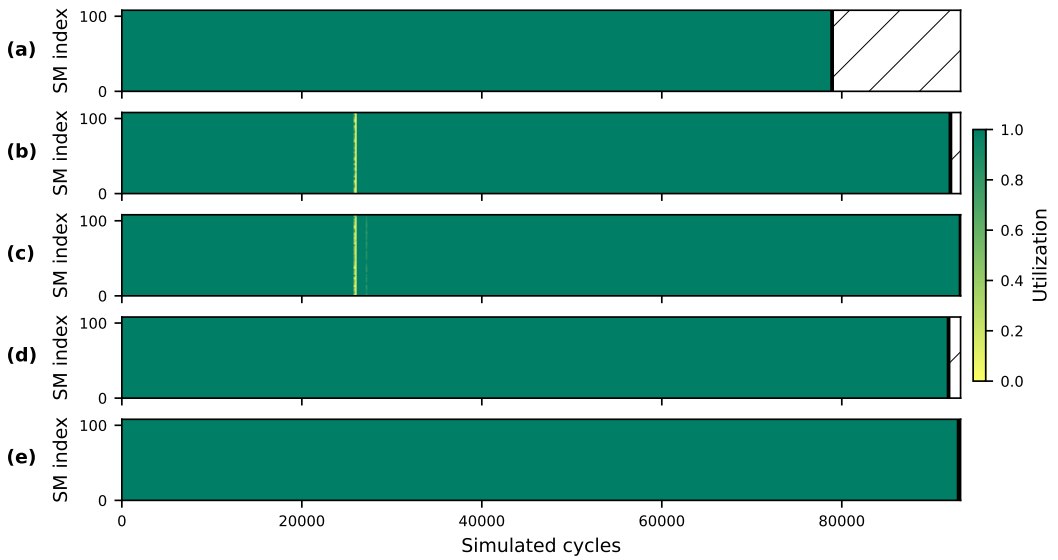

Figure 195: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,842 of them). Edge slices in (c) and (e) hold 4,382 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 78{,}924$, $T/T^* = 1.000$ (slot), $1.00\times$; (b) $T = 92{,}072$, $T/T^* = 1.002$ (slot), $0.86\times$; (c) $T = 93{,}199$, $T/T^* = 1.003$ (slot), $0.85\times$; (d) $T = 91{,}865$, $T/T^* = 1.000$ (slot), $0.86\times$; (e) $T = 92{,}981$, $T/T^* = 1.000$ (slot), $0.85\times$.

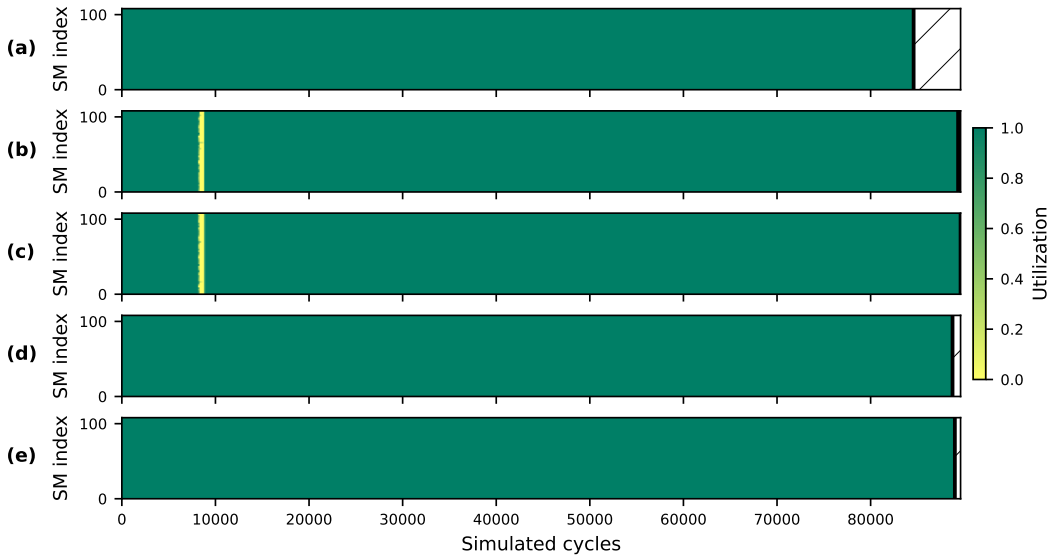

Figure 196: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,462 of them). Edge slices in (c) and (e) hold 3,681 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 84{,}594$, $T/T^* = 1.000$ (slot), $1.00\times$; (b) $T = 89{,}348$, $T/T^* = 1.007$ (slot), $0.95\times$; (c) $T = 89{,}610$, $T/T^* = 1.007$ (slot), $0.94\times$; (d) $T = 88{,}752$, $T/T^* = 1.000$ (slot), $0.95\times$; (e) $T = 89{,}000$, $T/T^* = 1.000$ (slot), $0.95\times$.

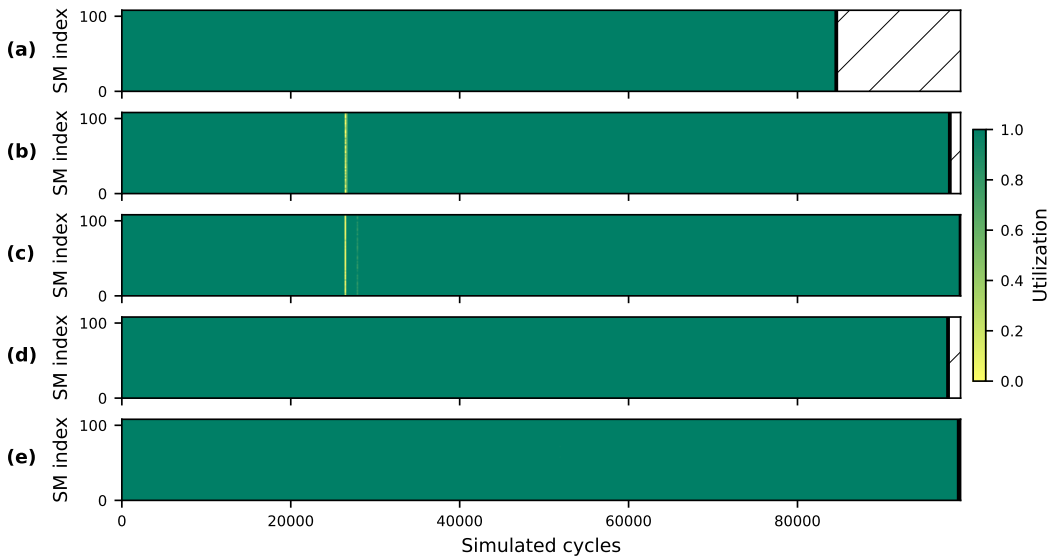

Figure 197: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 8,764, skew $444\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,842 of them). Edge slices in (c) and (e) hold 4,382 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 84{,}594$, $T/T^* = 1.000$ (slot), $1.00\times$; (b) $T = 98{,}035$, $T/T^* = 1.002$ (slot), $0.86\times$; (c) $T = 99{,}309$, $T/T^* = 1.002$ (slot), $0.85\times$; (d) $T = 97{,}827$, $T/T^* = 1.000$ (slot), $0.86\times$; (e) $T = 99{,}089$, $T/T^* = 1.000$ (slot), $0.85\times$.

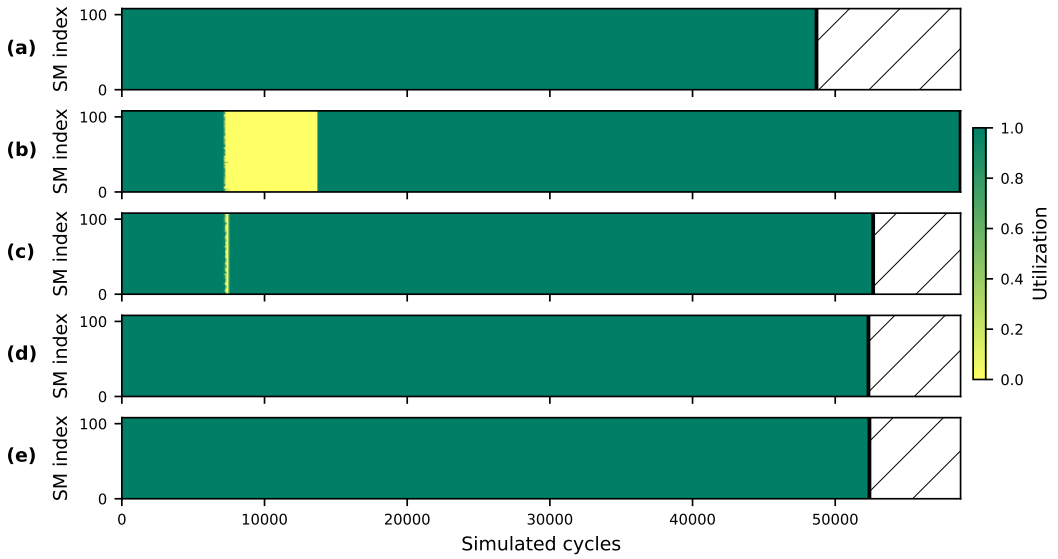

Figure 198: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 48{,}688$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 58{,}785$, $T/T^* = 1.124$ (slot), 0.83×; (c) $T = 52{,}660$, $T/T^* = 1.005$ (slot), 0.92×; (d) $T = 52{,}330$, $T/T^* = 1.000$ (slot), 0.93×; (e) $T = 52{,}398$, $T/T^* = 1.000$ (slot), 0.93×.

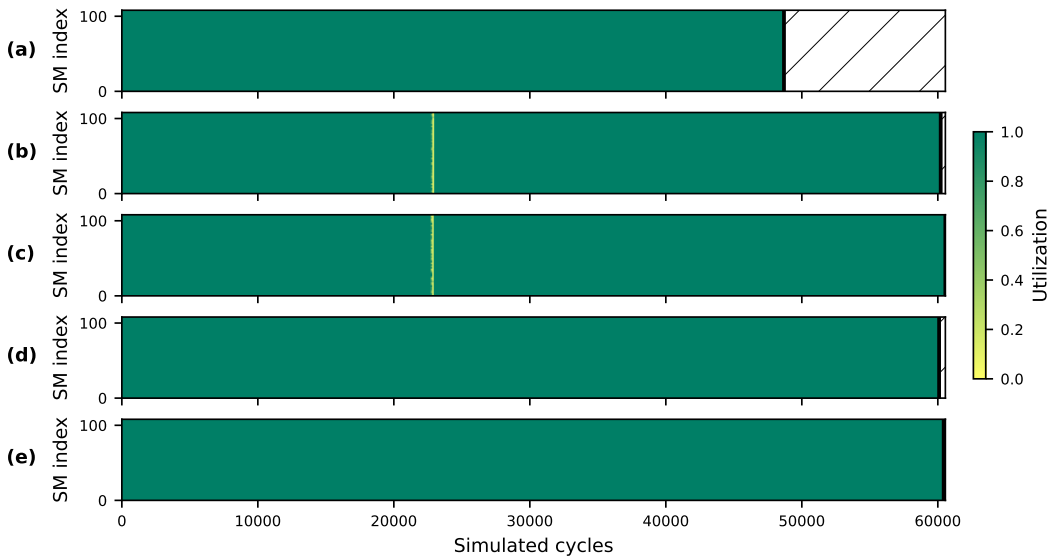

Figure 199: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 48{,}688$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 60{,}211$, $T/T^* = 1.002$ (slot), 0.81×; (c) $T = 60{,}554$, $T/T^* = 1.002$ (slot), 0.80×; (d) $T = 60{,}095$, $T/T^* = 1.000$ (slot), 0.81×; (e) $T = 60{,}431$, $T/T^* = 1.000$ (slot), 0.81×.

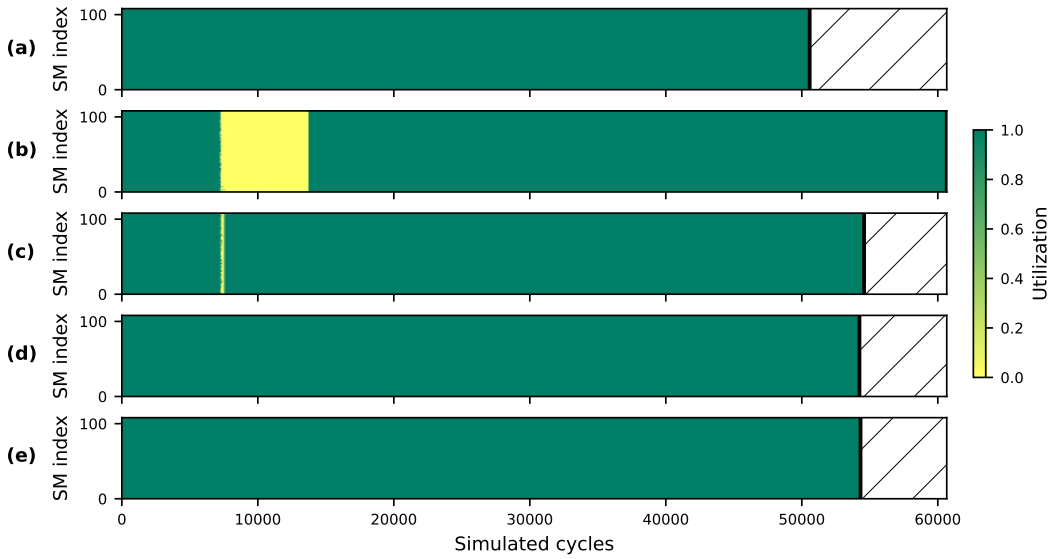

Figure 200: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (16,670 of them). Edge slices in (c) and (e) hold 3,527 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 50{,}578$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 60{,}657$, $T/T^* = 1.119$ (slot), 0.83×; (c) $T = 54{,}580$, $T/T^* = 1.005$ (slot), 0.93×; (d) $T = 54{,}239$, $T/T^* = 1.000$ (slot), 0.93×; (e) $T = 54{,}317$, $T/T^* = 1.000$ (slot), 0.93×.

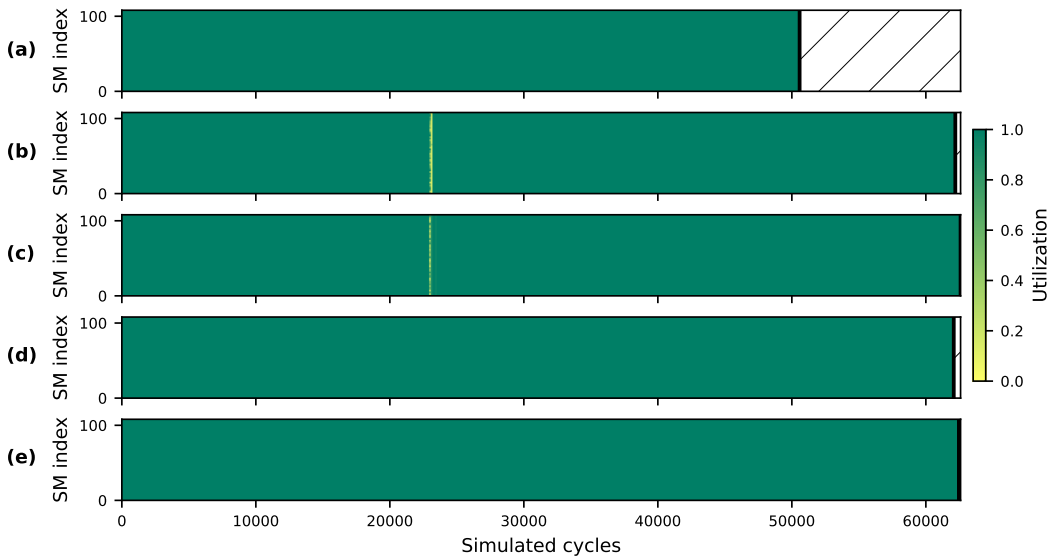

Figure 201: Per-SM occupancy over time for `pokec-regions` ($N = 1{,}632{,}803$ vertices, $E = 32{,}255{,}367$ edges, mean degree 19.8, maximum degree 13,734, skew 695×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (83,029 of them). Edge slices in (c) and (e) hold 6,867 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 50{,}578$, $T/T^* = 1.000$ (slot), 1.00×; (b) $T = 62{,}198$, $T/T^* = 1.002$ (slot), 0.81×; (c) $T = 62{,}590$, $T/T^* = 1.002$ (slot), 0.81×; (d) $T = 62{,}081$, $T/T^* = 1.000$ (slot), 0.81×; (e) $T = 62{,}466$, $T/T^* = 1.000$ (slot), 0.81×.

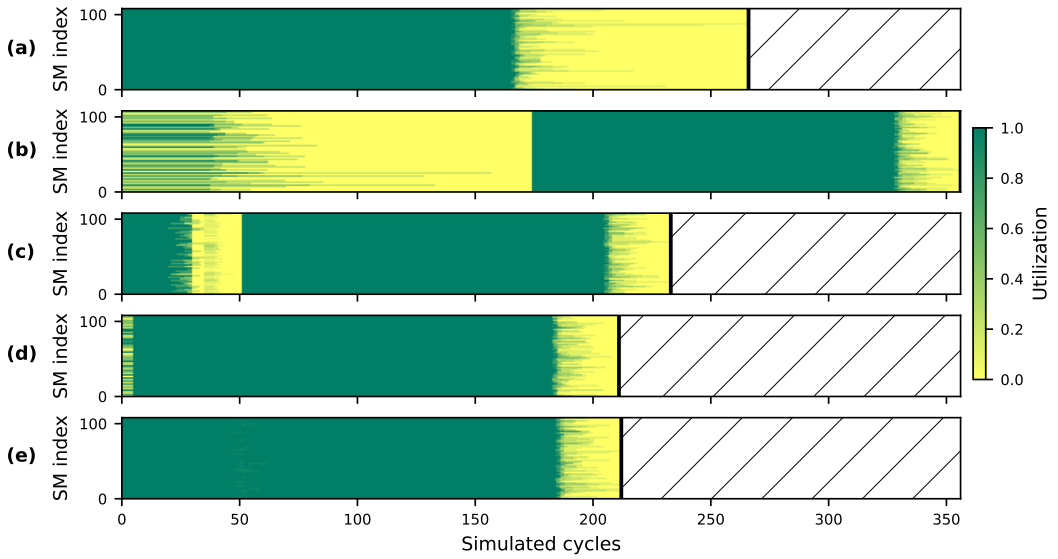

Figure 202: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 266$, $T/T^* = 1.529$ (critical path), 1.00×; (b) $T = 356$, $T/T^* = 1.935$ (slot), 0.75×; (c) $T = 233$, $T/T^* = 1.239$ (slot), 1.14×; (d) $T = 211$, $T/T^* = 1.147$ (slot), 1.26×; (e) $T = 212$, $T/T^* = 1.128$ (slot), 1.25×.

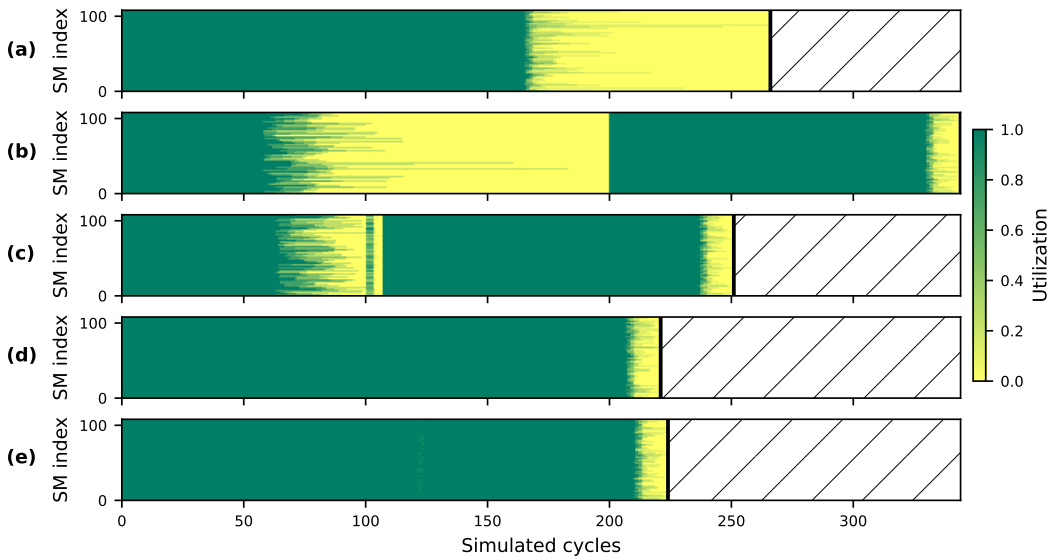

Figure 203: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 266$, $T/T^* = 1.529$ (critical path), 1.00×; (b) $T = 344$, $T/T^* = 1.642$ (slot), 0.77×; (c) $T = 251$, $T/T^* = 1.181$ (slot), 1.06×; (d) $T = 221$, $T/T^* = 1.055$ (slot), 1.20×; (e) $T = 224$, $T/T^* = 1.054$ (slot), 1.19×.

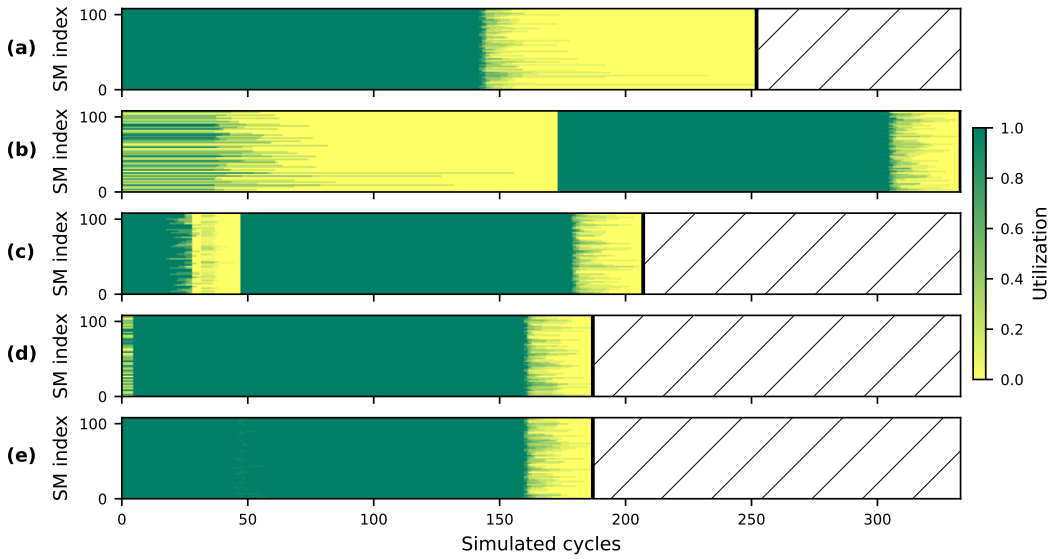

Figure 204: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 252$, $T/T^* = 1.457$ (critical path), 1.00×; (b) $T = 333$, $T/T^* = 1.925$ (critical path), 0.76×; (c) $T = 207$, $T/T^* = 1.268$ (slot), 1.22×; (d) $T = 187$, $T/T^* = 1.081$ (critical path), 1.35×; (e) $T = 187$, $T/T^* = 1.146$ (slot), 1.35×.

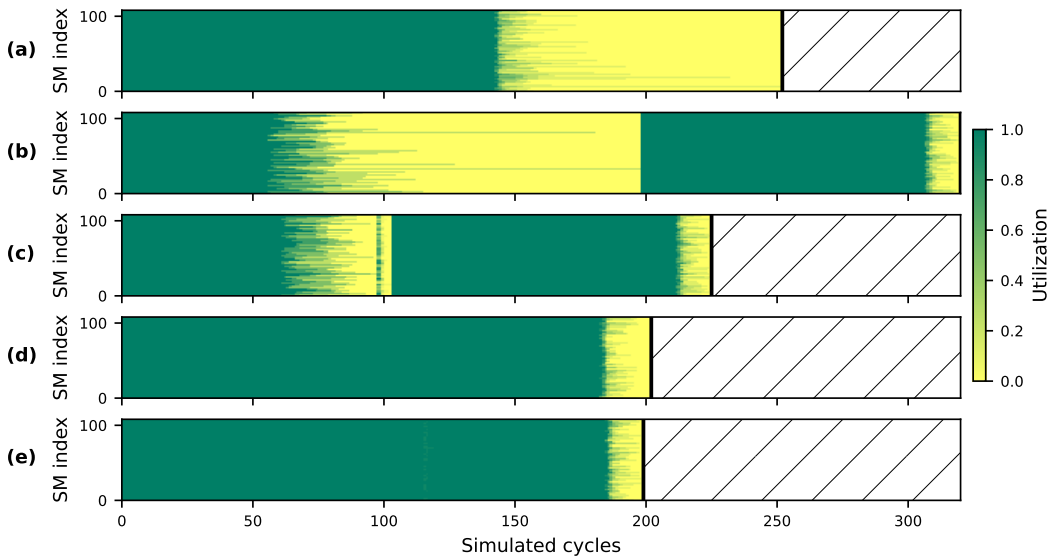

Figure 205: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 252$, $T/T^* = 1.457$ (critical path), 1.00×; (b) $T = 320$, $T/T^* = 1.726$ (slot), 0.79×; (c) $T = 225$, $T/T^* = 1.201$ (slot), 1.12×; (d) $T = 202$, $T/T^* = 1.089$ (slot), 1.25×; (e) $T = 199$, $T/T^* = 1.062$ (slot), 1.27×.

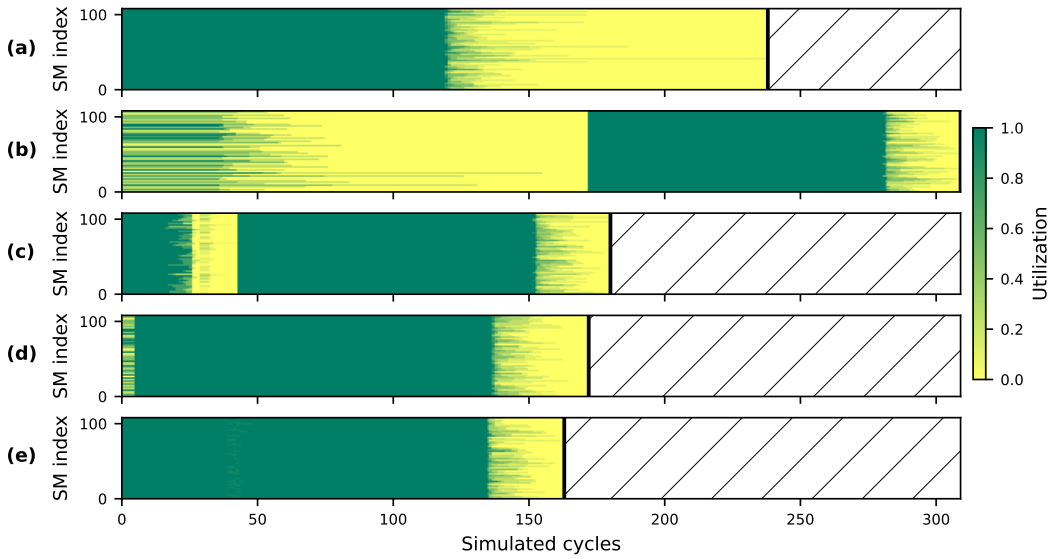

Figure 206: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 238$, $T/T^* = 1.384$ (critical path), 1.00×; (b) $T = 309$, $T/T^* = 1.797$ (critical path), 0.77×; (c) $T = 180$, $T/T^* = 1.301$ (slot), 1.32×; (d) $T = 172$, $T/T^* = 1.000$ (critical path), 1.38×; (e) $T = 163$, $T/T^* = 1.178$ (slot), 1.46×.

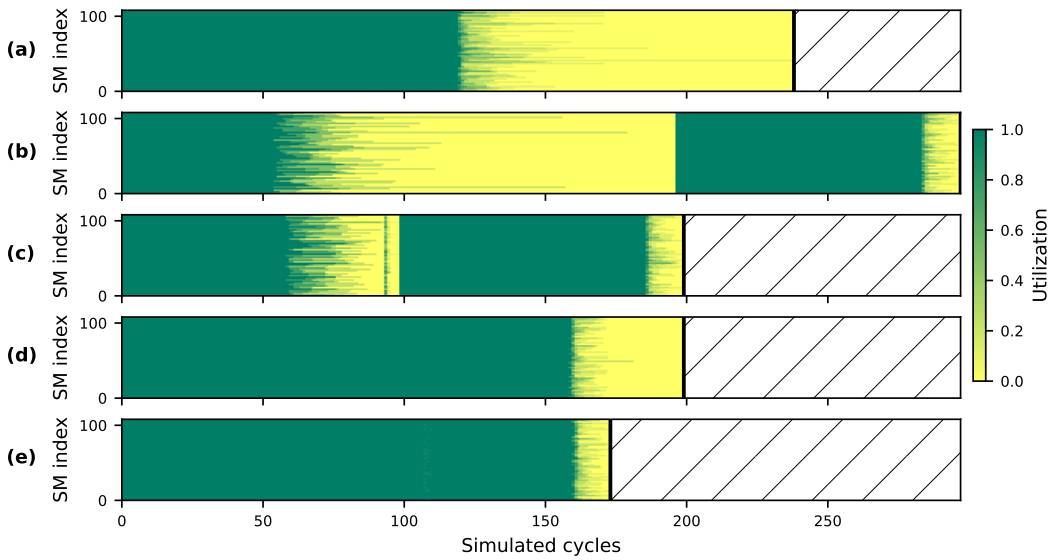

Figure 207: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 238$, $T/T^* = 1.384$ (critical path), 1.00×; (b) $T = 297$, $T/T^* = 1.727$ (critical path), 0.80×; (c) $T = 199$, $T/T^* = 1.227$ (slot), 1.20×; (d) $T = 199$, $T/T^* = 1.157$ (critical path), 1.20×; (e) $T = 173$, $T/T^* = 1.067$ (slot), 1.38×.

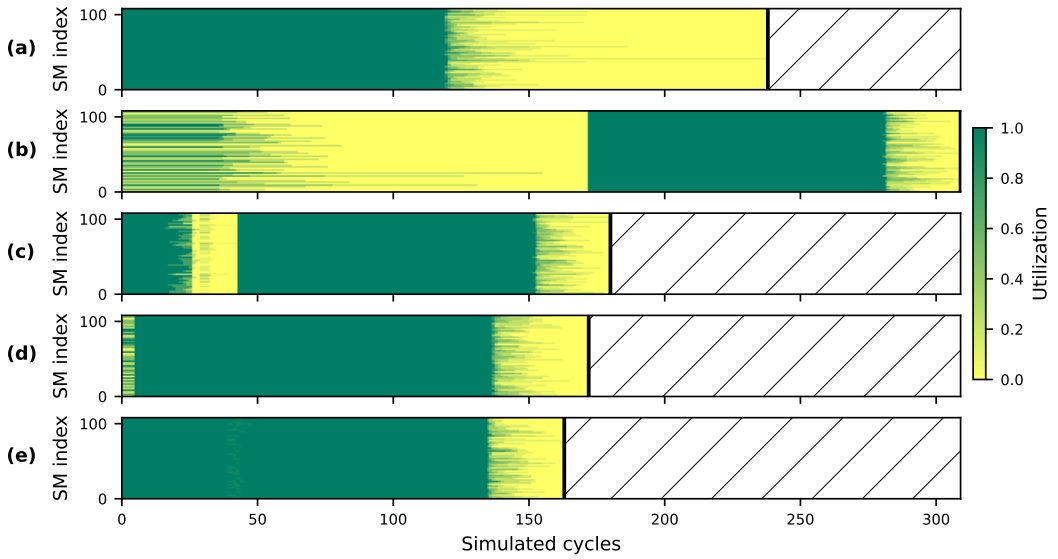

Figure 208: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 238$, $T/T^* = 1.384$ (critical path), 1.00×; (b) $T = 309$, $T/T^* = 1.797$ (critical path), 0.77×; (c) $T = 180$, $T/T^* = 1.301$ (slot), 1.32×; (d) $T = 172$, $T/T^* = 1.000$ (critical path), 1.38×; (e) $T = 163$, $T/T^* = 1.178$ (slot), 1.46×.

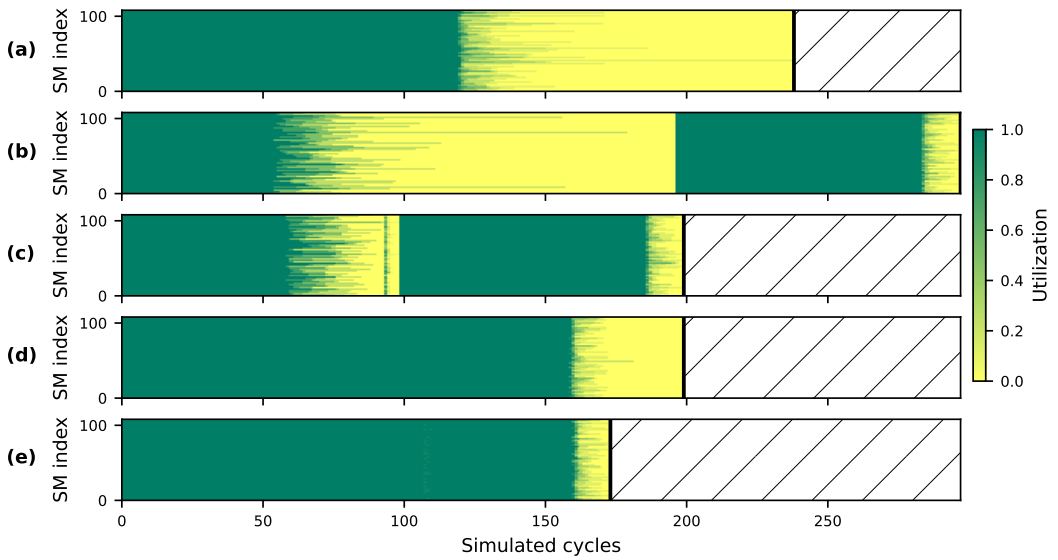

Figure 209: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 238$, $T/T^* = 1.384$ (critical path), 1.00×; (b) $T = 297$, $T/T^* = 1.727$ (critical path), 0.80×; (c) $T = 199$, $T/T^* = 1.227$ (slot), 1.20×; (d) $T = 199$, $T/T^* = 1.157$ (critical path), 1.20×; (e) $T = 173$, $T/T^* = 1.067$ (slot), 1.38×.

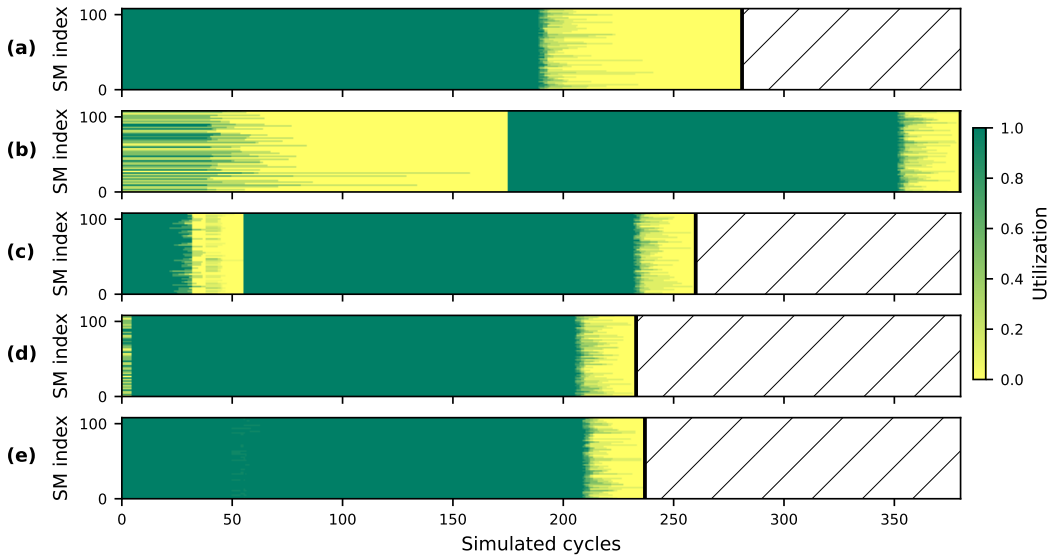

Figure 210: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 281$, $T/T^* = 1.449$ (slot), 1.00×; (b) $T = 380$, $T/T^* = 1.835$ (slot), 0.74×; (c) $T = 260$, $T/T^* = 1.222$ (slot), 1.08×; (d) $T = 233$, $T/T^* = 1.125$ (slot), 1.21×; (e) $T = 237$, $T/T^* = 1.114$ (slot), 1.19×.

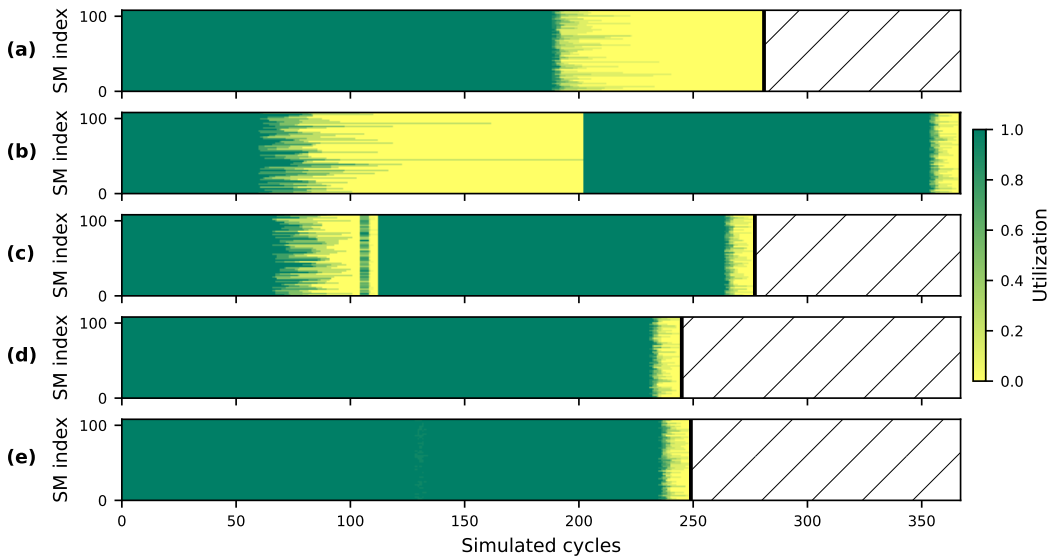

Figure 211: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 281$, $T/T^* = 1.449$ (slot), 1.00×; (b) $T = 367$, $T/T^* = 1.572$ (slot), 0.77×; (c) $T = 277$, $T/T^* = 1.166$ (slot), 1.01×; (d) $T = 245$, $T/T^* = 1.049$ (slot), 1.15×; (e) $T = 249$, $T/T^* = 1.048$ (slot), 1.13×.

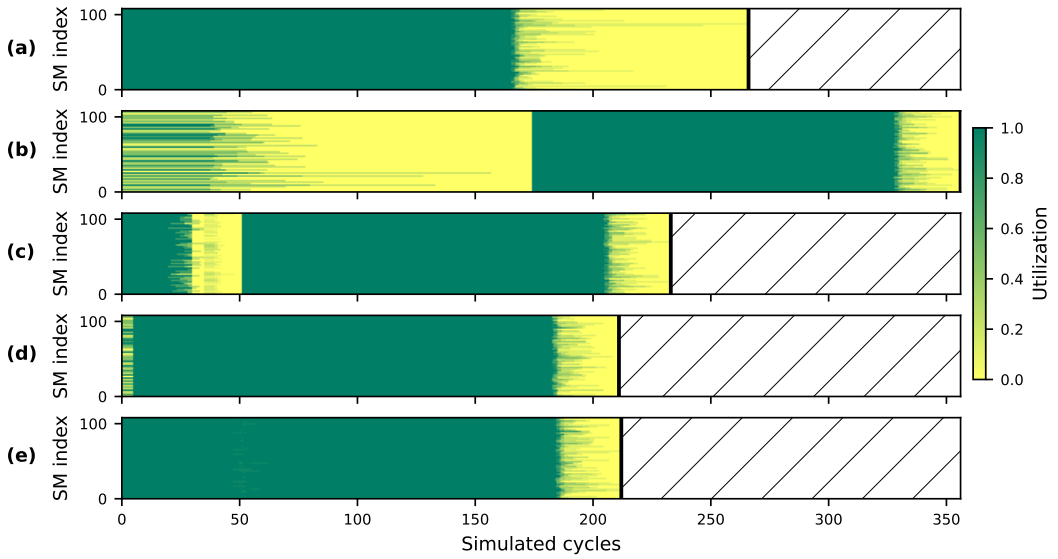

Figure 212: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 266$, $T/T^* = 1.529$ (critical path), 1.00×; (b) $T = 356$, $T/T^* = 1.935$ (slot), 0.75×; (c) $T = 233$, $T/T^* = 1.239$ (slot), 1.14×; (d) $T = 211$, $T/T^* = 1.147$ (slot), 1.26×; (e) $T = 212$, $T/T^* = 1.128$ (slot), 1.25×.

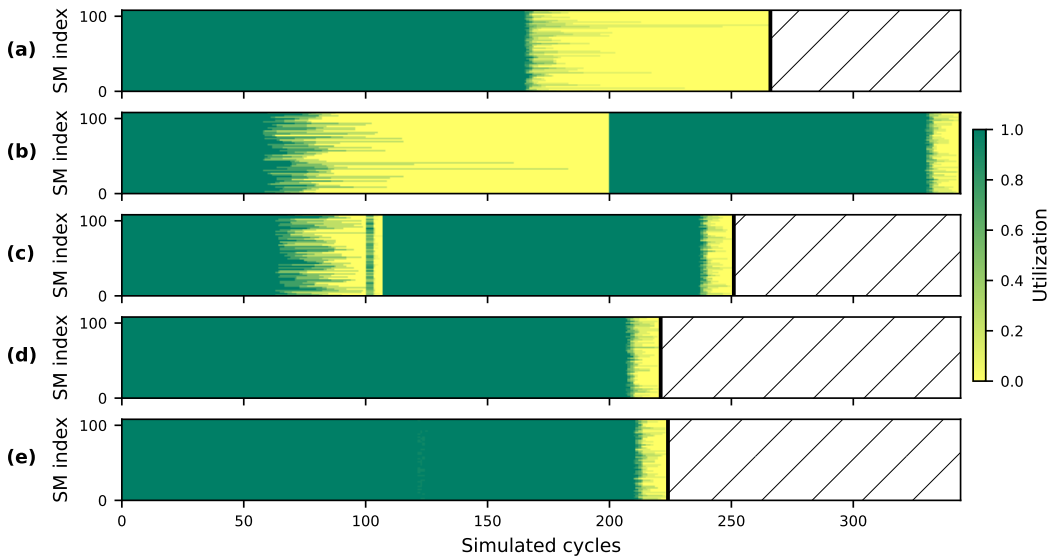

Figure 213: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 266$, $T/T^* = 1.529$ (critical path), 1.00×; (b) $T = 344$, $T/T^* = 1.642$ (slot), 0.77×; (c) $T = 251$, $T/T^* = 1.181$ (slot), 1.06×; (d) $T = 221$, $T/T^* = 1.055$ (slot), 1.20×; (e) $T = 224$, $T/T^* = 1.054$ (slot), 1.19×.

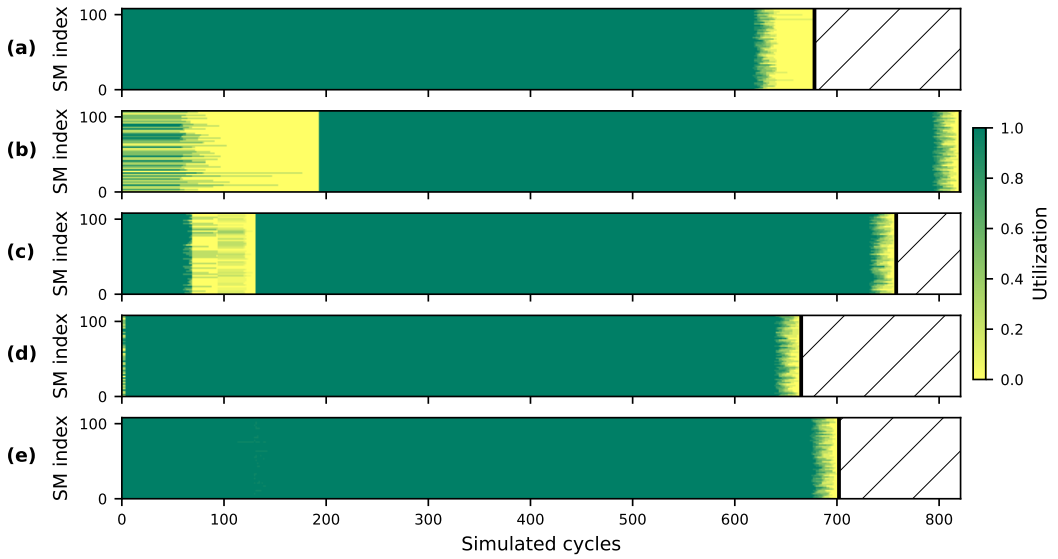

Figure 214: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 678$, $T/T^* = 1.081$ (slot), 1.00×; (b) $T = 821$, $T/T^* = 1.272$ (slot), 0.83×; (c) $T = 758$, $T/T^* = 1.108$ (slot), 0.89×; (d) $T = 665$, $T/T^* = 1.030$ (slot), 1.02×; (e) $T = 702$, $T/T^* = 1.026$ (slot), 0.97×.

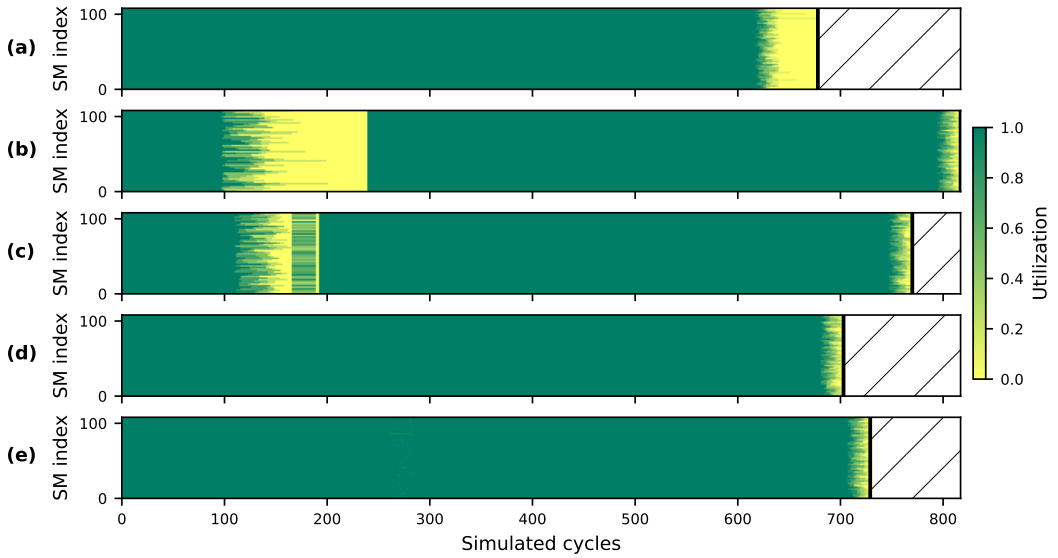

Figure 215: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 678$, $T/T^* = 1.081$ (slot), 1.00×; (b) $T = 817$, $T/T^* = 1.184$ (slot), 0.83×; (c) $T = 770$, $T/T^* = 1.076$ (slot), 0.88×; (d) $T = 703$, $T/T^* = 1.018$ (slot), 0.96×; (e) $T = 729$, $T/T^* = 1.019$ (slot), 0.93×.

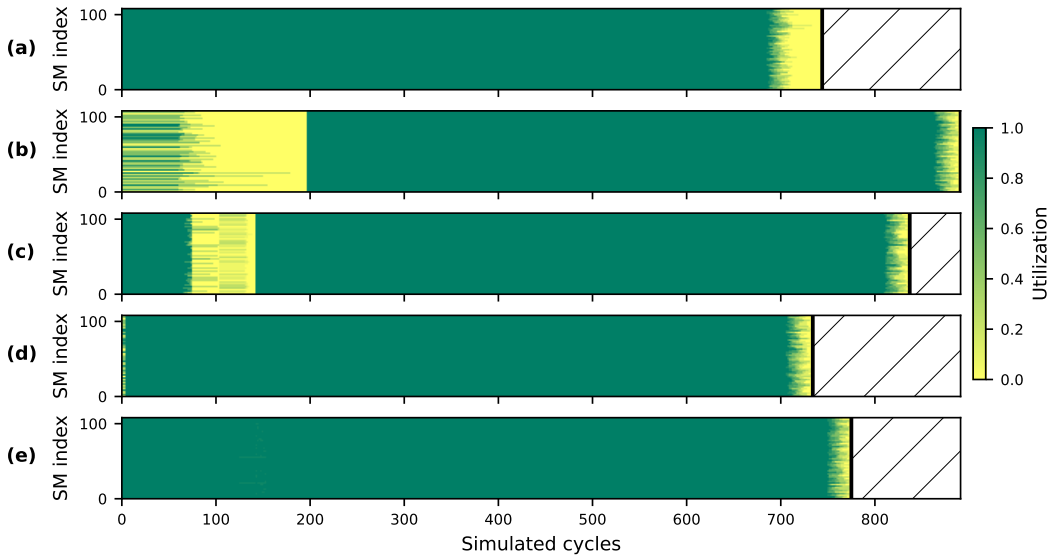

Figure 216: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 744$, $T/T^* = 1.069$ (slot), 1.00×; (b) $T = 891$, $T/T^* = 1.247$ (slot), 0.84×; (c) $T = 837$, $T/T^* = 1.103$ (slot), 0.89×; (d) $T = 734$, $T/T^* = 1.027$ (slot), 1.01×; (e) $T = 775$, $T/T^* = 1.022$ (slot), 0.96×.

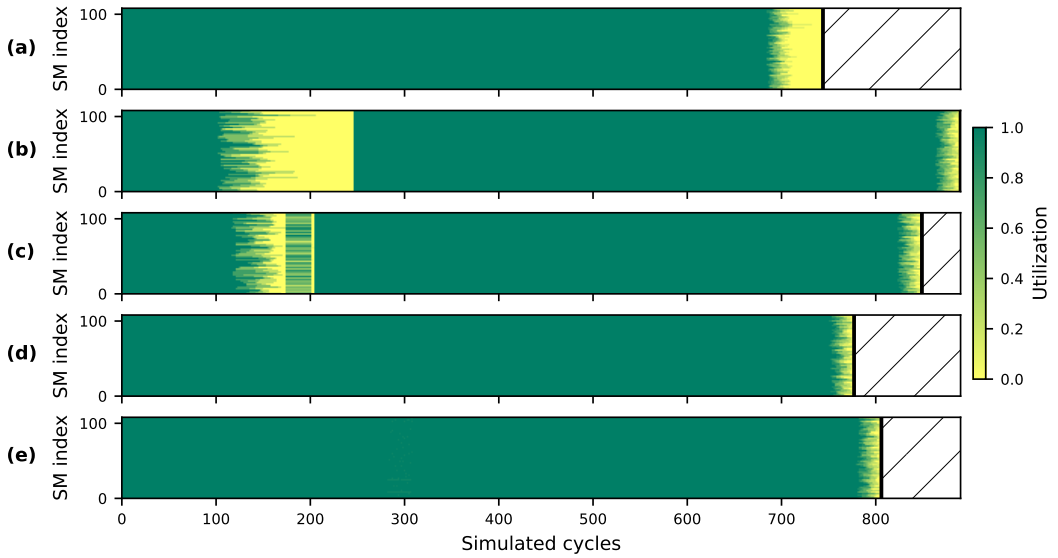

Figure 217: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 744$, $T/T^* = 1.069$ (slot), 1.00×; (b) $T = 890$, $T/T^* = 1.167$ (slot), 0.84×; (c) $T = 849$, $T/T^* = 1.073$ (slot), 0.88×; (d) $T = 777$, $T/T^* = 1.019$ (slot), 0.96×; (e) $T = 806$, $T/T^* = 1.019$ (slot), 0.92×.

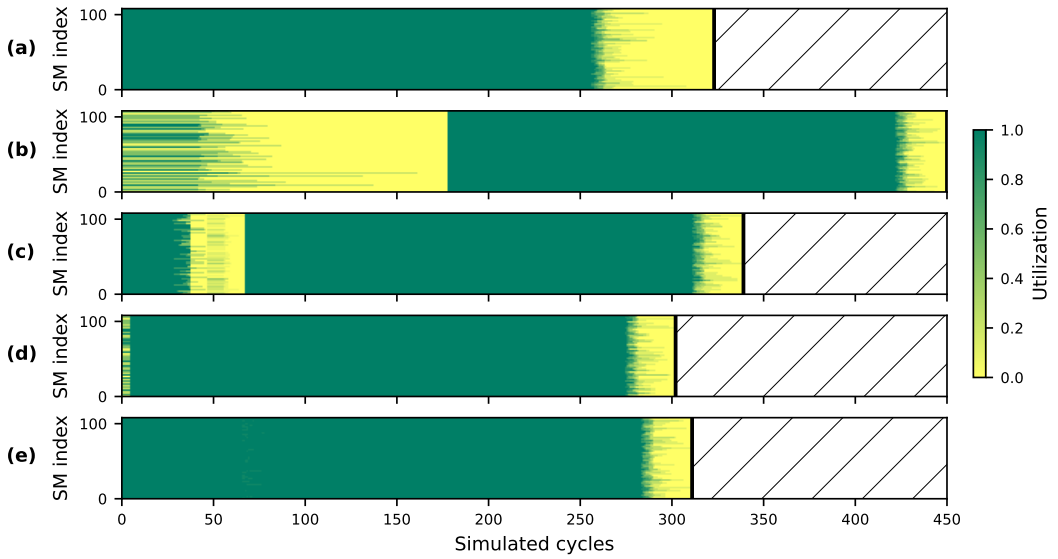

Figure 218: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 323$, $T/T^* = 1.231$ (slot), 1.00×; (b) $T = 450$, $T/T^* = 1.629$ (slot), 0.72×; (c) $T = 339$, $T/T^* = 1.180$ (slot), 0.95×; (d) $T = 302$, $T/T^* = 1.093$ (slot), 1.07×; (e) $T = 311$, $T/T^* = 1.083$ (slot), 1.04×.

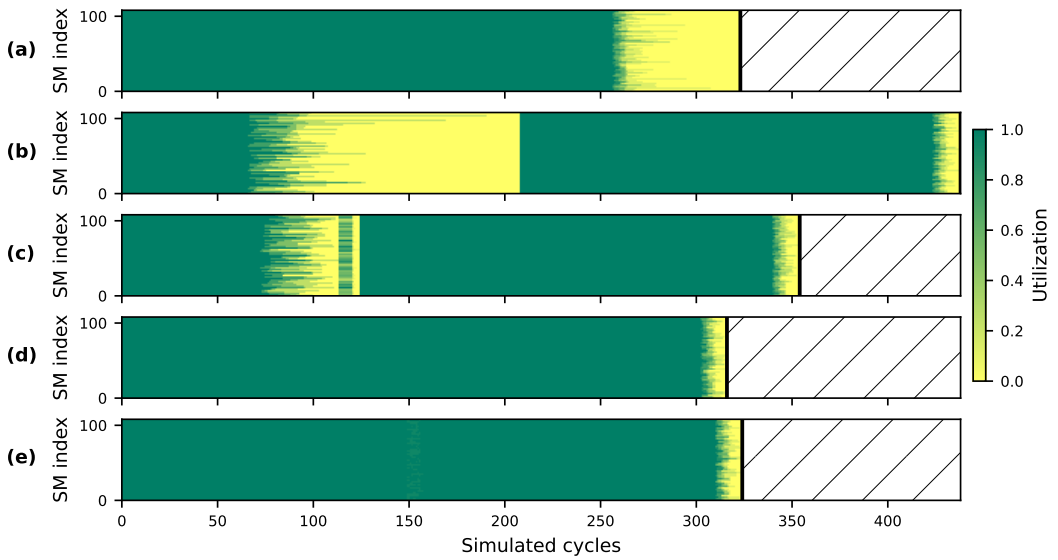

Figure 219: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 323$, $T/T^* = 1.231$ (slot), 1.00×; (b) $T = 438$, $T/T^* = 1.433$ (slot), 0.74×; (c) $T = 354$, $T/T^* = 1.131$ (slot), 0.91×; (d) $T = 316$, $T/T^* = 1.034$ (slot), 1.02×; (e) $T = 324$, $T/T^* = 1.035$ (slot), 1.00×.

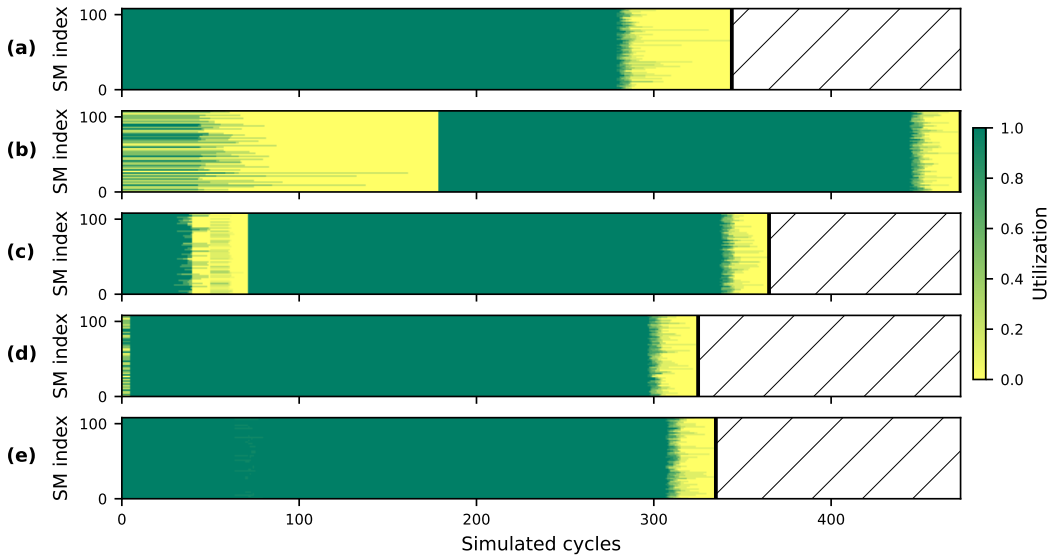

Figure 220: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (214 of them). Edge slices in (c) and (e) hold 13 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 344$, $T/T^* = 1.206$ (slot), 1.00×; (b) $T = 473$, $T/T^* = 1.580$ (slot), 0.73×; (c) $T = 365$, $T/T^* = 1.170$ (slot), 0.94×; (d) $T = 325$, $T/T^* = 1.086$ (slot), 1.06×; (e) $T = 335$, $T/T^* = 1.074$ (slot), 1.03×.

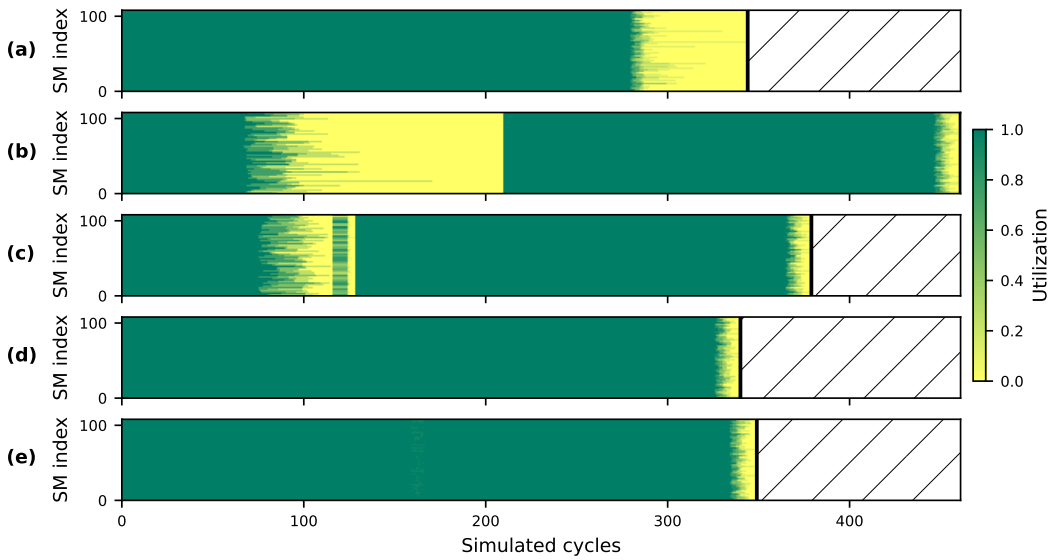

Figure 221: Per-SM occupancy over time for `pubmed` ($N = 19{,}717$ vertices, $E = 108{,}365$ edges, mean degree 5.5, maximum degree 172, skew 31×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (1,052 of them). Edge slices in (c) and (e) hold 36 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 344$, $T/T^* = 1.206$ (slot), 1.00×; (b) $T = 461$, $T/T^* = 1.398$ (slot), 0.75×; (c) $T = 379$, $T/T^* = 1.120$ (slot), 0.91×; (d) $T = 340$, $T/T^* = 1.031$ (slot), 1.01×; (e) $T = 349$, $T/T^* = 1.032$ (slot), 0.99×.

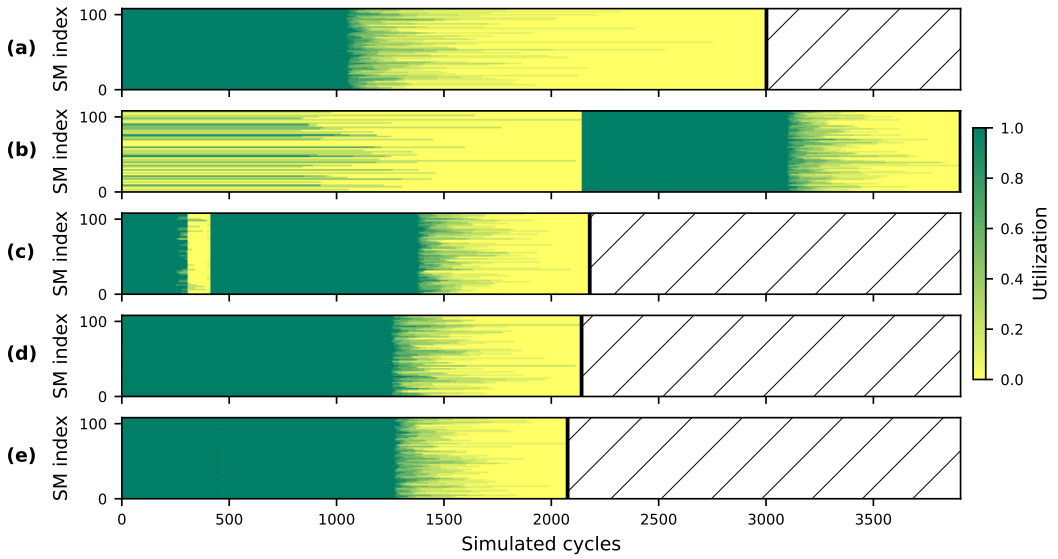

Figure 222: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}002$, $T/T^* = 1.402$ (critical path), 1.00×; (b) $T = 3{,}906$, $T/T^* = 1.824$ (critical path), 0.77×; (c) $T = 2{,}179$, $T/T^* = 1.557$ (slot), 1.38×; (d) $T = 2{,}141$, $T/T^* = 1.000$ (critical path), 1.40×; (e) $T = 2{,}076$, $T/T^* = 1.483$ (slot), 1.45×.

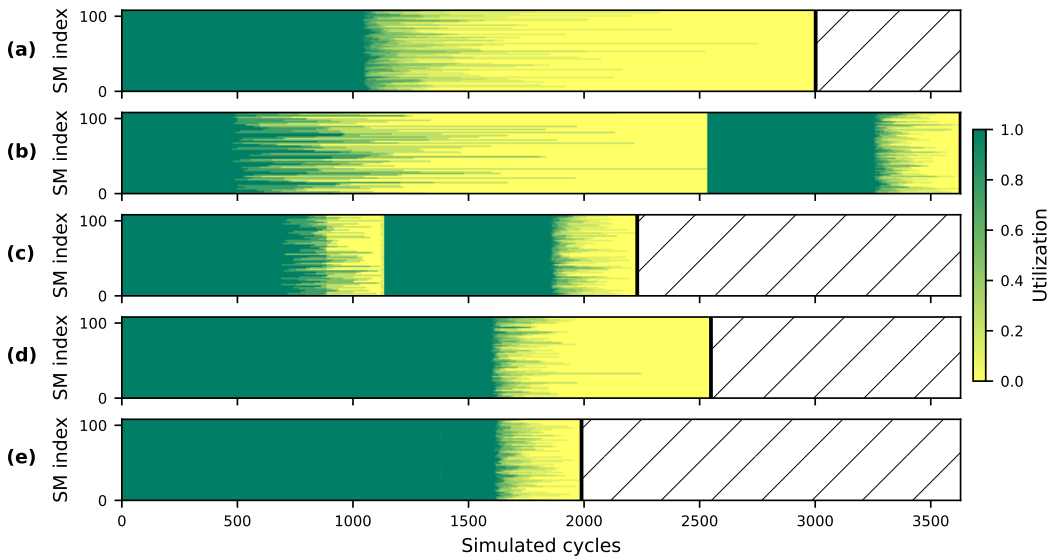

Figure 223: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}002$, $T/T^* = 1.402$ (critical path), 1.00×; (b) $T = 3{,}629$, $T/T^* = 1.695$ (critical path), 0.83×; (c) $T = 2{,}230$, $T/T^* = 1.320$ (slot), 1.35×; (d) $T = 2{,}549$, $T/T^* = 1.191$ (critical path), 1.18×; (e) $T = 1{,}989$, $T/T^* = 1.177$ (slot), 1.51×.

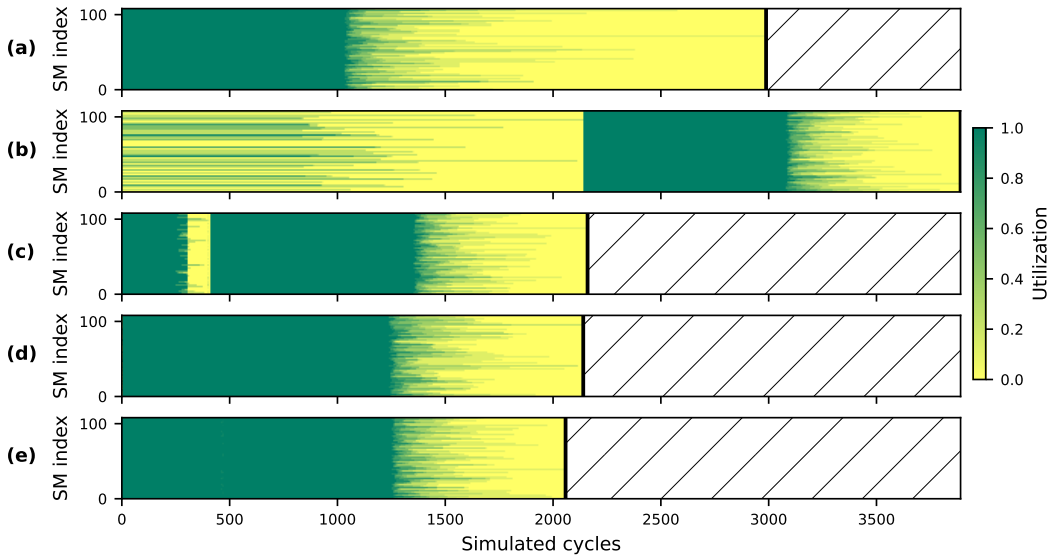

Figure 224: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}988$, $T/T^* = 1.396$ (critical path), 1.00×; (b) $T = 3{,}890$, $T/T^* = 1.818$ (critical path), 0.77×; (c) $T = 2{,}160$, $T/T^* = 1.561$ (slot), 1.38×; (d) $T = 2{,}140$, $T/T^* = 1.000$ (critical path), 1.40×; (e) $T = 2{,}058$, $T/T^* = 1.487$ (slot), 1.45×.

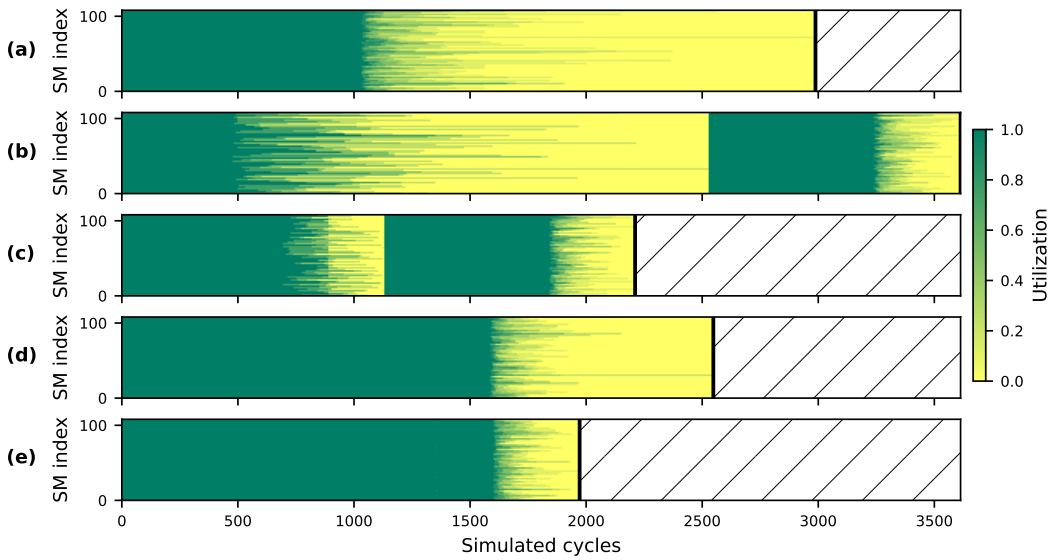

Figure 225: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 2{,}988$, $T/T^* = 1.396$ (critical path), 1.00×; (b) $T = 3{,}613$, $T/T^* = 1.688$ (critical path), 0.83×; (c) $T = 2{,}211$, $T/T^* = 1.321$ (slot), 1.35×; (d) $T = 2{,}548$, $T/T^* = 1.191$ (critical path), 1.17×; (e) $T = 1{,}972$, $T/T^* = 1.178$ (slot), 1.52×.

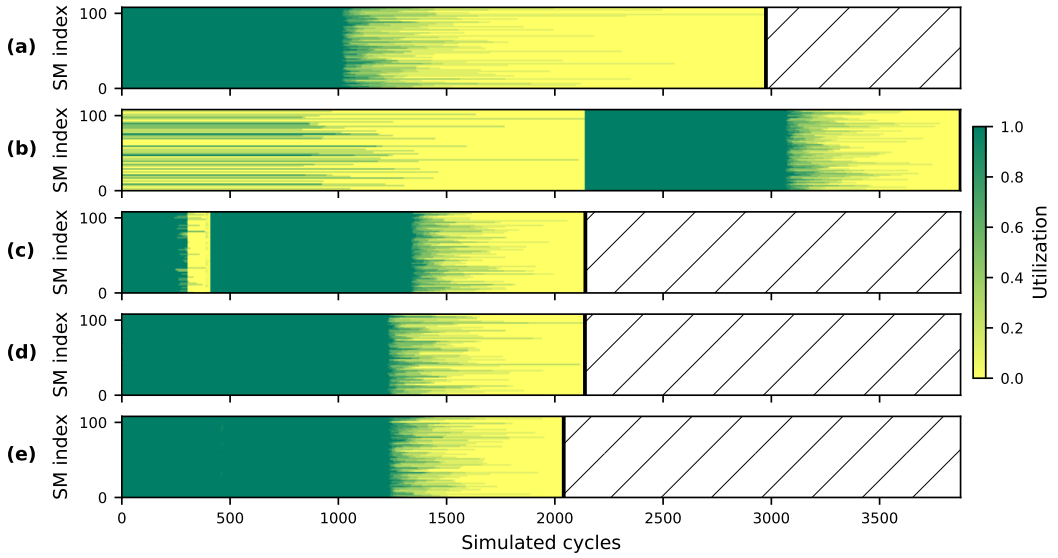

Figure 226: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 2,975, T/T^* = 1.391 (critical path), 1.00×; (b) T = 3,874, T/T^* = 1.811 (critical path), 0.77×; (c) T = 2,141, T/T^* = 1.565 (slot), 1.39×; (d) T = 2,139, T/T^* = 1.000 (critical path), 1.39×; (e) T = 2,041, T/T^* = 1.491 (slot), 1.46×.

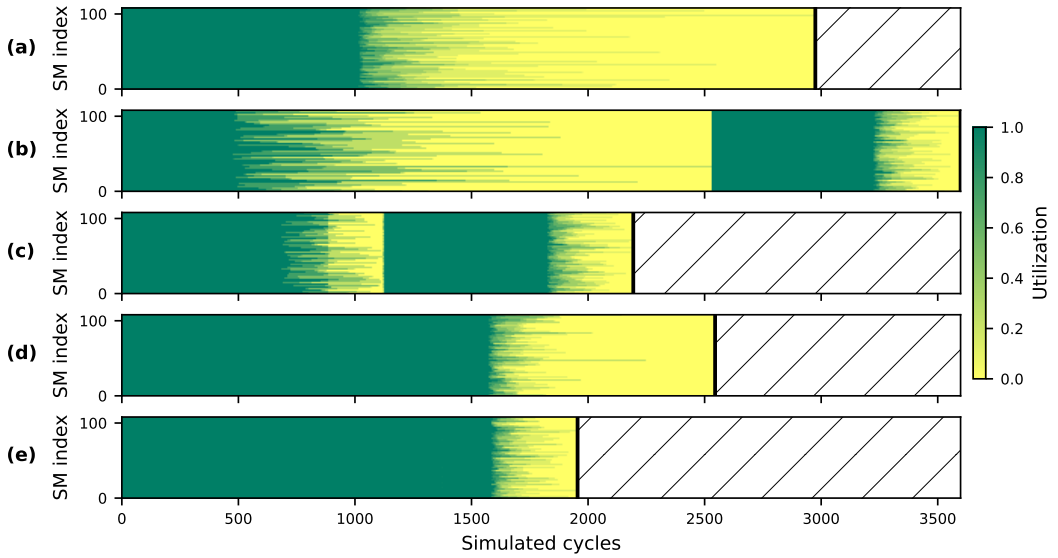

Figure 227: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 2,975, T/T^* = 1.391 (critical path), 1.00×; (b) T = 3,598, T/T^* = 1.682 (critical path), 0.83×; (c) T = 2,194, T/T^* = 1.324 (slot), 1.36×; (d) T = 2,545, T/T^* = 1.190 (critical path), 1.17×; (e) T = 1,955, T/T^* = 1.179 (slot), 1.52×.

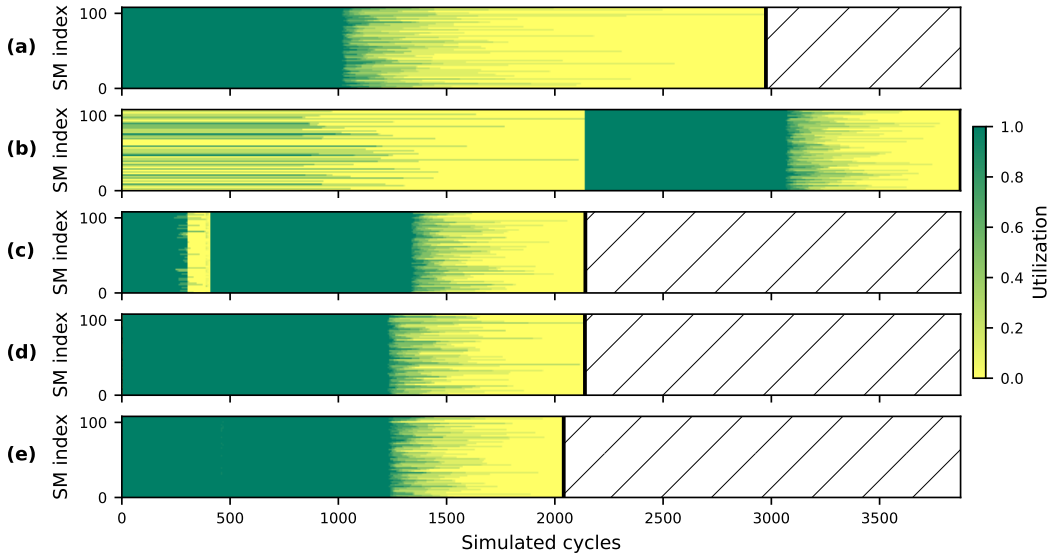

Figure 228: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 2,975, T/T^* = 1.391 (critical path), 1.00×; (b) T = 3,874, T/T^* = 1.811 (critical path), 0.77×; (c) T = 2,141, T/T^* = 1.565 (slot), 1.39×; (d) T = 2,139, T/T^* = 1.000 (critical path), 1.39×; (e) T = 2,041, T/T^* = 1.491 (slot), 1.46×.

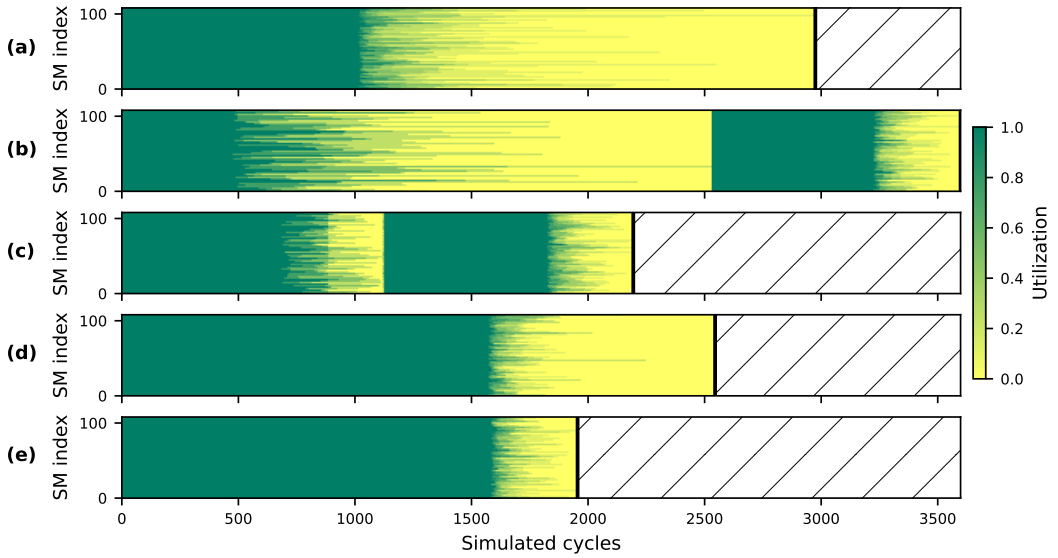

Figure 229: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 2,975, T/T^* = 1.391 (critical path), 1.00×; (b) T = 3,598, T/T^* = 1.682 (critical path), 0.83×; (c) T = 2,194, T/T^* = 1.324 (slot), 1.36×; (d) T = 2,545, T/T^* = 1.190 (critical path), 1.17×; (e) T = 1,955, T/T^* = 1.179 (slot), 1.52×.

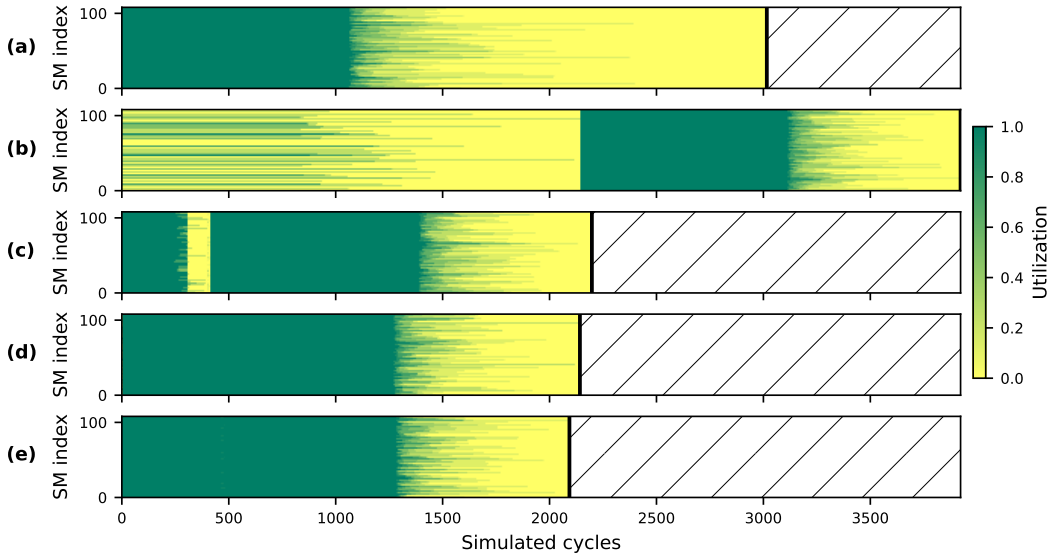

Figure 230: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,016, T/T^* = 1.408 (critical path), 1.00×; (b) T = 3,922, T/T^* = 1.831 (critical path), 0.77×; (c) T = 2,198, T/T^* = 1.553 (slot), 1.37×; (d) T = 2,142, T/T^* = 1.000 (critical path), 1.41×; (e) T = 2,093, T/T^* = 1.479 (slot), 1.44×.

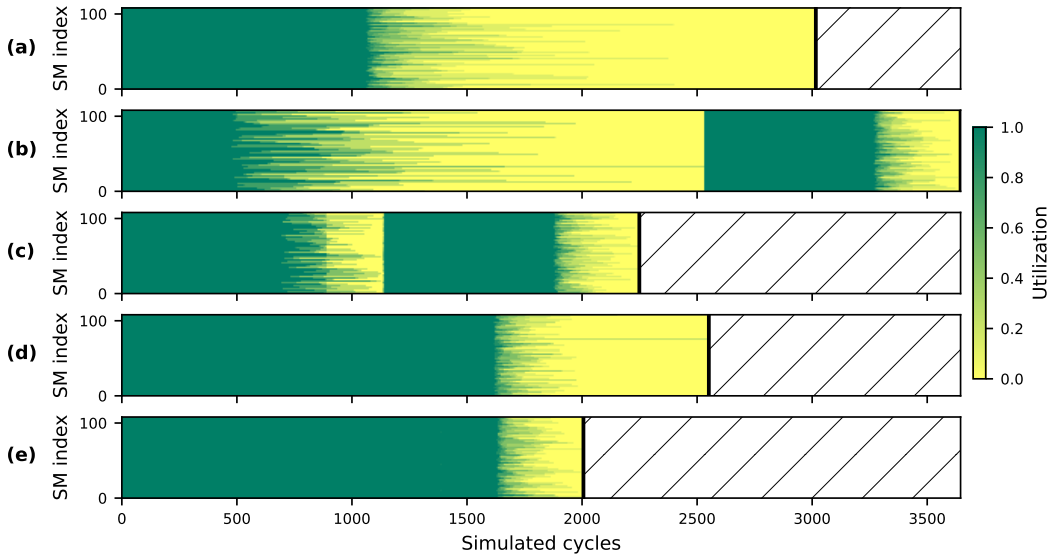

Figure 231: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,016, T/T^* = 1.408 (critical path), 1.00×; (b) T = 3,645, T/T^* = 1.702 (critical path), 0.83×; (c) T = 2,249, T/T^* = 1.319 (slot), 1.34×; (d) T = 2,551, T/T^* = 1.191 (critical path), 1.18×; (e) T = 2,006, T/T^* = 1.176 (slot), 1.50×.

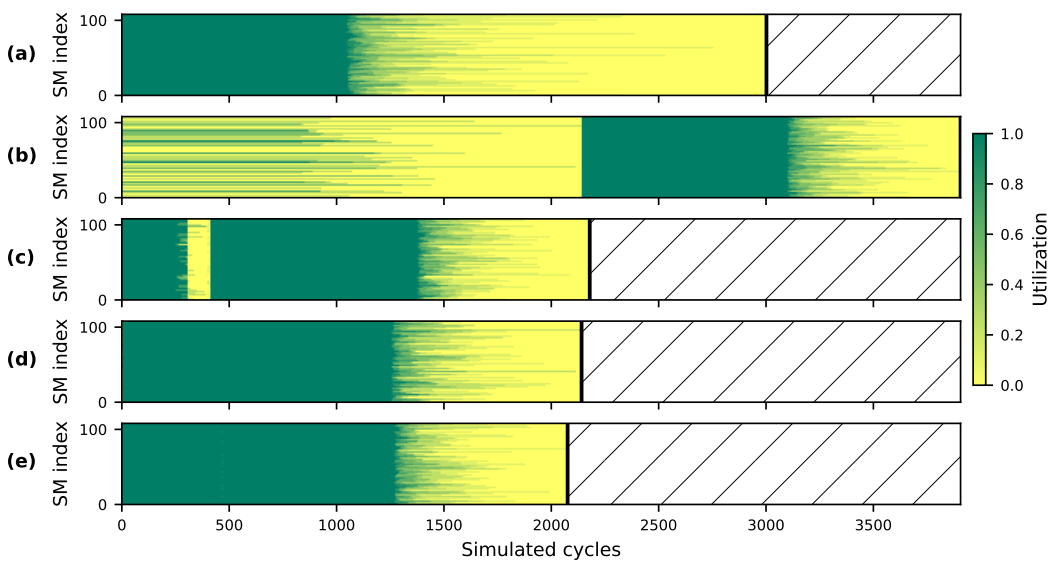

Figure 232: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}002$, $T/T^* = 1.402$ (critical path), 1.00×; (b) $T = 3{,}906$, $T/T^* = 1.824$ (critical path), 0.77×; (c) $T = 2{,}179$, $T/T^* = 1.557$ (slot), 1.38×; (d) $T = 2{,}141$, $T/T^* = 1.000$ (critical path), 1.40×; (e) $T = 2{,}076$, $T/T^* = 1.483$ (slot), 1.45×.

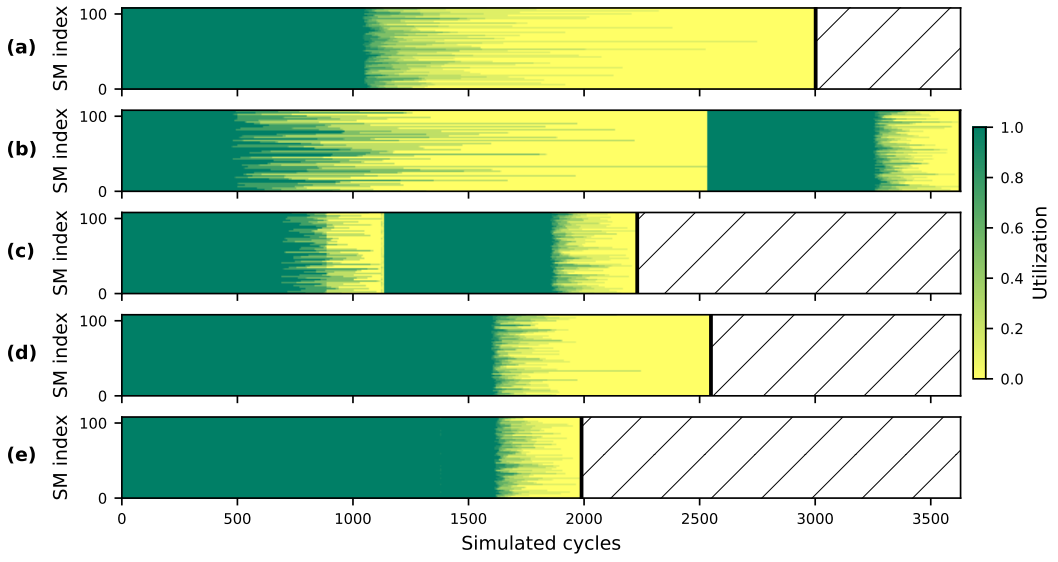

Figure 233: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}002$, $T/T^* = 1.402$ (critical path), 1.00×; (b) $T = 3{,}629$, $T/T^* = 1.695$ (critical path), 0.83×; (c) $T = 2{,}230$, $T/T^* = 1.320$ (slot), 1.35×; (d) $T = 2{,}549$, $T/T^* = 1.191$ (critical path), 1.18×; (e) $T = 1{,}989$, $T/T^* = 1.177$ (slot), 1.51×.

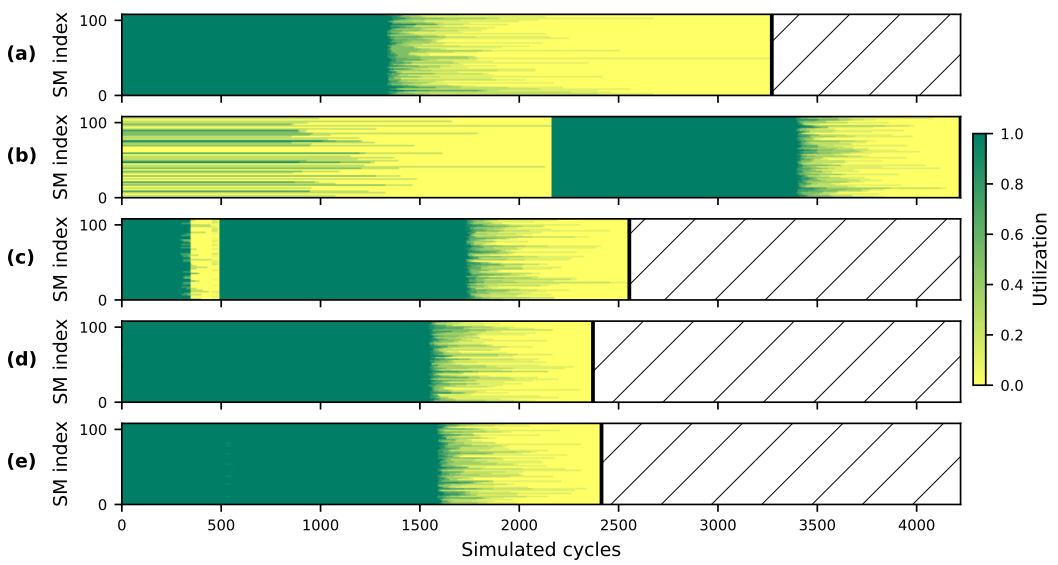

Figure 234: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,271, T/T^* = 1.514 (critical path), 1.00×; (b) T = 4,221, T/T^* = 1.953 (critical path), 0.77×; (c) T = 2,554, T/T^* = 1.491 (slot), 1.28×; (d) T = 2,371, T/T^* = 1.097 (critical path), 1.38×; (e) T = 2,414, T/T^* = 1.409 (slot), 1.36×.

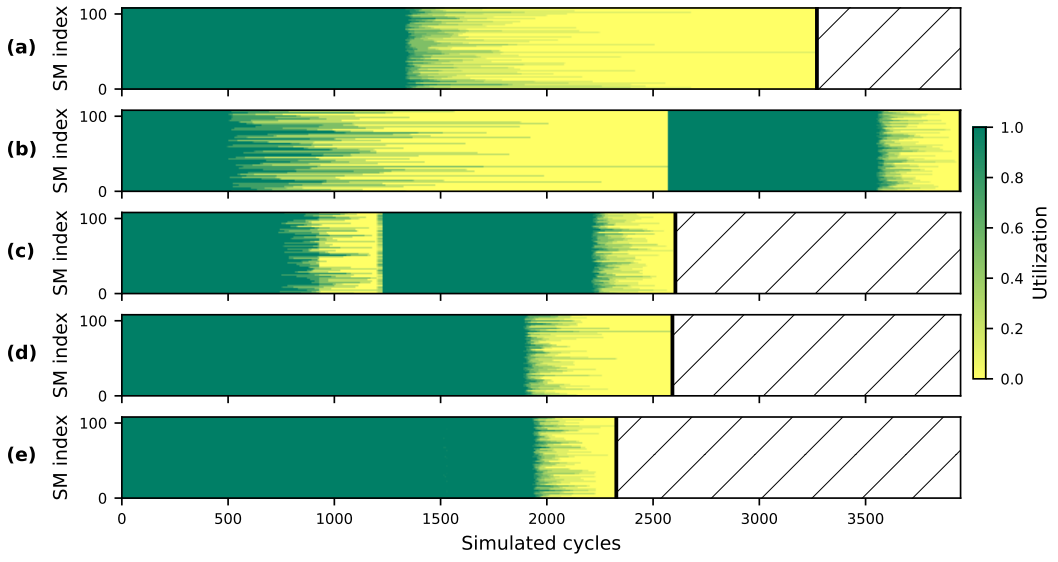

Figure 235: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,271, T/T^* = 1.514 (critical path), 1.00×; (b) T = 3,947, T/T^* = 1.826 (critical path), 0.83×; (c) T = 2,605, T/T^* = 1.297 (slot), 1.26×; (d) T = 2,591, T/T^* = 1.199 (critical path), 1.26×; (e) T = 2,327, T/T^* = 1.159 (slot), 1.41×.

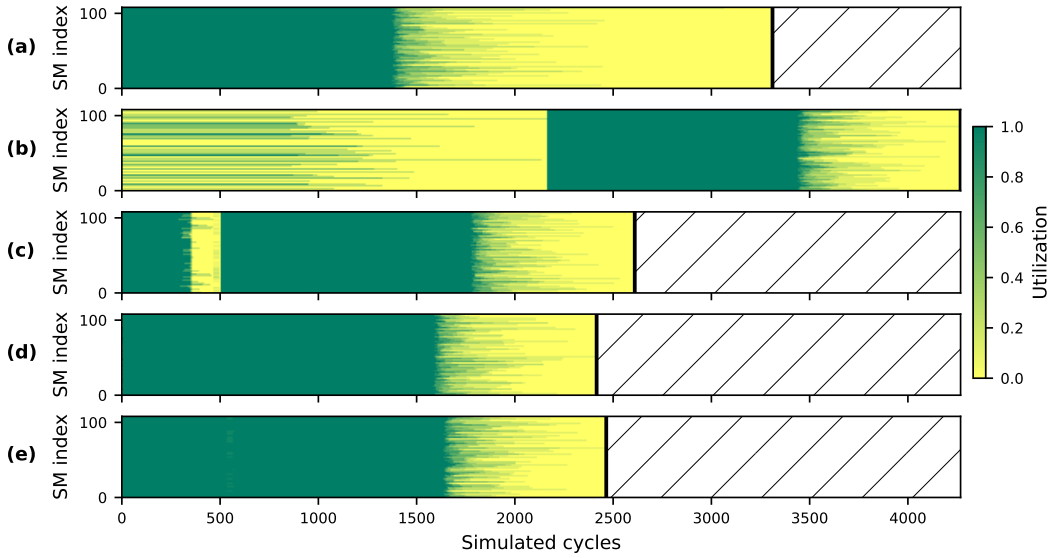

Figure 236: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}311$, $T/T^* = 1.530$ (critical path), 1.00×; (b) $T = 4{,}268$, $T/T^* = 1.972$ (critical path), 0.78×; (c) $T = 2{,}610$, $T/T^* = 1.483$ (slot), 1.27×; (d) $T = 2{,}416$, $T/T^* = 1.116$ (critical path), 1.37×; (e) $T = 2{,}465$, $T/T^* = 1.401$ (slot), 1.34×.

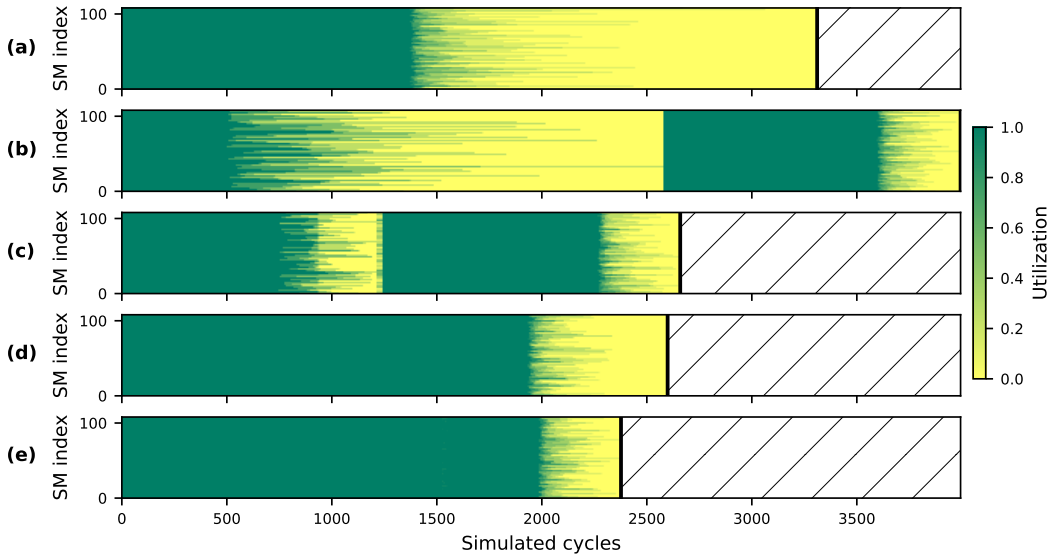

Figure 237: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}311$, $T/T^* = 1.530$ (critical path), 1.00×; (b) $T = 3{,}994$, $T/T^* = 1.846$ (critical path), 0.83×; (c) $T = 2{,}659$, $T/T^* = 1.293$ (slot), 1.25×; (d) $T = 2{,}599$, $T/T^* = 1.201$ (critical path), 1.27×; (e) $T = 2{,}377$, $T/T^* = 1.156$ (slot), 1.39×.

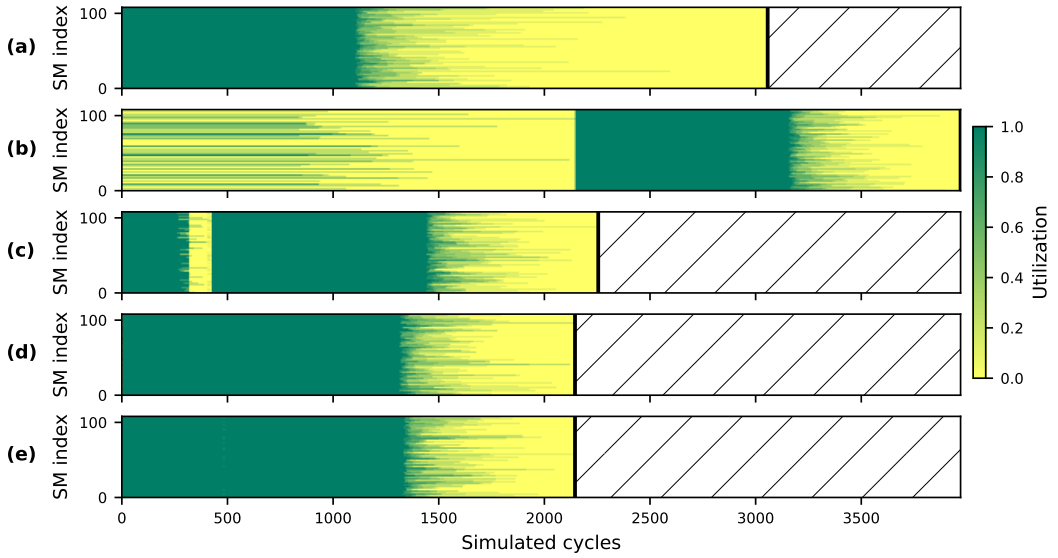

Figure 238: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,057, $T/T^* = 1.425$ (critical path), 1.00×; (b) T = 3,970, $T/T^* = 1.851$ (critical path), 0.77×; (c) T = 2,255, $T/T^* = 1.542$ (slot), 1.36×; (d) T = 2,145, $T/T^* = 1.000$ (critical path), 1.43×; (e) T = 2,145, $T/T^* = 1.467$ (slot), 1.43×.

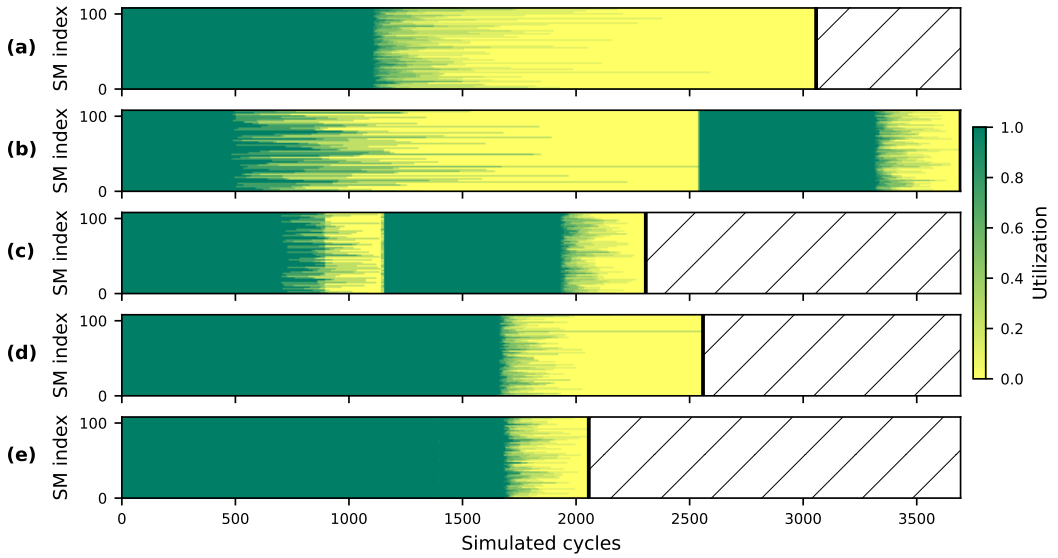

Figure 239: Per-SM occupancy over time for `tolokers-2` (N = 11,758 vertices, E = 1,049,758 edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) T = 3,057, $T/T^* = 1.425$ (critical path), 1.00×; (b) T = 3,693, $T/T^* = 1.722$ (critical path), 0.83×; (c) T = 2,307, $T/T^* = 1.316$ (slot), 1.33×; (d) T = 2,559, $T/T^* = 1.193$ (critical path), 1.19×; (e) T = 2,056, $T/T^* = 1.173$ (slot), 1.49×.

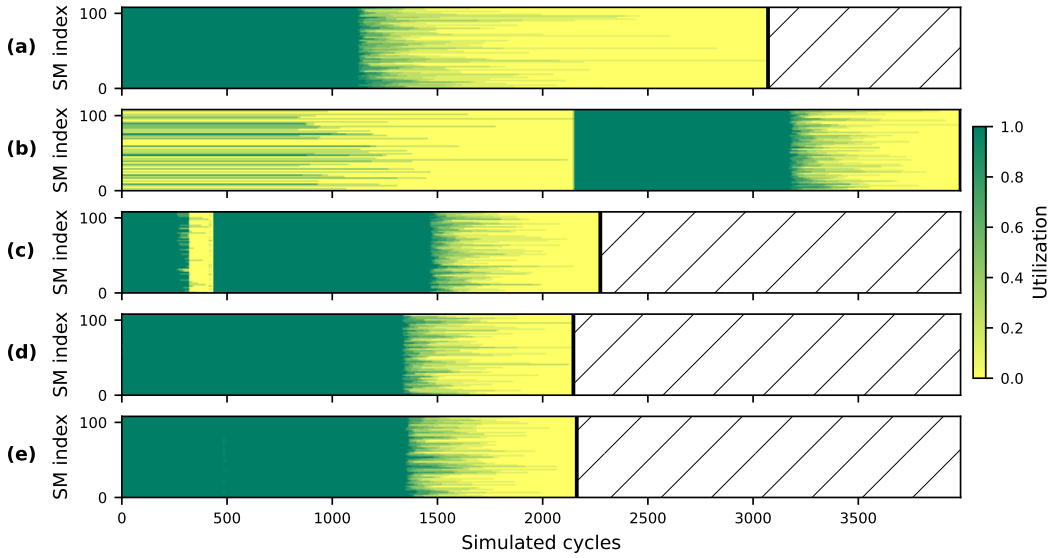

Figure 240: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (118 of them). Edge slices in (c) and (e) hold 153 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}071$, $T/T^* = 1.431$ (critical path), 1.00×; (b) $T = 3{,}986$, $T/T^* = 1.857$ (critical path), 0.77×; (c) $T = 2{,}274$, $T/T^* = 1.538$ (slot), 1.35×; (d) $T = 2{,}146$, $T/T^* = 1.000$ (critical path), 1.43×; (e) $T = 2{,}162$, $T/T^* = 1.463$ (slot), 1.42×.

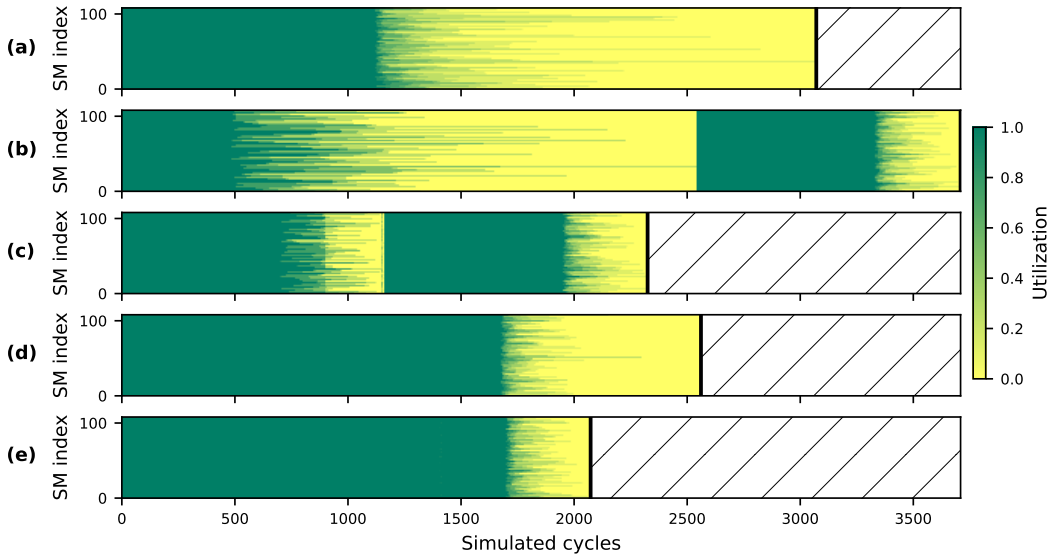

Figure 241: Per-SM occupancy over time for `tolokers-2` ($N = 11{,}758$ vertices, $E = 1{,}049{,}758$ edges, mean degree 89.3, maximum degree 2,139, skew 24×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (588 of them). Edge slices in (c) and (e) hold 442 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 3{,}071$, $T/T^* = 1.431$ (critical path), 1.00×; (b) $T = 3{,}709$, $T/T^* = 1.728$ (critical path), 0.83×; (c) $T = 2{,}325$, $T/T^* = 1.314$ (slot), 1.32×; (d) $T = 2{,}561$, $T/T^* = 1.193$ (critical path), 1.20×; (e) $T = 2{,}073$, $T/T^* = 1.172$ (slot), 1.48×.

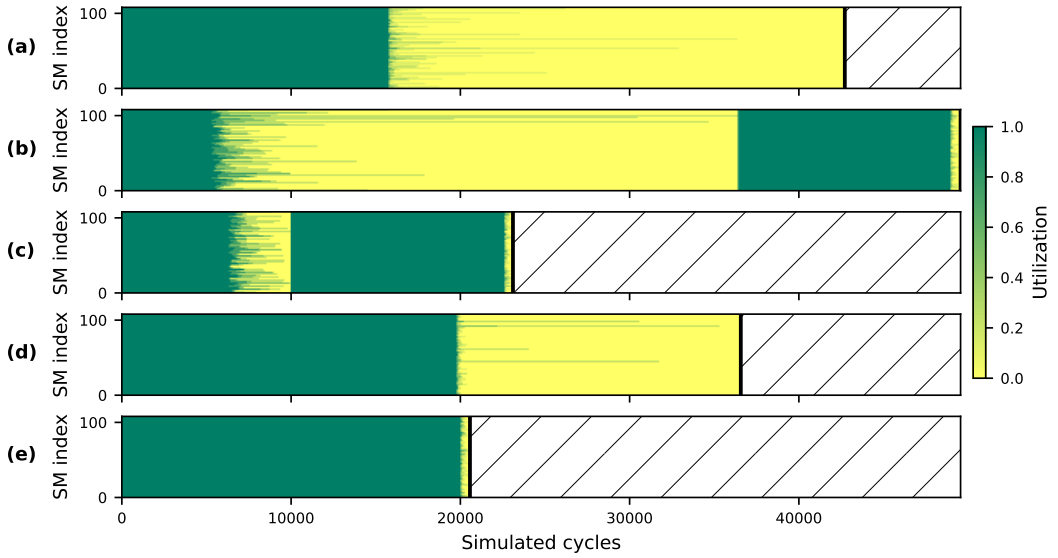

Figure 242: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}714$, $T/T^* = 1.211$ (critical path), 1.00×; (b) $T = 49{,}553$, $T/T^* = 1.404$ (critical path), 0.86×; (c) $T = 23{,}108$, $T/T^* = 1.154$ (slot), 1.85×; (d) $T = 36{,}569$, $T/T^* = 1.036$ (critical path), 1.17×; (e) $T = 20{,}567$, $T/T^* = 1.027$ (slot), 2.08×.

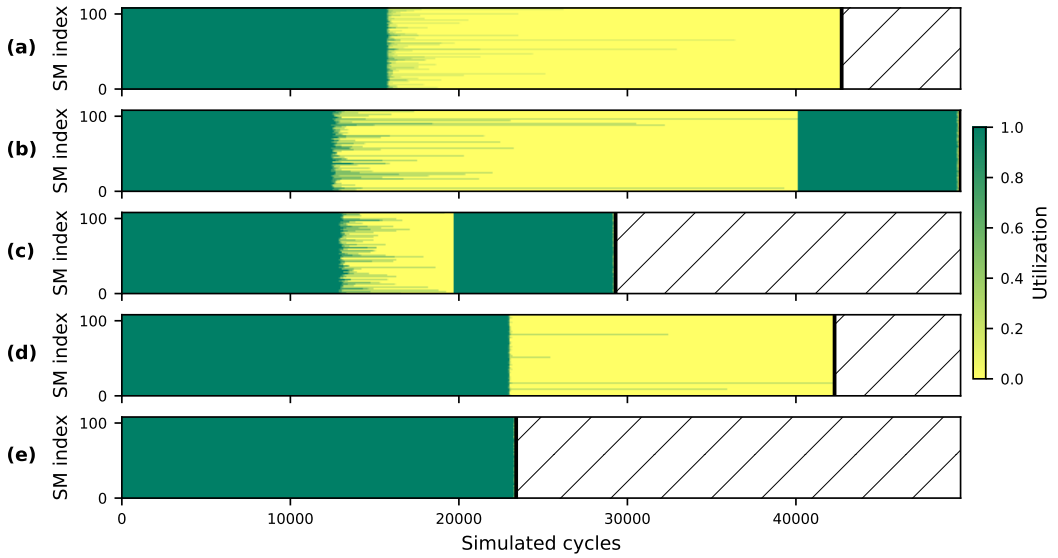

Figure 243: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}714$, $T/T^* = 1.211$ (critical path), 1.00×; (b) $T = 49{,}770$, $T/T^* = 1.411$ (critical path), 0.86×; (c) $T = 29{,}299$, $T/T^* = 1.263$ (slot), 1.46×; (d) $T = 42{,}293$, $T/T^* = 1.199$ (critical path), 1.01×; (e) $T = 23{,}399$, $T/T^* = 1.009$ (slot), 1.83×.

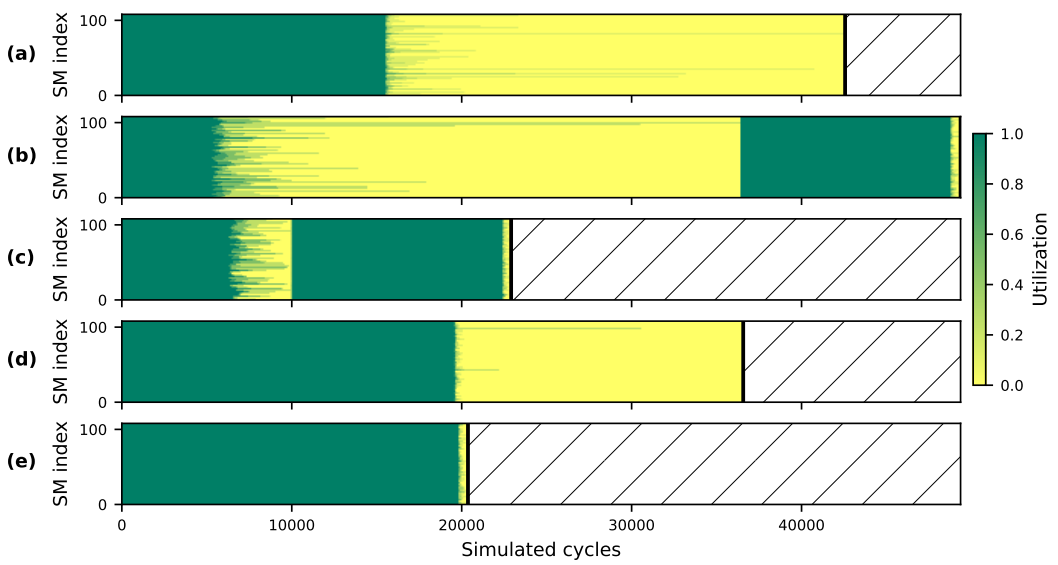

Figure 244: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}563$, $T/T^* = 1.206$ (critical path), 1.00×; (b) $T = 49{,}358$, $T/T^* = 1.399$ (critical path), 0.86×; (c) $T = 22{,}909$, $T/T^* = 1.155$ (slot), 1.86×; (d) $T = 36{,}567$, $T/T^* = 1.036$ (critical path), 1.16×; (e) $T = 20{,}369$, $T/T^* = 1.027$ (slot), 2.09×.

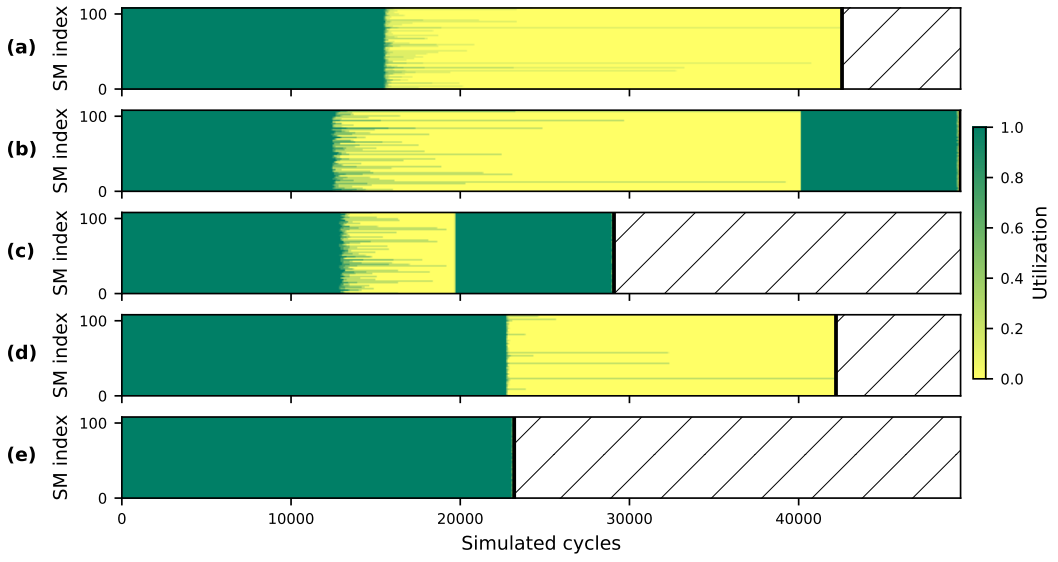

Figure 245: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}563$, $T/T^* = 1.206$ (critical path), 1.00×; (b) $T = 49{,}569$, $T/T^* = 1.405$ (critical path), 0.86×; (c) $T = 29{,}087$, $T/T^* = 1.265$ (slot), 1.46×; (d) $T = 42{,}207$, $T/T^* = 1.196$ (critical path), 1.01×; (e) $T = 23{,}188$, $T/T^* = 1.009$ (slot), 1.84×.

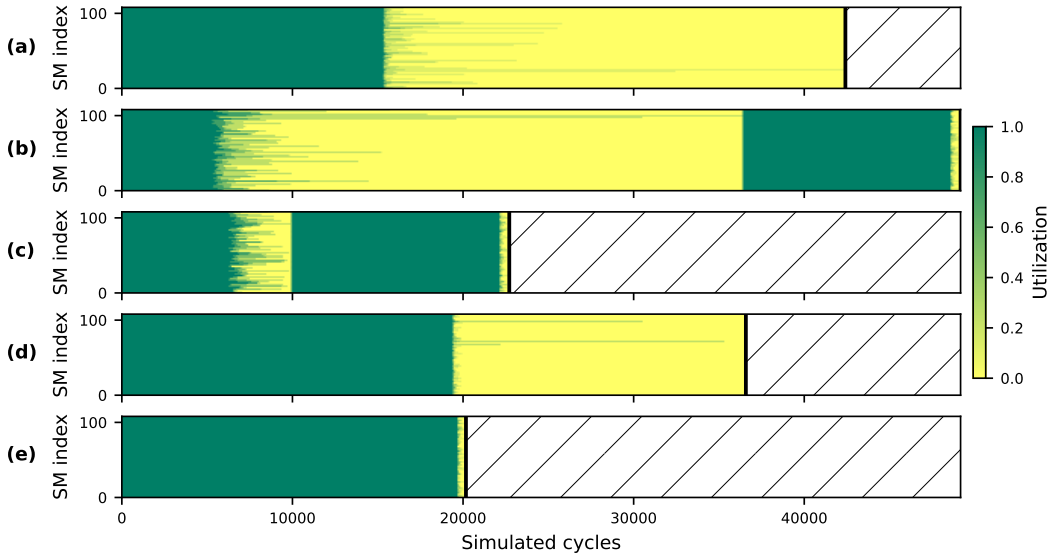

Figure 246: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}412$, $T/T^* = 1.202$ (critical path), 1.00×; (b) $T = 49{,}163$, $T/T^* = 1.394$ (critical path), 0.86×; (c) $T = 22{,}710$, $T/T^* = 1.157$ (slot), 1.87×; (d) $T = 36{,}578$, $T/T^* = 1.037$ (critical path), 1.16×; (e) $T = 20{,}170$, $T/T^* = 1.027$ (slot), 2.10×.

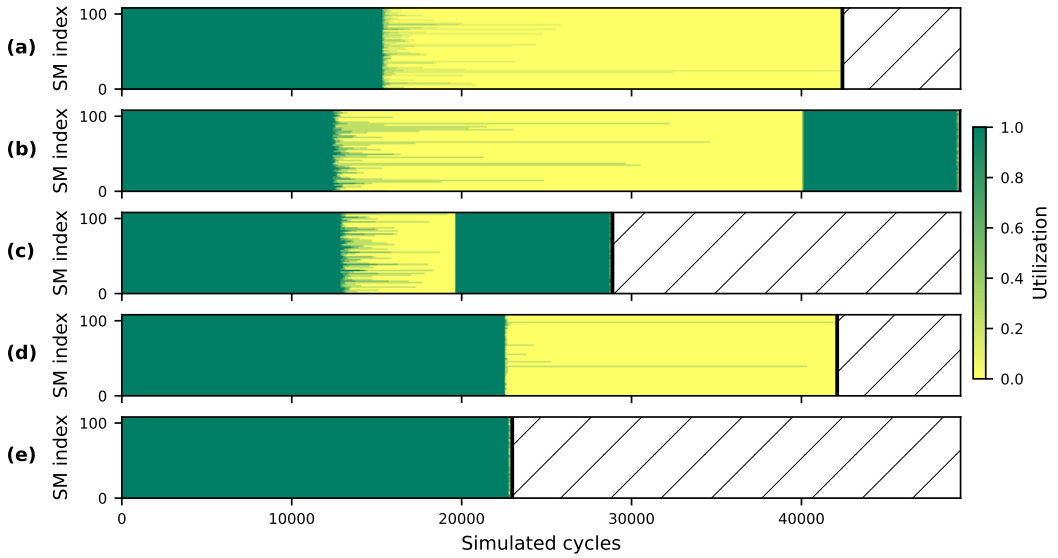

Figure 247: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}412$, $T/T^* = 1.202$ (critical path), 1.00×; (b) $T = 49{,}365$, $T/T^* = 1.399$ (critical path), 0.86×; (c) $T = 28{,}876$, $T/T^* = 1.267$ (slot), 1.47×; (d) $T = 42{,}103$, $T/T^* = 1.193$ (critical path), 1.01×; (e) $T = 22{,}978$, $T/T^* = 1.009$ (slot), 1.85×.

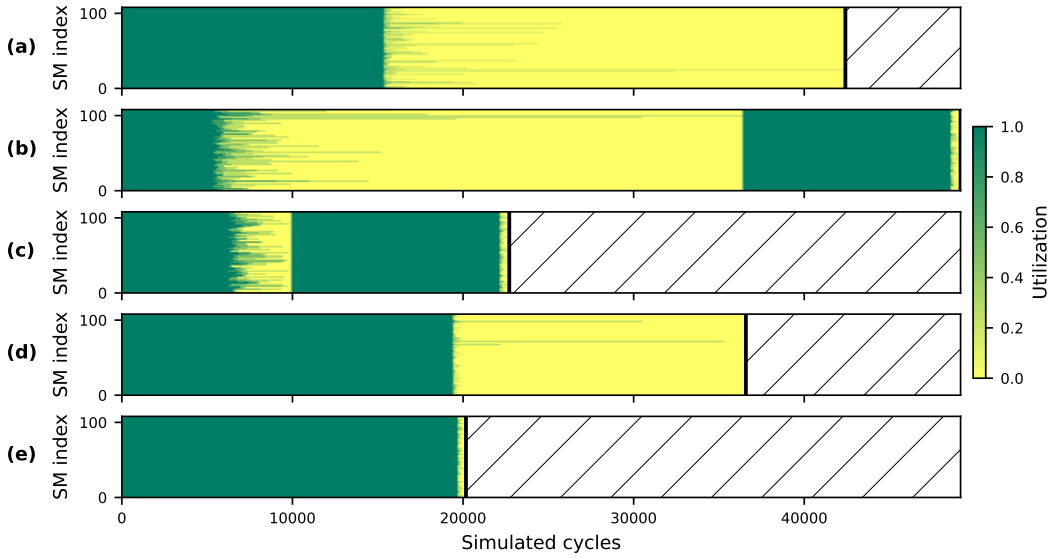

Figure 248: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}412$, $T/T^* = 1.202$ (critical path), 1.00×; (b) $T = 49{,}163$, $T/T^* = 1.394$ (critical path), 0.86×; (c) $T = 22{,}710$, $T/T^* = 1.157$ (slot), 1.87×; (d) $T = 36{,}578$, $T/T^* = 1.037$ (critical path), 1.16×; (e) $T = 20{,}170$, $T/T^* = 1.027$ (slot), 2.10×.

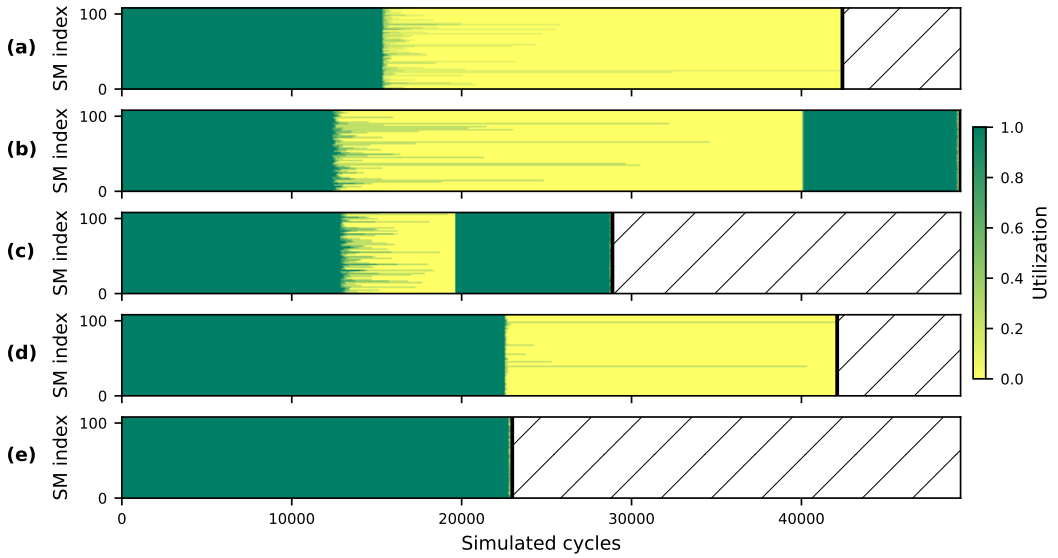

Figure 249: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}412$, $T/T^* = 1.202$ (critical path), 1.00×; (b) $T = 49{,}365$, $T/T^* = 1.399$ (critical path), 0.86×; (c) $T = 28{,}876$, $T/T^* = 1.267$ (slot), 1.47×; (d) $T = 42{,}103$, $T/T^* = 1.193$ (critical path), 1.01×; (e) $T = 22{,}978$, $T/T^* = 1.009$ (slot), 1.85×.

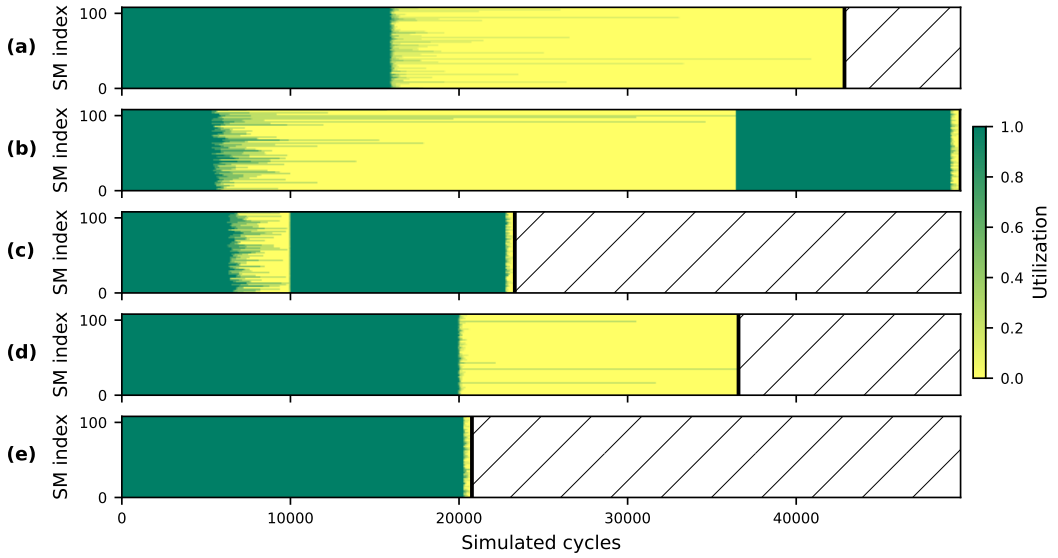

Figure 250: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}864$, $T/T^* = 1.215$ (critical path), $1.00\times$; (b) $T = 49{,}749$, $T/T^* = 1.410$ (critical path), $0.86\times$; (c) $T = 23{,}308$, $T/T^* = 1.152$ (slot), $1.84\times$; (d) $T = 36{,}578$, $T/T^* = 1.037$ (critical path), $1.17\times$; (e) $T = 20{,}766$, $T/T^* = 1.027$ (slot), $2.06\times$.

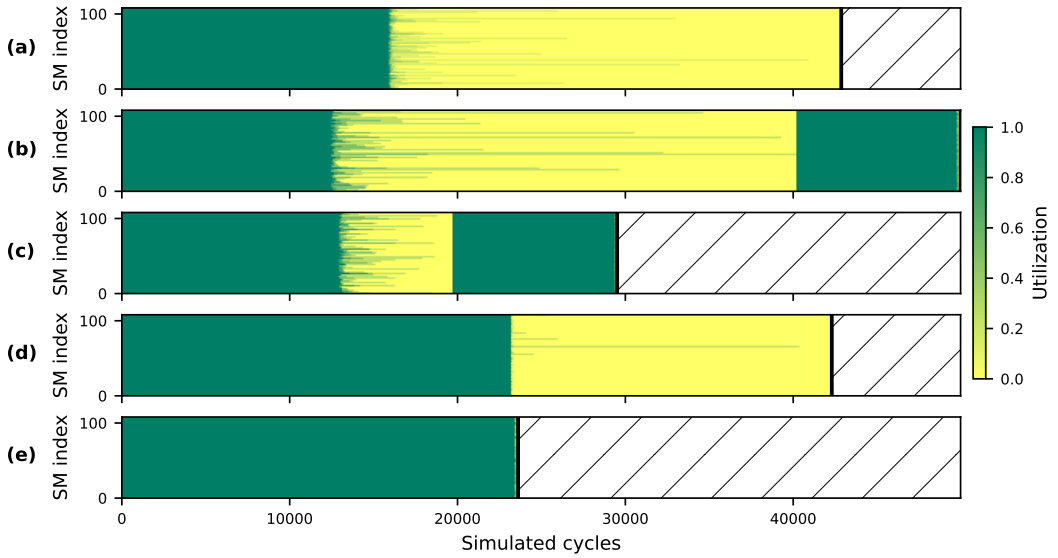

Figure 251: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}864$, $T/T^* = 1.215$ (critical path), $1.00\times$; (b) $T = 49{,}973$, $T/T^* = 1.416$ (critical path), $0.86\times$; (c) $T = 29{,}512$, $T/T^* = 1.261$ (slot), $1.45\times$; (d) $T = 42{,}300$, $T/T^* = 1.199$ (critical path), $1.01\times$; (e) $T = 23{,}609$, $T/T^* = 1.008$ (slot), $1.82\times$.

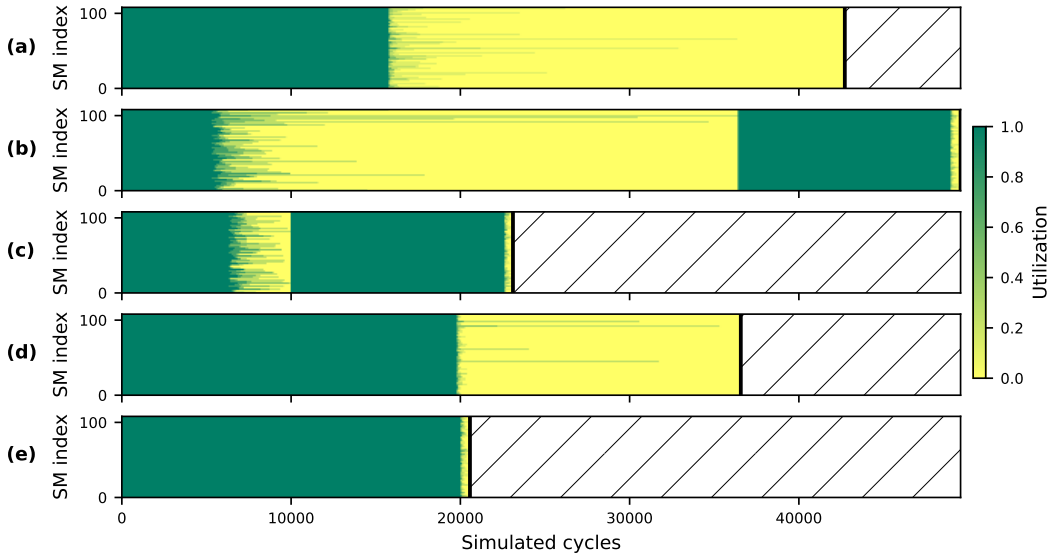

Figure 252: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}714$, $T/T^* = 1.211$ (critical path), $1.00\times$; (b) $T = 49{,}553$, $T/T^* = 1.404$ (critical path), $0.86\times$; (c) $T = 23{,}108$, $T/T^* = 1.154$ (slot), $1.85\times$; (d) $T = 36{,}569$, $T/T^* = 1.036$ (critical path), $1.17\times$; (e) $T = 20{,}567$, $T/T^* = 1.027$ (slot), $2.08\times$.

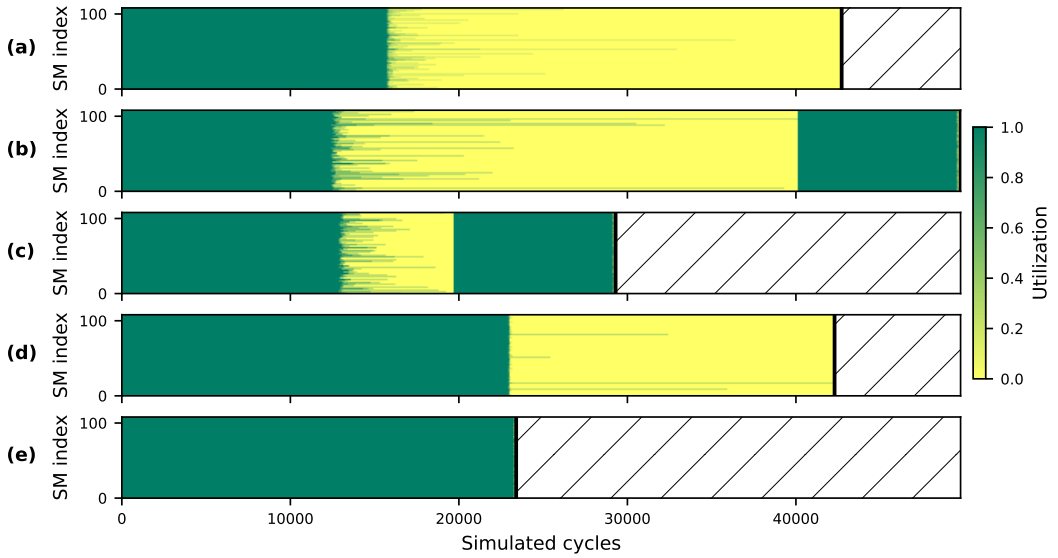

Figure 253: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 42{,}714$, $T/T^* = 1.211$ (critical path), $1.00\times$; (b) $T = 49{,}770$, $T/T^* = 1.411$ (critical path), $0.86\times$; (c) $T = 29{,}299$, $T/T^* = 1.263$ (slot), $1.46\times$; (d) $T = 42{,}293$, $T/T^* = 1.199$ (critical path), $1.01\times$; (e) $T = 23{,}399$, $T/T^* = 1.009$ (slot), $1.83\times$.

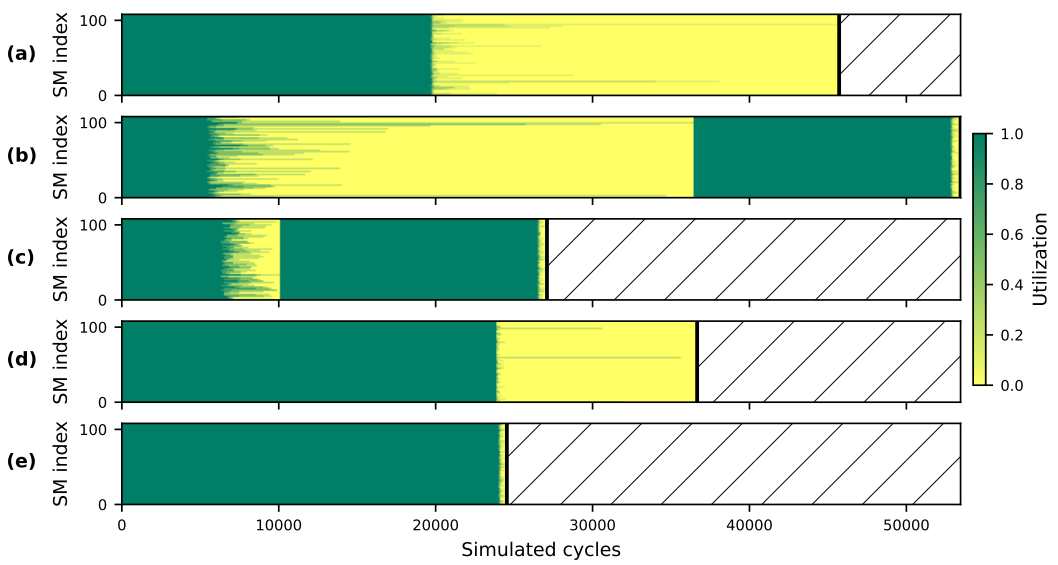

Figure 254: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 45{,}716$, $T/T^* = 1.295$ (critical path), $1.00\times$; (b) $T = 53{,}454$, $T/T^* = 1.514$ (critical path), $0.86\times$; (c) $T = 27{,}094$, $T/T^* = 1.129$ (slot), $1.69\times$; (d) $T = 36{,}665$, $T/T^* = 1.039$ (critical path), $1.25\times$; (e) $T = 24{,}537$, $T/T^* = 1.023$ (slot), $1.86\times$.

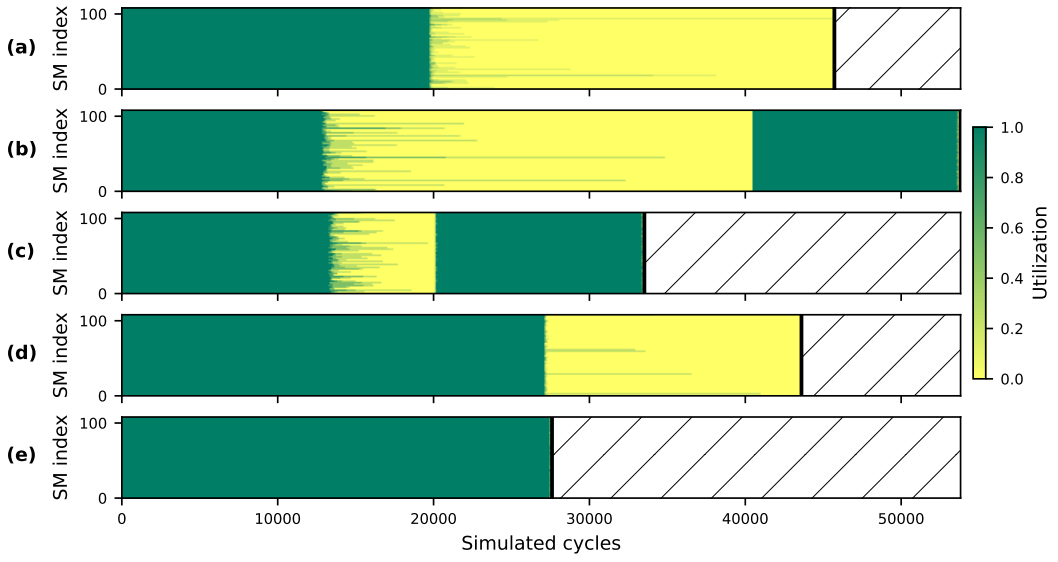

Figure 255: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 45{,}716$, $T/T^* = 1.295$ (critical path), $1.00\times$; (b) $T = 53{,}812$, $T/T^* = 1.524$ (critical path), $0.85\times$; (c) $T = 33{,}526$, $T/T^* = 1.224$ (slot), $1.36\times$; (d) $T = 43{,}604$, $T/T^* = 1.235$ (critical path), $1.05\times$; (e) $T = 27{,}600$, $T/T^* = 1.008$ (slot), $1.66\times$.

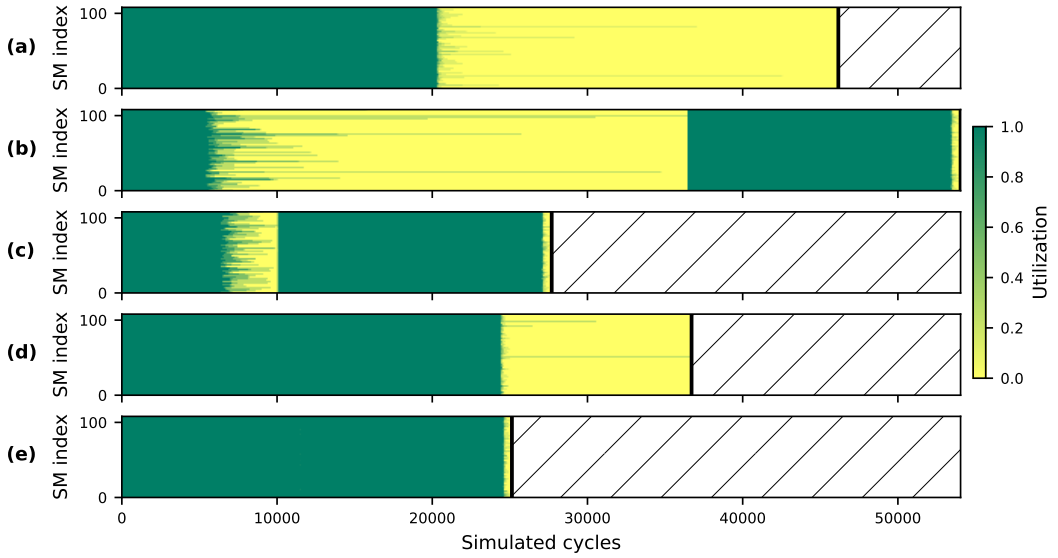

Figure 256: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 46{,}163$, $T/T^* = 1.308$ (critical path), $1.00\times$; (b) $T = 54{,}038$, $T/T^* = 1.531$ (critical path), $0.85\times$; (c) $T = 27{,}695$, $T/T^* = 1.127$ (slot), $1.67\times$; (d) $T = 36{,}706$, $T/T^* = 1.040$ (critical path), $1.26\times$; (e) $T = 25{,}132$, $T/T^* = 1.022$ (slot), $1.84\times$.

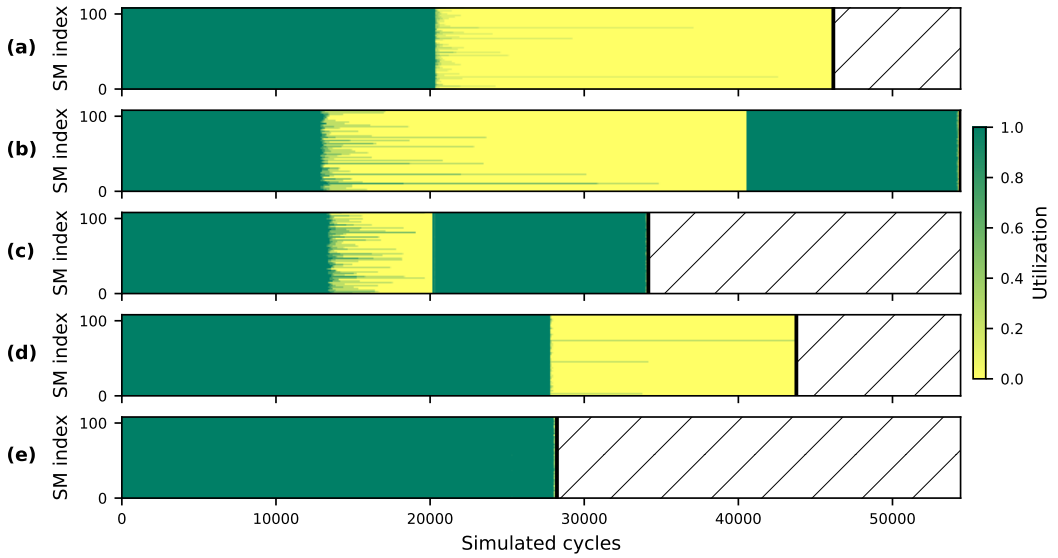

Figure 257: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew $431\times$), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 46{,}163$, $T/T^* = 1.308$ (critical path), $1.00\times$; (b) $T = 54{,}417$, $T/T^* = 1.541$ (critical path), $0.85\times$; (c) $T = 34{,}161$, $T/T^* = 1.219$ (slot), $1.35\times$; (d) $T = 43{,}764$, $T/T^* = 1.240$ (critical path), $1.05\times$; (e) $T = 28{,}230$, $T/T^* = 1.008$ (slot), $1.64\times$.

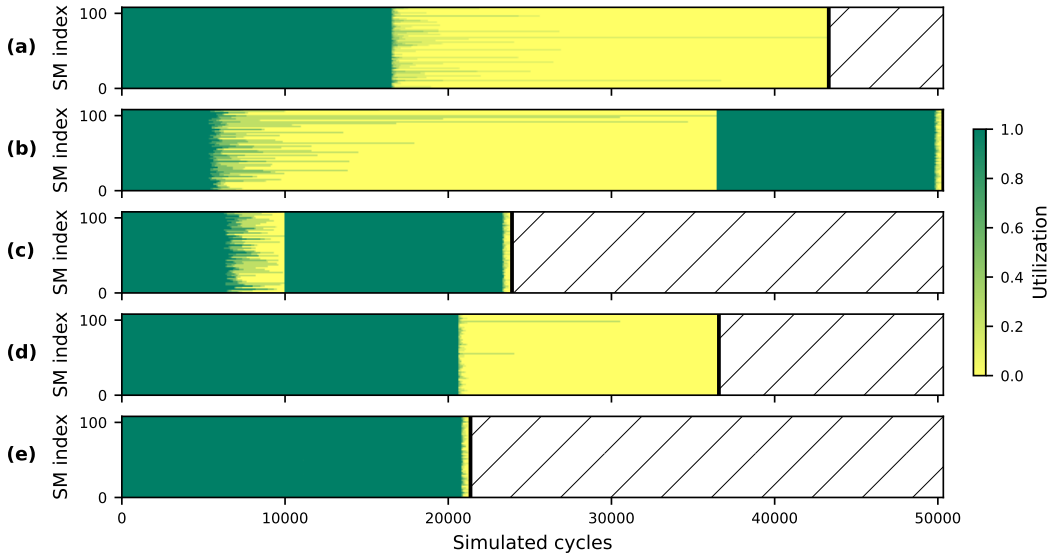

Figure 258: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}316$, $T/T^* = 1.228$ (critical path), 1.00×; (b) $T = 50{,}335$, $T/T^* = 1.426$ (critical path), 0.86×; (c) $T = 23{,}907$, $T/T^* = 1.148$ (slot), 1.81×; (d) $T = 36{,}585$, $T/T^* = 1.037$ (critical path), 1.18×; (e) $T = 21{,}363$, $T/T^* = 1.026$ (slot), 2.03×.

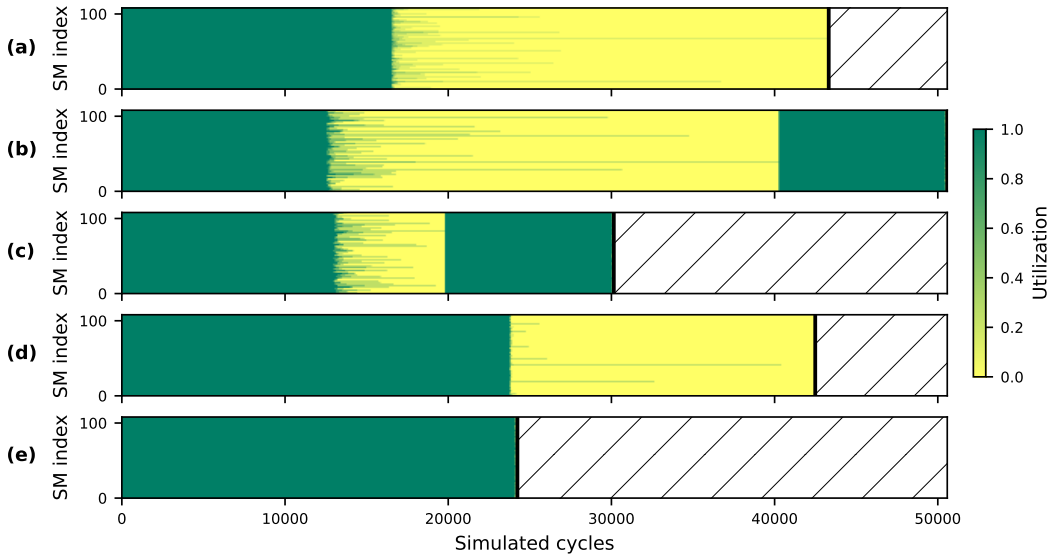

Figure 259: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}316$, $T/T^* = 1.228$ (critical path), 1.00×; (b) $T = 50{,}580$, $T/T^* = 1.433$ (critical path), 0.86×; (c) $T = 30{,}146$, $T/T^* = 1.254$ (slot), 1.44×; (d) $T = 42{,}490$, $T/T^* = 1.204$ (critical path), 1.02×; (e) $T = 24{,}239$, $T/T^* = 1.008$ (slot), 1.79×.

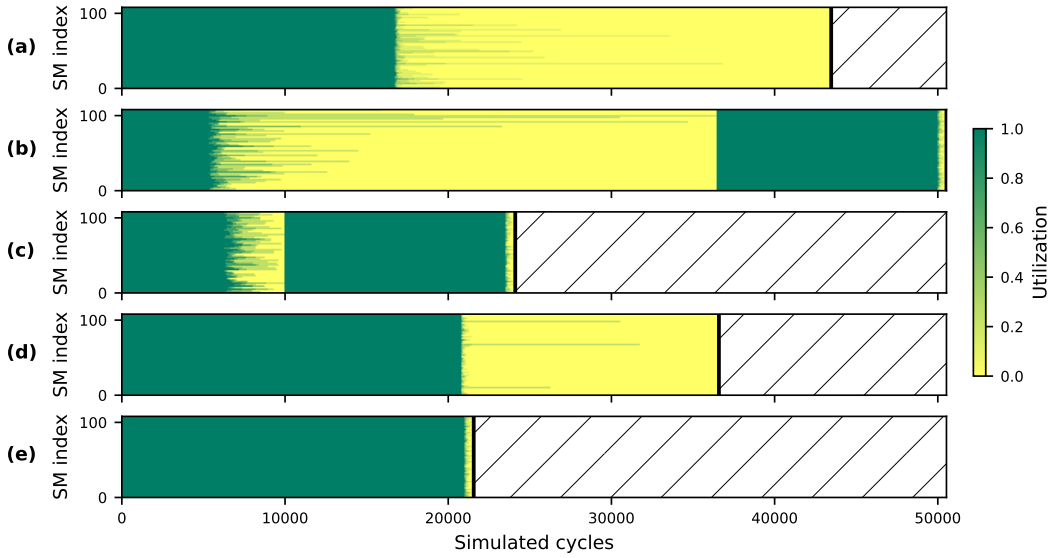

Figure 260: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (1,685 of them). Edge slices in (c) and (e) hold 3,701 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}467$, $T/T^* = 1.232$ (critical path), 1.00×; (b) $T = 50{,}530$, $T/T^* = 1.432$ (critical path), 0.86×; (c) $T = 24{,}107$, $T/T^* = 1.147$ (slot), 1.80×; (d) $T = 36{,}587$, $T/T^* = 1.037$ (critical path), 1.19×; (e) $T = 21{,}561$, $T/T^* = 1.026$ (slot), 2.02×.

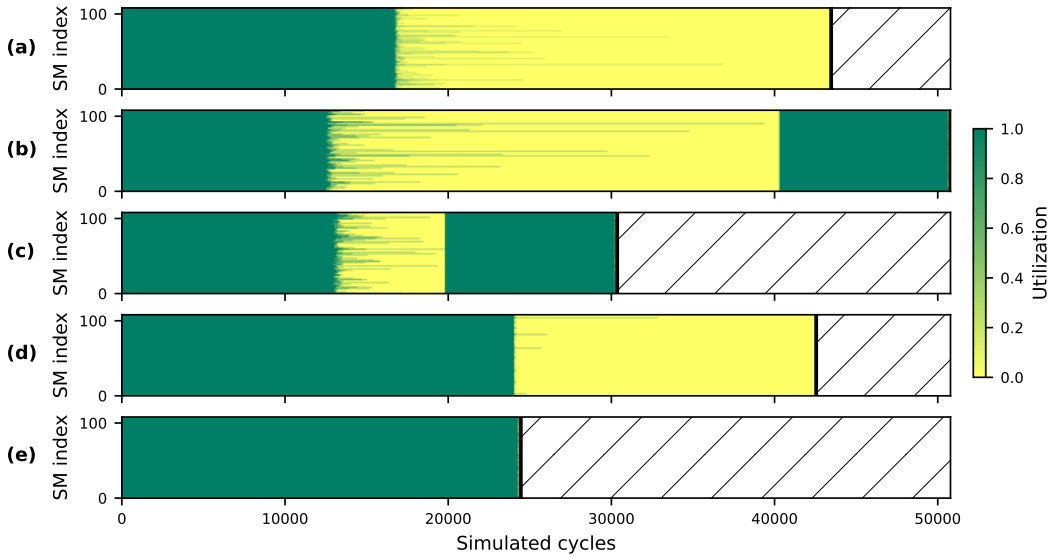

Figure 261: Per-SM occupancy over time for `twitch-views` ($N = 168{,}114$ vertices, $E = 13{,}763{,}228$ edges, mean degree 81.9, maximum degree 35,280, skew 431×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (8,408 of them). Edge slices in (c) and (e) hold 6,848 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 43{,}467$, $T/T^* = 1.232$ (critical path), 1.00×; (b) $T = 50{,}781$, $T/T^* = 1.439$ (critical path), 0.86×; (c) $T = 30{,}356$, $T/T^* = 1.252$ (slot), 1.43×; (d) $T = 42{,}551$, $T/T^* = 1.206$ (critical path), 1.02×; (e) $T = 24{,}449$, $T/T^* = 1.008$ (slot), 1.78×.

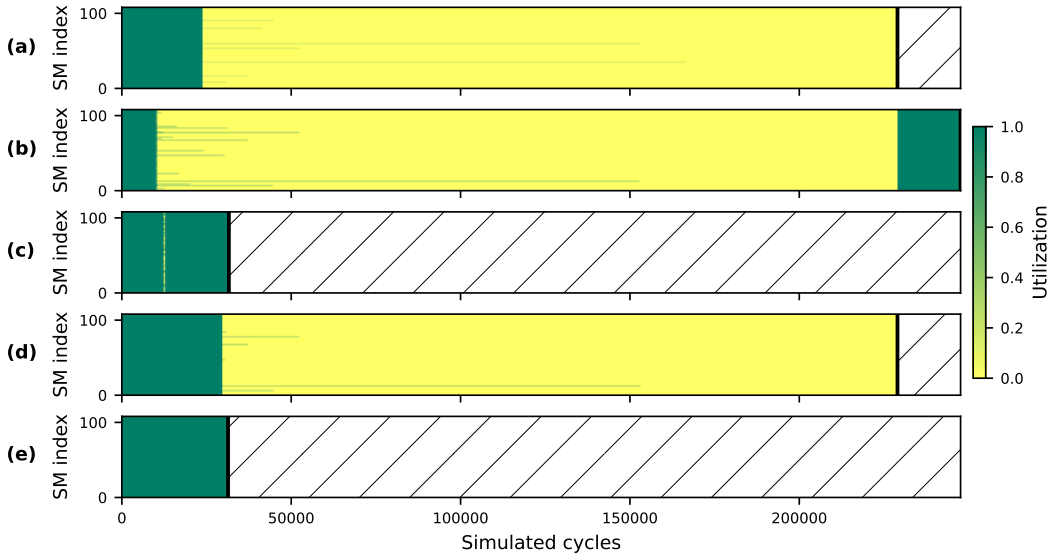

Figure 262: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 247{,}616$, $T/T^* = 1.081$ (critical path), $0.92\times$; (c) $T = 31{,}596$, $T/T^* = 1.008$ (slot), $7.25\times$; (d) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 31{,}357$, $T/T^* = 1.000$ (slot), $7.30\times$.

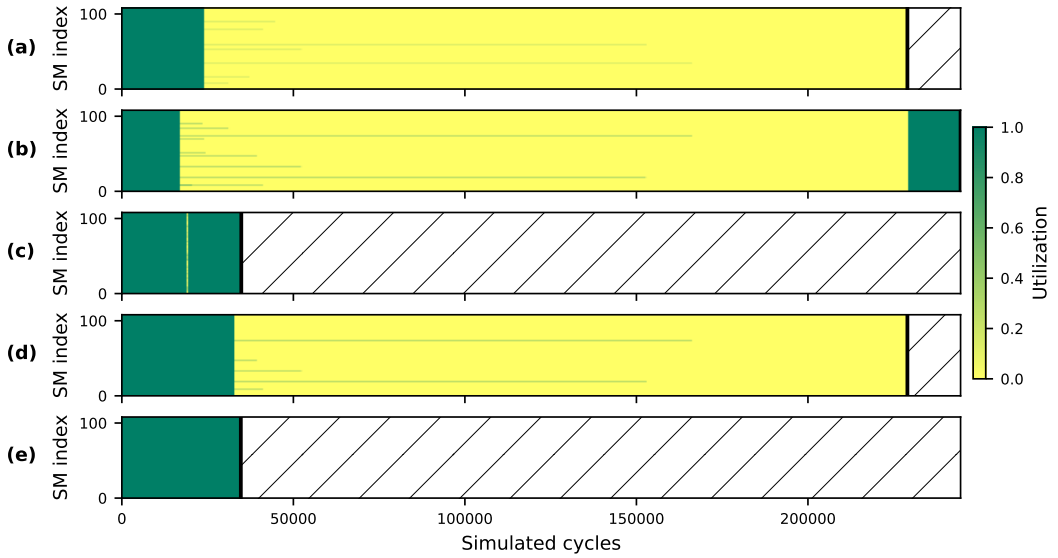

Figure 263: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel GATv2 forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 244{,}491$, $T/T^* = 1.068$ (critical path), $0.94\times$; (c) $T = 34{,}817$, $T/T^* = 1.004$ (slot), $6.58\times$; (d) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 34{,}681$, $T/T^* = 1.000$ (slot), $6.60\times$.

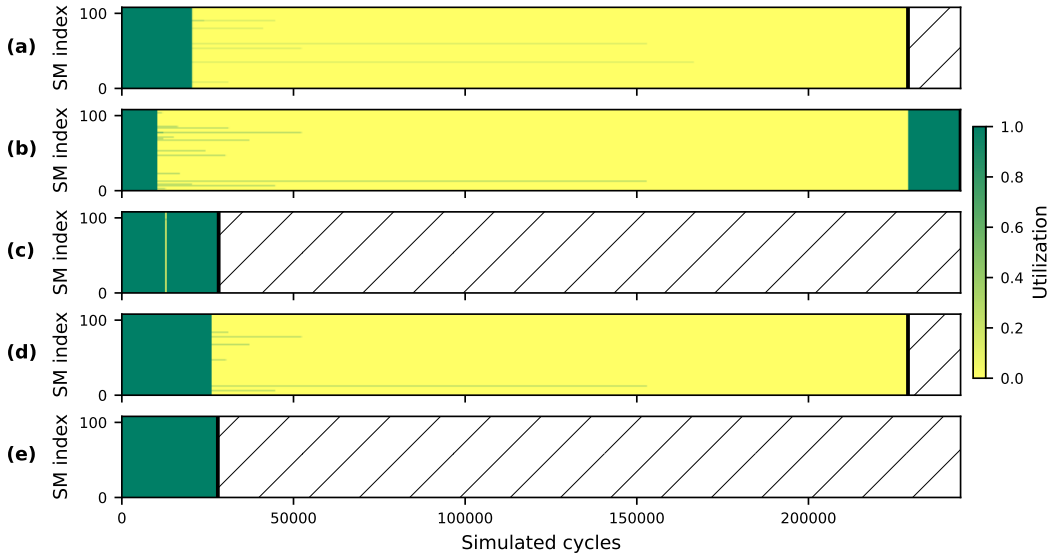

Figure 264: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}992$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 244{,}304$, $T/T^* = 1.067$ (critical path), $0.94\times$; (c) $T = 28{,}201$, $T/T^* = 1.009$ (slot), $8.12\times$; (d) $T = 228{,}992$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 27{,}959$, $T/T^* = 1.000$ (slot), $8.19\times$.

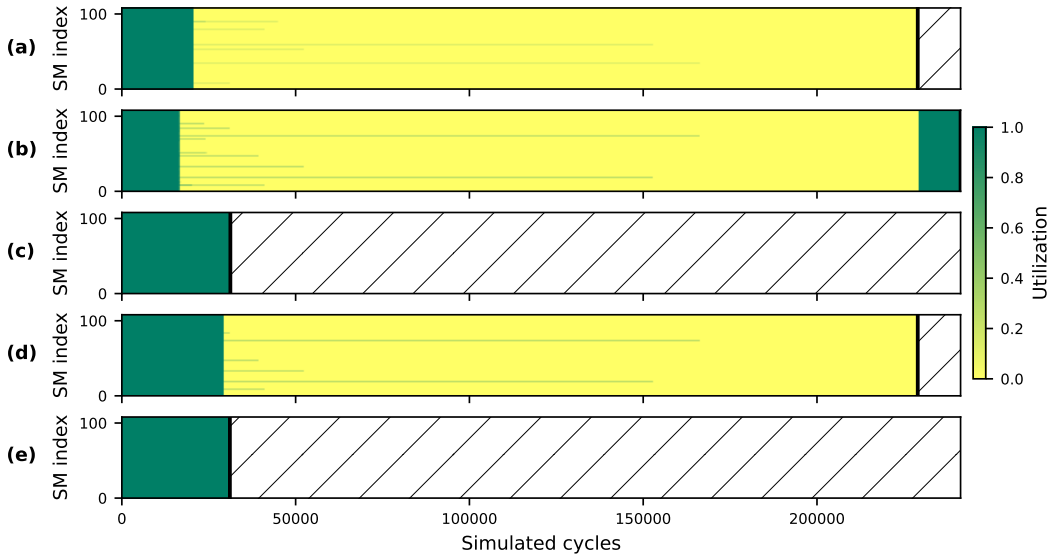

Figure 265: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel GATv2 forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}992$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 241{,}312$, $T/T^* = 1.054$ (critical path), $0.95\times$; (c) $T = 31{,}222$, $T/T^* = 1.005$ (slot), $7.33\times$; (d) $T = 228{,}992$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 31{,}084$, $T/T^* = 1.000$ (slot), $7.37\times$.

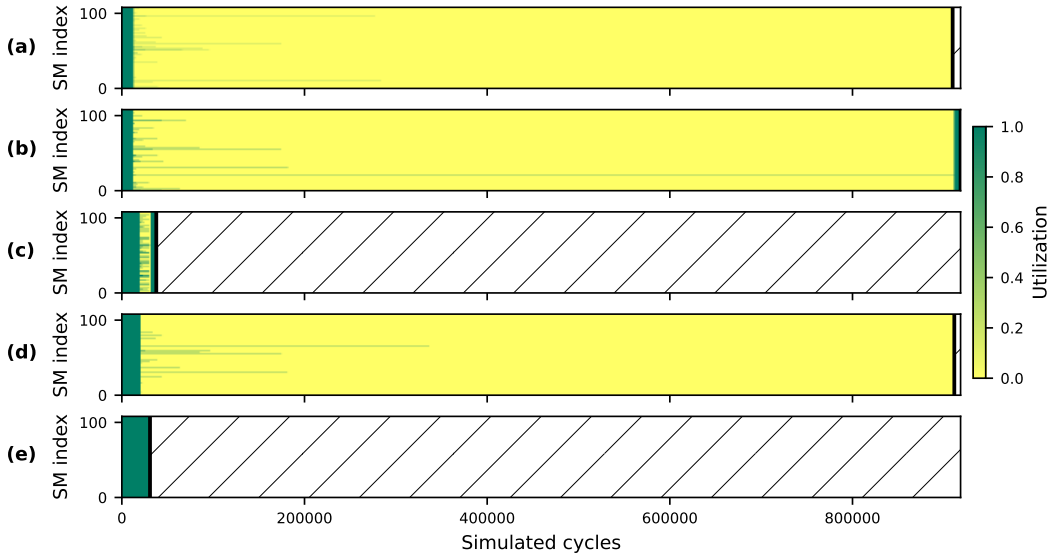

Figure 266: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,589 of them). Edge slices in (c) and (e) hold 11,041 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 909{,}647$, $T/T^* = 1.012$ (critical path), 1.00×; (b) $T = 918{,}319$, $T/T^* = 1.022$ (critical path), 0.99×; (c) $T = 37{,}706$, $T/T^* = 1.286$ (slot), 24.12×; (d) $T = 911{,}477$, $T/T^* = 1.014$ (critical path), 1.00×; (e) $T = 30{,}828$, $T/T^* = 1.051$ (slot), 29.51×.

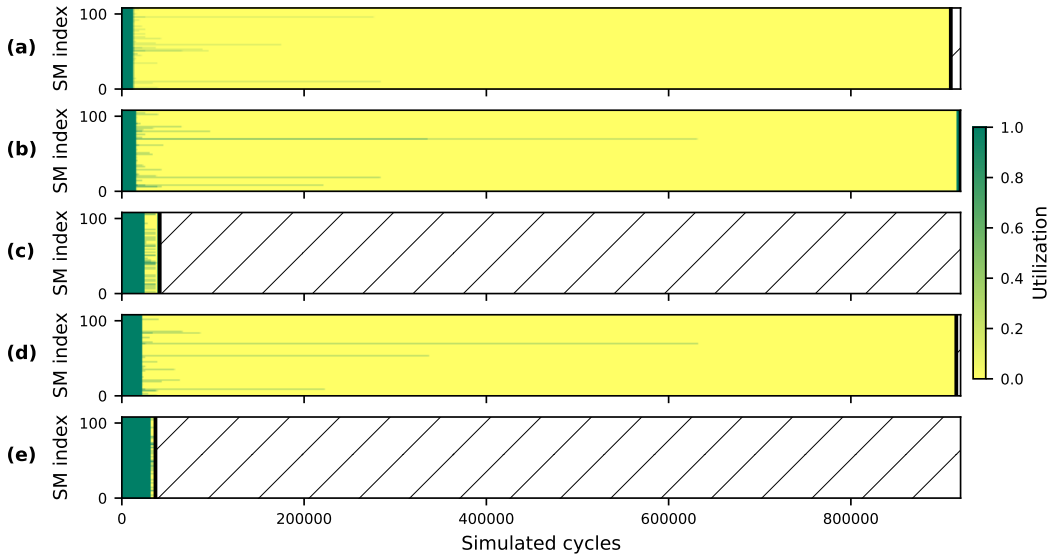

Figure 267: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel Graph Transformer backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (164,208 of them). Edge slices in (c) and (e) hold 12,953 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 909{,}647$, $T/T^* = 1.012$ (critical path), 1.00×; (b) $T = 920{,}367$, $T/T^* = 1.024$ (critical path), 0.99×; (c) $T = 41{,}548$, $T/T^* = 1.327$ (slot), 21.89×; (d) $T = 915{,}707$, $T/T^* = 1.019$ (critical path), 0.99×; (e) $T = 36{,}883$, $T/T^* = 1.178$ (slot), 24.66×.

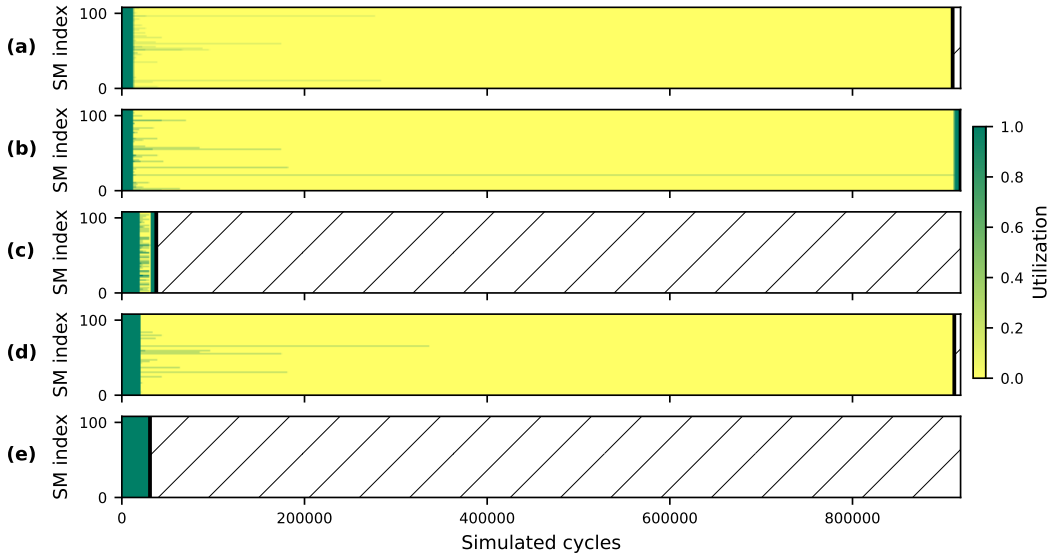

Figure 268: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,589 of them). Edge slices in (c) and (e) hold 11,041 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 909{,}647$, $T/T^* = 1.012$ (critical path), 1.00×; (b) $T = 918{,}319$, $T/T^* = 1.022$ (critical path), 0.99×; (c) $T = 37{,}706$, $T/T^* = 1.286$ (slot), 24.12×; (d) $T = 911{,}477$, $T/T^* = 1.014$ (critical path), 1.00×; (e) $T = 30{,}828$, $T/T^* = 1.051$ (slot), 29.51×.

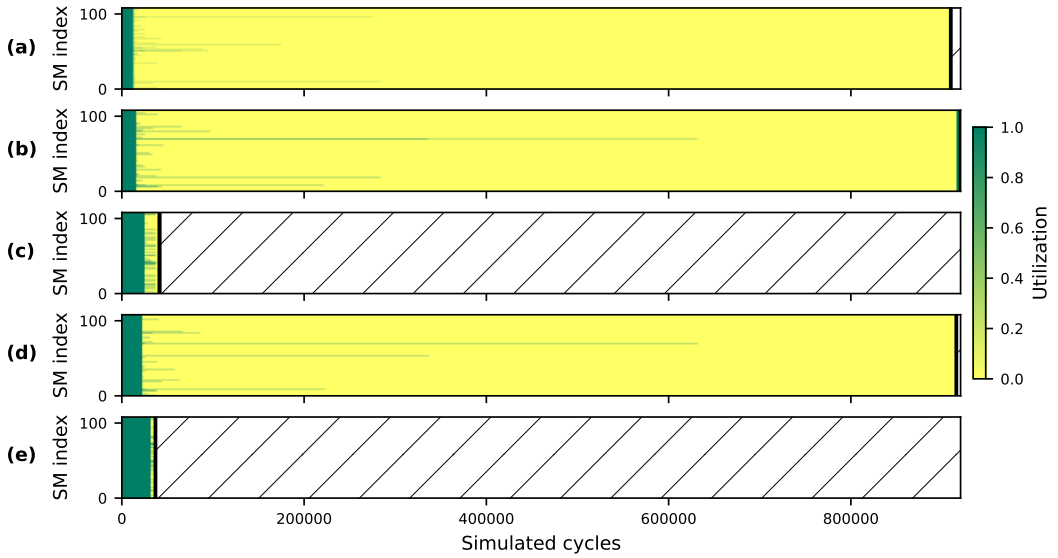

Figure 269: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel Graph Transformer backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (164,208 of them). Edge slices in (c) and (e) hold 12,953 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 909{,}647$, $T/T^* = 1.012$ (critical path), 1.00×; (b) $T = 920{,}367$, $T/T^* = 1.024$ (critical path), 0.99×; (c) $T = 41{,}548$, $T/T^* = 1.327$ (slot), 21.89×; (d) $T = 915{,}707$, $T/T^* = 1.019$ (critical path), 0.99×; (e) $T = 36{,}883$, $T/T^* = 1.178$ (slot), 24.66×.

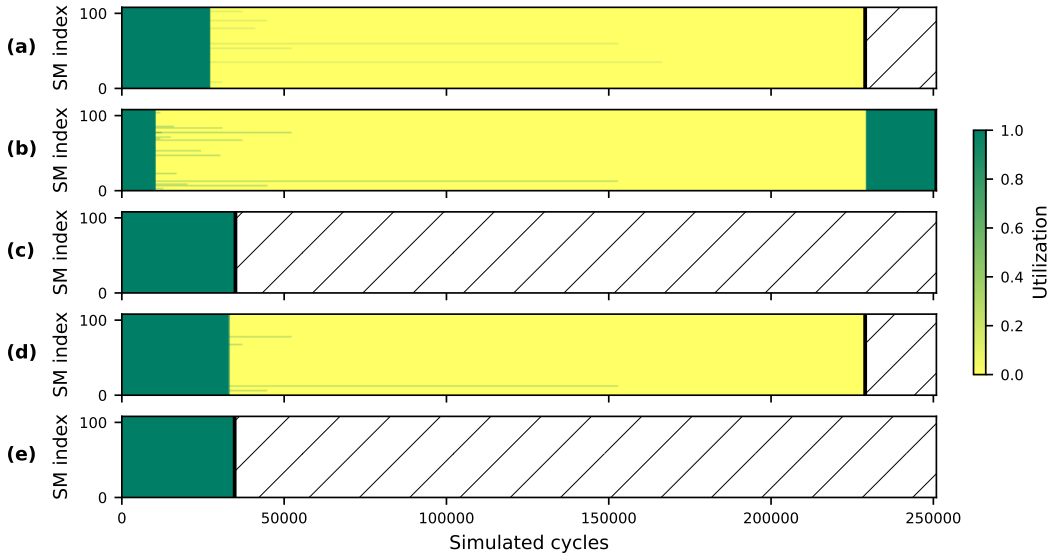

Figure 270: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}994$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 250{,}929$, $T/T^* = 1.096$ (critical path), $0.91\times$; (c) $T = 34{,}995$, $T/T^* = 1.007$ (slot), $6.54\times$; (d) $T = 228{,}994$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 34{,}754$, $T/T^* = 1.000$ (slot), $6.59\times$.

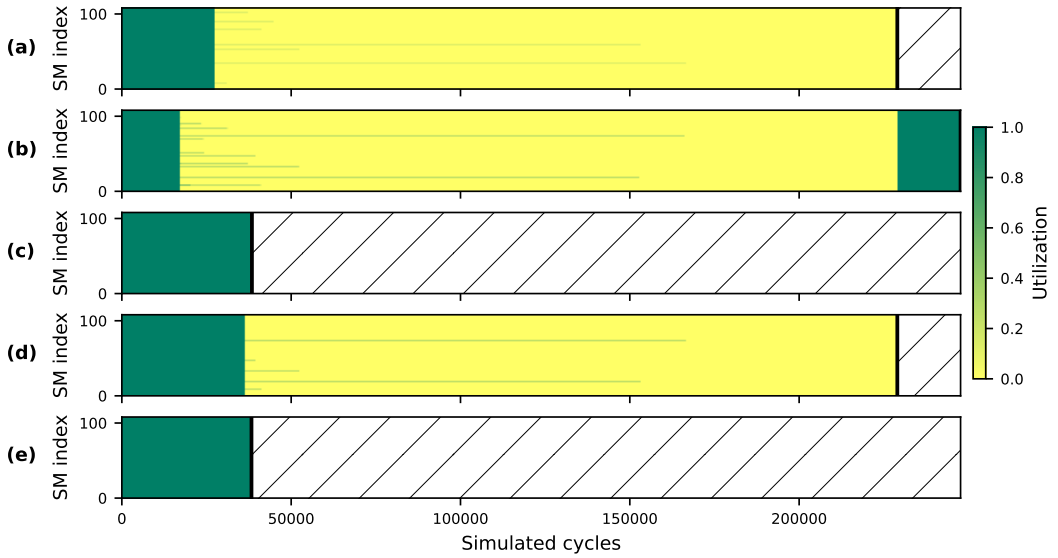

Figure 271: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel Graph Transformer forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}994$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 247{,}670$, $T/T^* = 1.082$ (critical path), $0.92\times$; (c) $T = 38{,}412$, $T/T^* = 1.004$ (slot), $5.96\times$; (d) $T = 228{,}994$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 38{,}278$, $T/T^* = 1.000$ (slot), $5.98\times$.

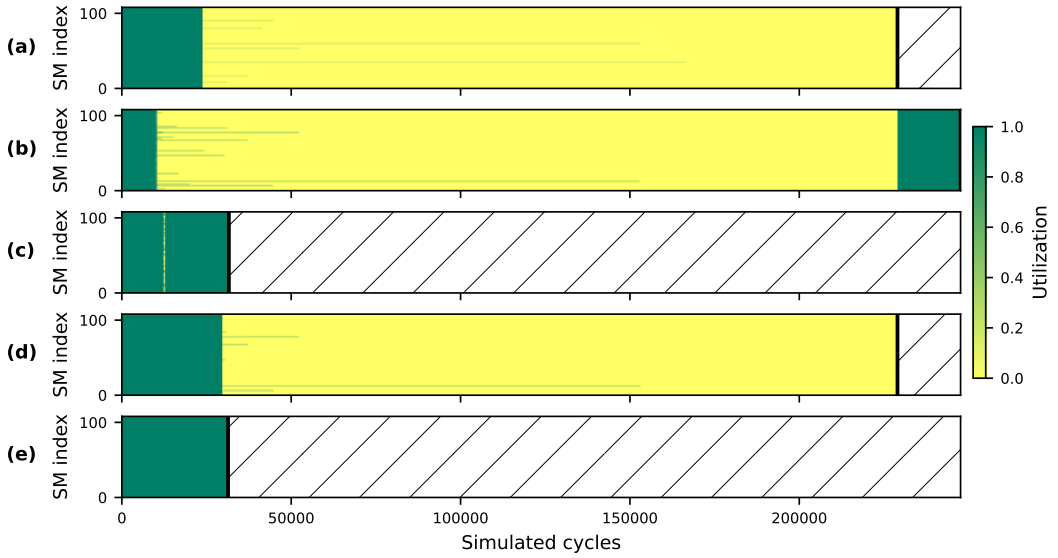

Figure 272: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 247{,}616$, $T/T^* = 1.081$ (critical path), $0.92\times$; (c) $T = 31{,}596$, $T/T^* = 1.008$ (slot), $7.25\times$; (d) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 31{,}357$, $T/T^* = 1.000$ (slot), $7.30\times$.

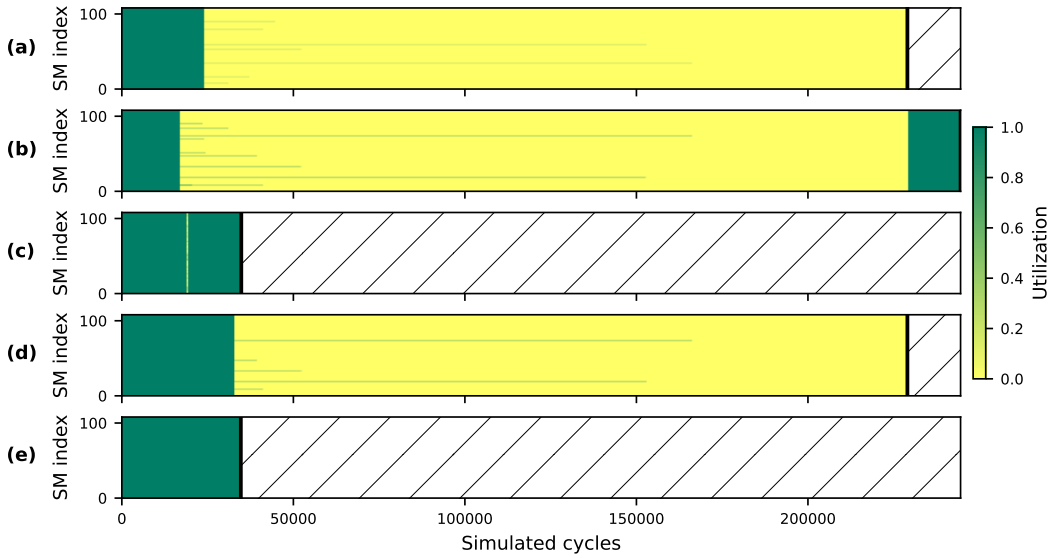

Figure 273: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew $41928\times$), kernel Graph Transformer forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (b) $T = 244{,}491$, $T/T^* = 1.068$ (critical path), $0.94\times$; (c) $T = 34{,}817$, $T/T^* = 1.004$ (slot), $6.58\times$; (d) $T = 228{,}993$, $T/T^* = 1.000$ (critical path), $1.00\times$; (e) $T = 34{,}681$, $T/T^* = 1.000$ (slot), $6.60\times$.

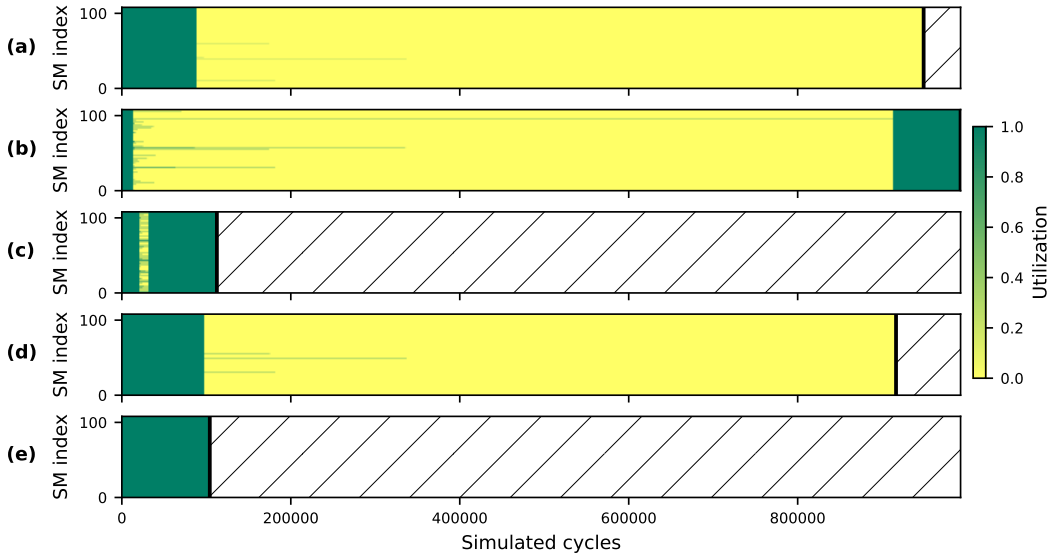

Figure 274: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,589 of them). Edge slices in (c) and (e) hold 11,041 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 949{,}116$, $T/T^* = 1.056$ (critical path), 1.00×; (b) $T = 992{,}836$, $T/T^* = 1.105$ (critical path), 0.96×; (c) $T = 112{,}488$, $T/T^* = 1.081$ (slot), 8.44×; (d) $T = 916{,}446$, $T/T^* = 1.020$ (critical path), 1.04×; (e) $T = 104{,}089$, $T/T^* = 1.000$ (slot), 9.12×.

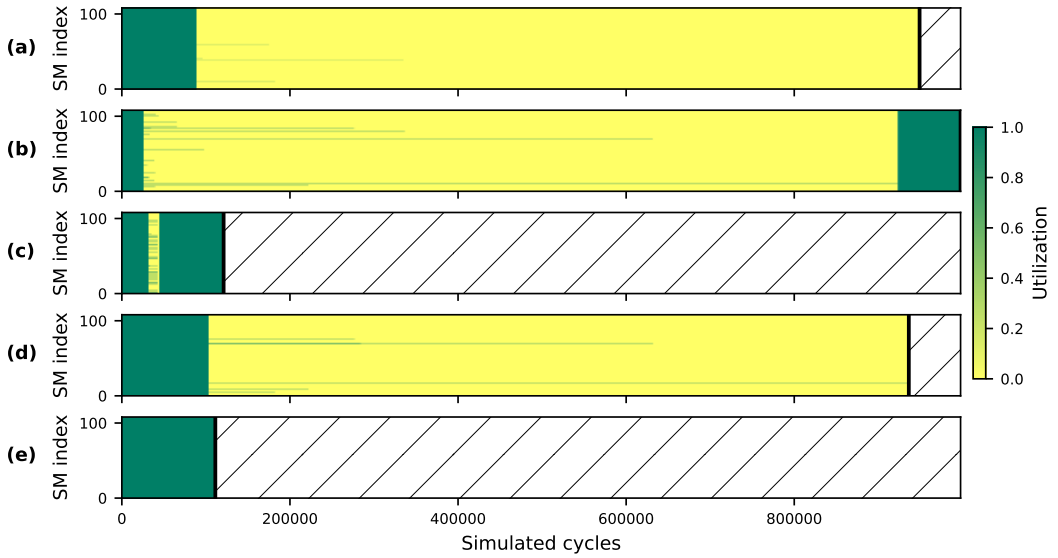

Figure 275: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel min-aggregation backward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (164,208 of them). Edge slices in (c) and (e) hold 12,953 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 949{,}116$, $T/T^* = 1.056$ (critical path), 1.00×; (b) $T = 997{,}882$, $T/T^* = 1.110$ (critical path), 0.95×; (c) $T = 121{,}072$, $T/T^* = 1.089$ (slot), 7.84×; (d) $T = 936{,}308$, $T/T^* = 1.042$ (critical path), 1.01×; (e) $T = 111{,}219$, $T/T^* = 1.000$ (slot), 8.53×.

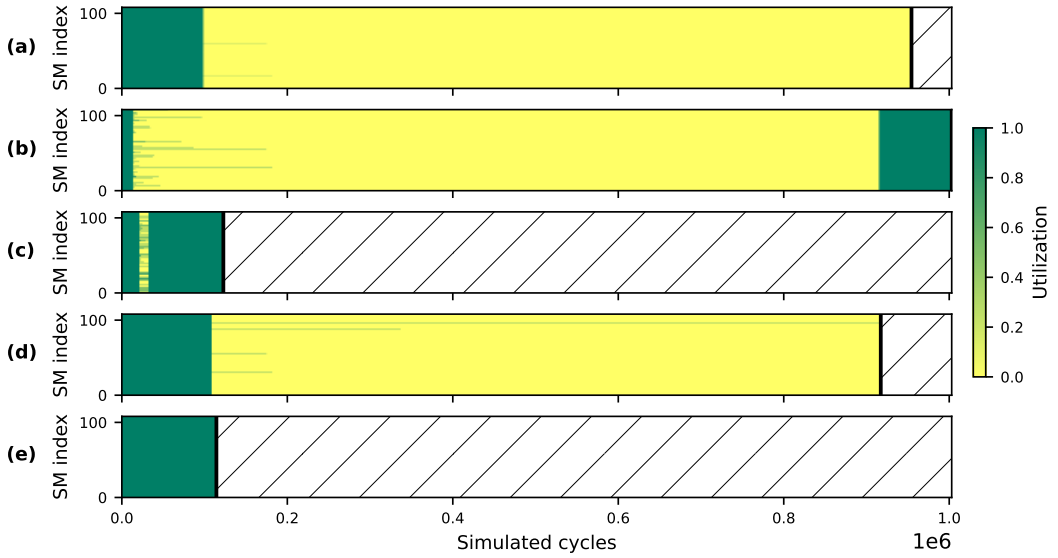

Figure 276: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,589 of them). Edge slices in (c) and (e) hold 11,041 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 954{,}388$, $T/T^* = 1.062$ (critical path), 1.00×; (b) $T = 1{,}002{,}996$, $T/T^* = 1.116$ (critical path), 0.95×; (c) $T = 122{,}683$, $T/T^* = 1.074$ (slot), 7.78×; (d) $T = 917{,}262$, $T/T^* = 1.021$ (critical path), 1.04×; (e) $T = 114{,}283$, $T/T^* = 1.000$ (slot), 8.35×.

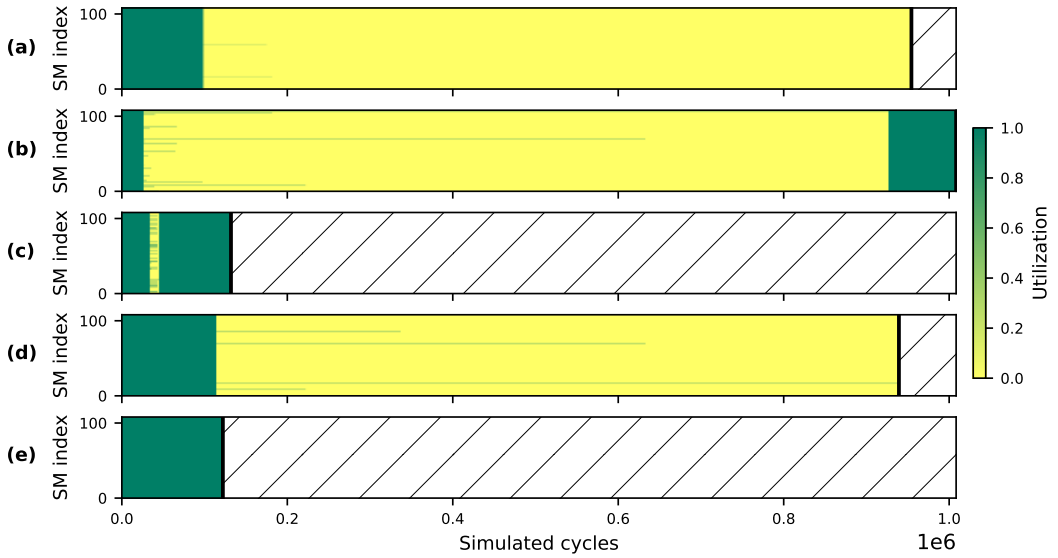

Figure 277: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 898,796, skew 164568×), kernel min-aggregation backward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (164,208 of them). Edge slices in (c) and (e) hold 12,953 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 954{,}388$, $T/T^* = 1.062$ (critical path), 1.00×; (b) $T = 1{,}008{,}423$, $T/T^* = 1.122$ (critical path), 0.95×; (c) $T = 131{,}917$, $T/T^* = 1.080$ (slot), 7.23×; (d) $T = 939{,}292$, $T/T^* = 1.045$ (critical path), 1.02×; (e) $T = 122{,}114$, $T/T^* = 1.000$ (slot), 7.82×.

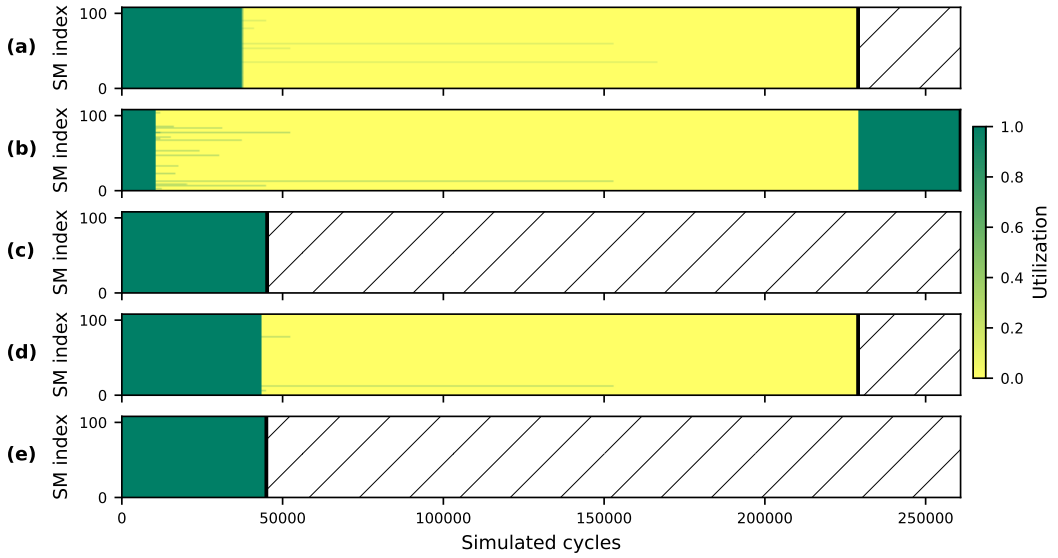

Figure 278: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew 41928×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}997$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 260{,}866$, $T/T^* = 1.139$ (critical path), 0.88×; (c) $T = 45{,}189$, $T/T^* = 1.005$ (slot), 5.07×; (d) $T = 228{,}997$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 44{,}947$, $T/T^* = 1.000$ (slot), 5.09×.

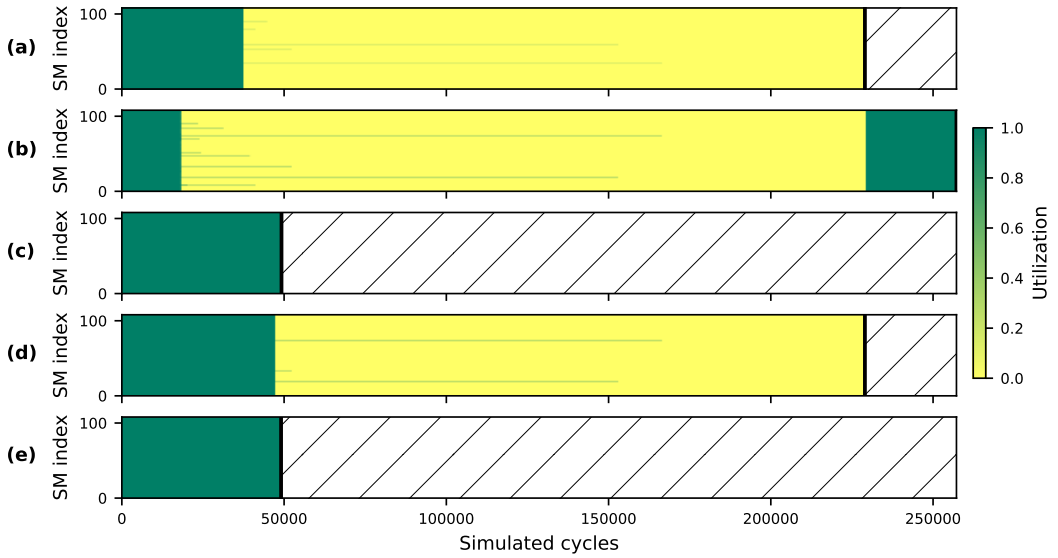

Figure 279: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew 41928×), kernel min-aggregation forward at $d = 128$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}997$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 257{,}208$, $T/T^* = 1.123$ (critical path), 0.89×; (c) $T = 49{,}199$, $T/T^* = 1.003$ (slot), 4.65×; (d) $T = 228{,}997$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 49{,}070$, $T/T^* = 1.000$ (slot), 4.67×.

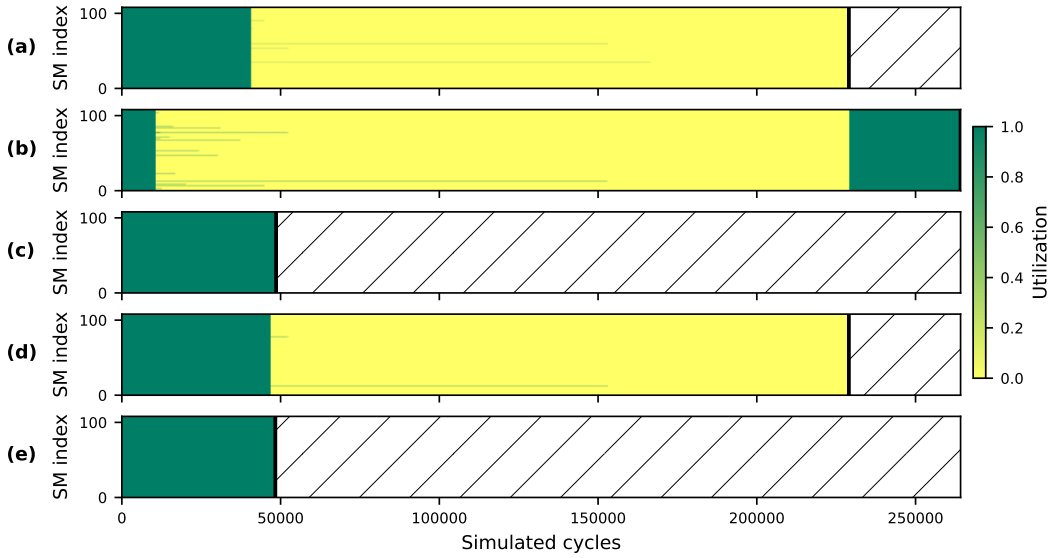

Figure 280: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew 41928×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 1% of vertices by degree (29,575 of them). Edge slices in (c) and (e) hold 6,272 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}998$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 264{,}179$, $T/T^* = 1.154$ (critical path), 0.87×; (c) $T = 48{,}588$, $T/T^* = 1.005$ (slot), 4.71×; (d) $T = 228{,}998$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 48{,}344$, $T/T^* = 1.000$ (slot), 4.74×.

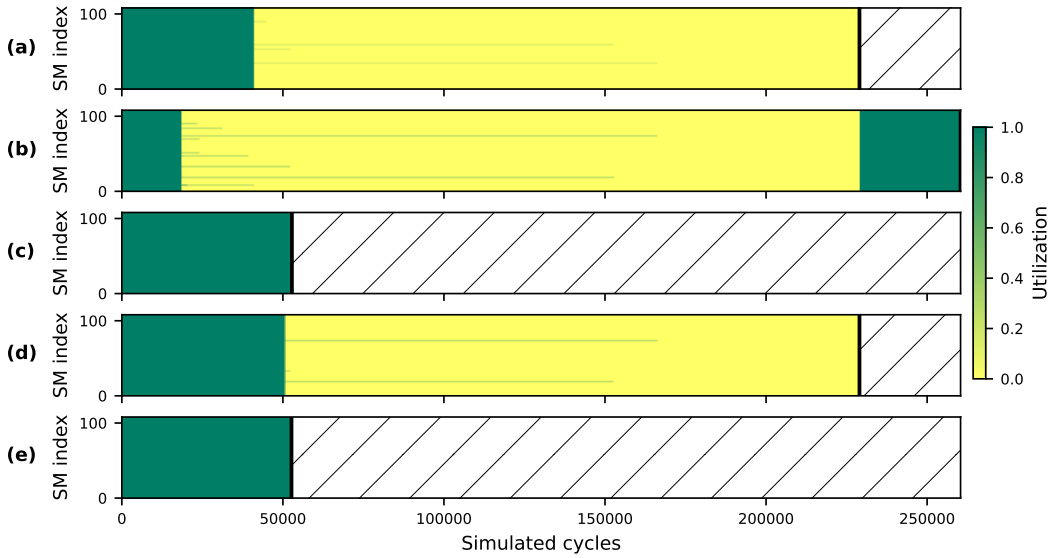

Figure 281: Per-SM occupancy over time for `web-fraud` ($N = 2{,}890{,}331$ vertices, $E = 15{,}785{,}700$ edges, mean degree 5.5, maximum degree 228,991, skew 41928×), kernel min-aggregation forward at $d = 256$, on 108 SMs. Utilization is the fraction of an SM's block slots that are occupied at that instant: 1 when every slot is busy, 0 when the SM stands idle. The heavy bucket is the top 5% of vertices by degree (144,700 of them). Edge slices in (c) and (e) hold 9,131 edges each. Per panel: the makespan T in simulated cycles, the ratio T/T^* with the bound that attains the maximum in brackets, and the speedup over (a). (a) $T = 228{,}998$, $T/T^* = 1.000$ (critical path), 1.00×; (b) $T = 260{,}387$, $T/T^* = 1.137$ (critical path), 0.88×; (c) $T = 52{,}794$, $T/T^* = 1.002$ (slot), 4.34×; (d) $T = 228{,}998$, $T/T^* = 1.000$ (critical path), 1.00×; (e) $T = 52{,}667$, $T/T^* = 1.000$ (slot), 4.35×.

J.1 SYNTHETIC WORKLOADS

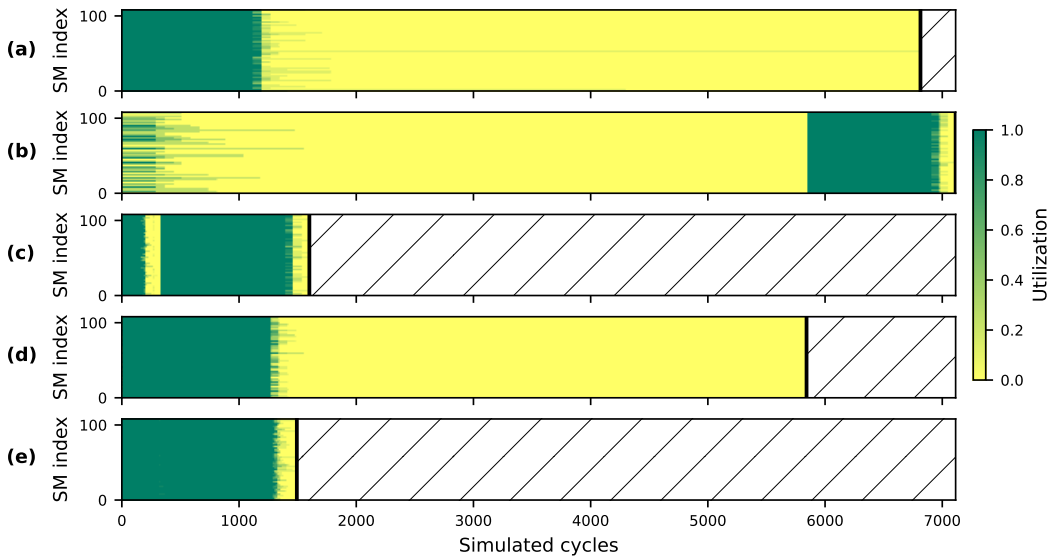

Figure 282: Simulated per-SM slot utilization for a synthetic workload with $N = 11{,}758$ vertices, GATv2 forward at head dimension 128 and degree quantile $q = 0.99$. Panels (a)–(e) use the scheduling configurations defined at the start of this appendix. The hatched region denotes time after a configuration has completed.

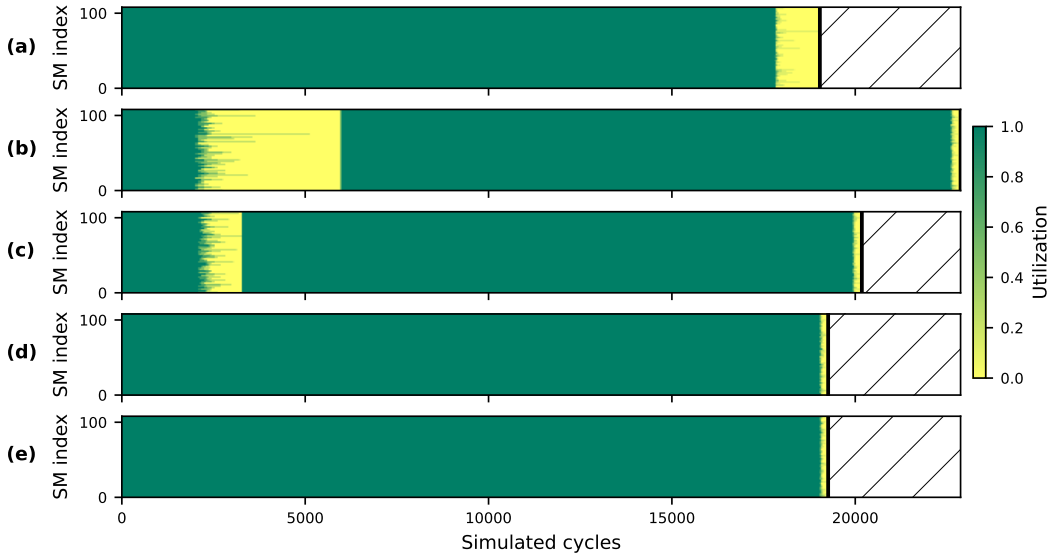

Figure 283: Simulated per-SM slot utilization for a synthetic workload with $N = 169{,}343$ vertices, Graph Transformer forward at head dimension 128 and degree quantile $q = 0.99$. Panels (a)–(e) use the scheduling configurations defined at the start of this appendix. The hatched region denotes time after a configuration has completed.

K COMPLETE MEASUREMENT TABLES

This section collects every full-size result table; the sections above refer to them by number.

K.1 PYG AND DGL BASELINE TIMINGS

Table 6: PyG and DGL timed in the same process at $d = 128$, fp16, for the PyG columns of Tables 2 and 3.

family	graph	op	pass	DGL (ms)	PyG (ms)
g-SpMM	citeseer	copy_u_sum	fwd	0.083	0.050
g-SpMM	citeseer	copy_u_sum	bwd	0.217	0.110
g-SpMM	citeseer	copy_u_max	fwd	0.126	0.137
g-SpMM	citeseer	copy_u_max	bwd	0.140	0.273
g-SpMM	citeseer	mul_sum	fwd	0.093	0.058
g-SpMM	citeseer	mul_sum	bwd	0.325	0.144
g-SpMM	cora	copy_u_sum	fwd	0.082	0.050
g-SpMM	cora	copy_u_sum	bwd	0.212	0.118
g-SpMM	cora	copy_u_max	fwd	0.129	0.196
g-SpMM	cora	copy_u_max	bwd	0.139	0.281
g-SpMM	cora	mul_sum	fwd	0.092	0.059
g-SpMM	cora	mul_sum	bwd	0.324	0.153
g-SpMM	pubmed	copy_u_sum	fwd	0.082	0.369
g-SpMM	pubmed	copy_u_sum	bwd	0.224	0.423
g-SpMM	pubmed	copy_u_max	fwd	0.128	1.050
g-SpMM	pubmed	copy_u_max	bwd	0.142	1.026
g-SpMM	pubmed	mul_sum	fwd	0.123	0.399
g-SpMM	pubmed	mul_sum	bwd	0.343	0.502
g-SpMM	city-roads-M	copy_u_sum	fwd	0.139	0.702
g-SpMM	city-roads-M	copy_u_sum	bwd	0.232	0.813
g-SpMM	city-roads-M	copy_u_max	fwd	0.250	0.956
g-SpMM	city-roads-M	copy_u_max	bwd	0.145	2.121
g-SpMM	city-roads-M	mul_sum	fwd	0.217	0.811
g-SpMM	city-roads-M	mul_sum	bwd	0.438	1.033
g-SpMM	city-roads-L	copy_u_sum	fwd	0.354	1.674
g-SpMM	city-roads-L	copy_u_sum	bwd	0.359	1.951
g-SpMM	city-roads-L	copy_u_max	fwd	0.589	2.215
g-SpMM	city-roads-L	copy_u_max	bwd	0.313	4.984
g-SpMM	city-roads-L	mul_sum	fwd	0.512	1.921
g-SpMM	city-roads-L	mul_sum	bwd	0.983	2.449
g-SpMM	artnet-exp	copy_u_sum	fwd	0.231	1.751
g-SpMM	artnet-exp	copy_u_sum	bwd	0.239	2.009
g-SpMM	artnet-exp	copy_u_max	fwd	0.348	2.562
g-SpMM	artnet-exp	copy_u_max	bwd	0.141	5.026
g-SpMM	artnet-exp	mul_sum	fwd	0.413	2.041
g-SpMM	artnet-exp	mul_sum	bwd	0.919	2.587
g-SpMM	tolokers-2	copy_u_sum	fwd	0.391	2.596
g-SpMM	tolokers-2	copy_u_sum	bwd	0.393	3.079
g-SpMM	tolokers-2	copy_u_max	fwd	0.437	3.393
g-SpMM	tolokers-2	copy_u_max	bwd	0.232	7.512
g-SpMM	tolokers-2	mul_sum	fwd	1.034	3.064
g-SpMM	tolokers-2	mul_sum	bwd	1.737	3.994
g-SpMM	ogbn-arxiv	copy_u_sum	fwd	3.129	4.159
g-SpMM	ogbn-arxiv	copy_u_sum	bwd	0.659	4.709
g-SpMM	ogbn-arxiv	copy_u_max	fwd	2.861	6.186
g-SpMM	ogbn-arxiv	copy_u_max	bwd	0.443	11.825
g-SpMM	ogbn-arxiv	mul_sum	fwd	4.654	4.813
g-SpMM	ogbn-arxiv	mul_sum	bwd	2.189	6.012
g-SpMM	city-reviews	copy_u_sum	fwd	1.969	7.135
g-SpMM	city-reviews	copy_u_sum	bwd	1.975	8.080
g-SpMM	city-reviews	copy_u_max	fwd	1.981	9.012
g-SpMM	city-reviews	copy_u_max	bwd	0.411	20.079
g-SpMM	city-reviews	mul_sum	fwd	2.885	8.271
g-SpMM	city-reviews	mul_sum	bwd	4.787	10.349
g-SpMM	twitch-views	copy_u_sum	fwd	9.771	37.551
g-SpMM	twitch-views	copy_u_sum	bwd	9.772	41.890
g-SpMM	twitch-views	copy_u_max	fwd	8.805	46.295
g-SpMM	twitch-views	copy_u_max	bwd	0.673	104.011
g-SpMM	web-fraud	copy_u_sum	fwd	77.328	64.983
g-SpMM	web-fraud	copy_u_sum	bwd	288.728	89.703
g-SpMM	web-fraud	copy_u_max	fwd	61.136	102.879
g-SpMM	web-fraud	copy_u_max	bwd	28.989	185.581
g-SpMM	hm-categories	copy_u_sum	fwd	6.921	67.193
g-SpMM	hm-categories	copy_u_sum	bwd	7.314	79.264
g-SpMM	hm-categories	copy_u_max	fwd	6.216	80.864
g-SpMM	hm-categories	copy_u_max	bwd	0.269	169.371

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family	graph	op	pass	DGL (ms)	PyG (ms)
g-SpMM	avazu-ctr	copy_u_sum	fwd	15.372	135.335
g-SpMM	avazu-ctr	copy_u_sum	bwd	15.301	78.571
g-SpMM	avazu-ctr	copy_u_max	fwd	12.345	90.979
g-SpMM	avazu-ctr	copy_u_max	bwd	59.229	173.231
g-SpMM	pokec-regions	copy_u_sum	fwd	12.596	117.655
g-SpMM	pokec-regions	copy_u_sum	bwd	12.633	128.072
g-SpMM	pokec-regions	copy_u_max	fwd	16.144	149.593
g-SpMM	pokec-regions	copy_u_max	bwd	7.583	288.710
g-SpMM	ogbn-proteins	copy_u_sum	fwd	16.433	382.679
g-SpMM	ogbn-proteins	copy_u_sum	bwd	16.433	306.893
g-SpMM	ogbn-proteins	copy_u_max	fwd	17.299	1587.323
g-SpMM	ogbn-proteins	copy_u_max	bwd	0.501	OOM
g-SpMM	ogbn-products	copy_u_sum	fwd	46.445	521.498
g-SpMM	ogbn-products	copy_u_sum	bwd	46.477	548.341
g-SpMM	ogbn-products	copy_u_max	fwd	52.656	1549.680
g-SpMM	ogbn-products	copy_u_max	bwd	21.278	OOM
g-SDDMM	cora	u_dot_v	fwd	0.075	0.069
g-SDDMM	cora	u_add_v	fwd	0.064	0.058
g-SDDMM	cora	u_mul_v	fwd	0.063	0.058
g-SDDMM	citeseer	u_dot_v	fwd	0.065	0.068
g-SDDMM	citeseer	u_add_v	fwd	0.062	0.058
g-SDDMM	citeseer	u_mul_v	fwd	0.062	0.058
g-SDDMM	pubmed	u_dot_v	fwd	0.065	0.527
g-SDDMM	pubmed	u_add_v	fwd	0.127	0.475
g-SDDMM	pubmed	u_mul_v	fwd	0.127	0.475
g-SDDMM	CoraFull	u_dot_v	fwd	0.064	0.675
g-SDDMM	CoraFull	u_add_v	fwd	0.157	0.611
g-SDDMM	CoraFull	u_mul_v	fwd	0.157	0.576
g-SDDMM	WikiCS	u_dot_v	fwd	0.127	1.657
g-SDDMM	WikiCS	u_add_v	fwd	0.336	1.501
g-SDDMM	WikiCS	u_mul_v	fwd	0.337	1.498
g-SDDMM	amazon-photo	u_dot_v	fwd	0.073	0.931
g-SDDMM	amazon-photo	u_add_v	fwd	0.200	0.841
g-SDDMM	amazon-photo	u_mul_v	fwd	0.198	0.841
g-SDDMM	amazon-computers	u_dot_v	fwd	0.145	1.898
g-SDDMM	amazon-computers	u_add_v	fwd	0.382	1.716
g-SDDMM	amazon-computers	u_mul_v	fwd	0.391	1.716
g-SDDMM	coauthor-cs	u_dot_v	fwd	0.065	0.753
g-SDDMM	coauthor-cs	u_add_v	fwd	0.169	0.684
g-SDDMM	coauthor-cs	u_mul_v	fwd	0.169	0.683
g-SDDMM	coauthor-physics	u_dot_v	fwd	0.180	2.117
g-SDDMM	coauthor-physics	u_add_v	fwd	0.447	1.921
g-SDDMM	coauthor-physics	u_mul_v	fwd	0.448	1.921
g-SDDMM	Flickr	u_dot_v	fwd	0.389	4.124
g-SDDMM	Flickr	u_add_v	fwd	0.848	3.754
g-SDDMM	Flickr	u_mul_v	fwd	0.849	3.749
g-SDDMM	city-roads-M	u_dot_v	fwd	0.104	0.968
g-SDDMM	city-roads-M	u_add_v	fwd	0.221	0.884
g-SDDMM	city-roads-M	u_mul_v	fwd	0.221	0.882
g-SDDMM	city-roads-L	u_dot_v	fwd	0.234	2.235
g-SDDMM	city-roads-L	u_add_v	fwd	0.483	2.040
g-SDDMM	city-roads-L	u_mul_v	fwd	0.482	2.039
g-SDDMM	artnet-exp	u_dot_v	fwd	0.221	2.487
g-SDDMM	artnet-exp	u_add_v	fwd	0.519	2.254
g-SDDMM	artnet-exp	u_mul_v	fwd	0.518	2.259
g-SDDMM	artnet-views	u_dot_v	fwd	0.221	2.493
g-SDDMM	artnet-views	u_add_v	fwd	0.518	2.256
g-SDDMM	artnet-views	u_mul_v	fwd	0.517	2.258
g-SDDMM	tolokers-2	u_dot_v	fwd	0.310	3.779
g-SDDMM	tolokers-2	u_add_v	fwd	0.718	3.411
g-SDDMM	tolokers-2	u_mul_v	fwd	0.723	3.412
g-SDDMM	ogbn-arxiv	u_dot_v	fwd	0.548	5.735
g-SDDMM	ogbn-arxiv	u_add_v	fwd	1.166	5.217
g-SDDMM	ogbn-arxiv	u_mul_v	fwd	1.165	5.218
g-SDDMM	web-topics	u_dot_v	fwd	7.066	99.441
g-SDDMM	web-topics	u_add_v	fwd	14.295	87.527
g-SDDMM	web-topics	u_mul_v	fwd	14.313	87.610
g-SDDMM	city-reviews	u_dot_v	fwd	0.938	10.088
g-SDDMM	city-reviews	u_add_v	fwd	1.959	9.076
g-SDDMM	city-reviews	u_mul_v	fwd	1.959	9.076
g-SDDMM	reddit	u_dot_v	fwd	39.082	OOM
g-SDDMM	reddit	u_add_v	fwd	82.278	OOM
g-SDDMM	reddit	u_mul_v	fwd	82.237	OOM
g-SDDMM	twitch-views	u_dot_v	fwd	4.806	56.656
g-SDDMM	twitch-views	u_add_v	fwd	9.908	47.455
g-SDDMM	twitch-views	u_mul_v	fwd	9.894	47.590
g-SDDMM	hm-categories	u_dot_v	fwd	6.403	109.532
g-SDDMM	hm-categories	u_add_v	fwd	13.971	95.761

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family	graph	op	pass	DGL (ms)	PyG (ms)
g-SDDMM	hm-categories	u_mul_v	fwd	13.963	95.829
g-SDDMM	hm-prices	u_dot_v	fwd	6.386	109.931
g-SDDMM	hm-prices	u_add_v	fwd	13.990	96.217
g-SDDMM	hm-prices	u_mul_v	fwd	13.985	96.357
g-SDDMM	avazu-ctr	u_dot_v	fwd	6.558	113.582
g-SDDMM	avazu-ctr	u_add_v	fwd	14.761	99.310
g-SDDMM	avazu-ctr	u_mul_v	fwd	14.772	99.343
g-SDDMM	pokec-regions	u_dot_v	fwd	12.906	184.158
g-SDDMM	pokec-regions	u_add_v	fwd	25.548	162.322
g-SDDMM	pokec-regions	u_mul_v	fwd	25.552	162.425
g-SDDMM	ogbn-products	u_dot_v	fwd	49.923	OOM
g-SDDMM	ogbn-products	u_add_v	fwd	96.412	OOM
g-SDDMM	ogbn-products	u_mul_v	fwd	96.372	OOM

K.2 Complete GATv2 ablation

Table 7: The complete GATv2 forward ablation: 16 graphs $\times$ heads $h \in \{2, 4, 8\}$ $\times$ total width $h\, d_h \in \{64, 128, 256\}$, fp16, milliseconds (median of 3 repeats; the split quantile tuned per graph). Each column enables one more technique, as in Table 1; *gain* is TurboGNN over the last column. OOM: the baseline exceeded 80 GB, or was not run at that setup. Columns are the techniques of Section 3: bucketing, ordering, concurrent launch, edge slicing and asynchronous staging.

graph	h	d_h	DGL	PyG	TurboGNN	+ bucketing	+ ordering	+ concurrent	+ edge slicing	+ async	gain
artnet-exp	2	32	3.032	4.165	0.403	0.378	0.302	0.302	0.302	0.295	1.36
avazu-ctr	2	32	103.620	145.699	23.972	8.482	8.371	6.507	6.507	6.507	3.68
citeseer	2	32	1.796	0.651	0.054	0.032	0.030	0.030	0.030	0.027	1.97
city-reviews	2	32	12.707	13.267	4.636	1.638	1.524	1.170	1.163	1.078	4.30
city-roads-L	2	32	2.558	2.297	0.442	0.442	0.413	0.413	0.410	0.393	1.13
city-roads-M	2	32	1.997	1.158	0.193	0.193	0.178	0.178	0.178	0.165	1.18
cora	2	32	1.696	0.659	0.079	0.035	0.034	0.034	0.034	0.029	2.68
hm-categories	2	32	92.724	132.924	15.375	7.608	6.789	6.551	6.551	6.551	2.35
ogbn-arxiv	2	32	12.714	7.856	6.459	1.694	1.534	1.152	0.852	0.751	8.60
ogbn-products	2	32	OOM	OOM	73.490	70.939	58.448	58.448	58.448	47.266	1.55
ogbn-proteins	2	32	260.871	OOM	28.497	27.693	25.148	25.148	25.148	25.148	1.13
pokec-regions	2	32	118.835	180.370	20.136	19.343	17.908	17.166	17.166	13.509	1.49
pubmed	2	32	1.823	0.777	0.139	0.107	0.093	0.088	0.088	0.078	1.78
tolokers-2	2	32	5.001	7.297	1.065	0.473	0.364	0.353	0.353	0.353	3.02
twitch-views	2	32	71.453	78.335	18.151	7.426	6.502	5.324	5.034	4.888	3.71
web-fraud	2	32	226.623	97.846	133.409	30.145	30.145	23.591	10.765	10.190	13.09
artnet-exp	2	64	4.147	5.546	0.451	0.429	0.340	0.340	0.340	0.338	1.33
avazu-ctr	2	64	137.138	188.990	26.460	9.475	9.174	7.159	7.159	7.159	3.70
citeseer	2	64	1.717	0.678	0.056	0.033	0.031	0.031	0.031	0.029	1.95
city-reviews	2	64	17.303	18.226	5.001	1.833	1.745	1.296	1.296	1.255	3.98
city-roads-L	2	64	3.644	3.362	0.469	0.469	0.450	0.442	0.438	0.418	1.12
city-roads-M	2	64	2.328	1.571	0.204	0.204	0.193	0.193	0.191	0.178	1.15
cora	2	64	1.719	0.671	0.082	0.036	0.035	0.035	0.035	0.031	2.69
hm-categories	2	64	127.708	175.819	16.220	8.591	7.920	7.419	7.419	7.419	2.19
ogbn-arxiv	2	64	17.053	11.407	6.857	1.907	1.841	1.427	0.956	0.873	7.85
ogbn-products	2	64	OOM	OOM	81.511	78.444	65.477	65.477	65.476	55.209	1.48
ogbn-proteins	2	64	OOM	OOM	32.403	31.343	30.015	30.015	30.015	30.015	1.08
pokec-regions	2	64	184.175	OOM	20.882	20.882	19.914	19.084	19.084	15.600	1.34
pubmed	2	64	1.963	1.042	0.151	0.118	0.102	0.092	0.092	0.089	1.69
tolokers-2	2	64	6.962	9.901	1.173	0.547	0.413	0.401	0.401	0.401	2.92
twitch-views	2	64	96.797	104.769	20.495	8.723	7.587	5.831	5.831	5.749	3.57
web-fraud	2	64	258.978	127.080	143.334	32.400	32.400	25.477	11.792	11.261	12.73
artnet-exp	2	128	6.544	9.269	0.578	0.542	0.431	0.431	0.430	0.409	1.41
avazu-ctr	2	128	OOM	OOM	35.321	12.536	11.950	10.325	10.325	10.325	3.42
citeseer	2	128	1.748	0.636	0.069	0.037	0.035	0.035	0.035	0.033	2.13
city-reviews	2	128	28.423	34.181	6.000	2.325	2.250	1.680	1.680	1.534	3.91
city-roads-L	2	128	5.902	5.934	0.535	0.535	0.517	0.502	0.497	0.495	1.08
city-roads-M	2	128	3.272	2.782	0.232	0.232	0.224	0.221	0.216	0.211	1.10
cora	2	128	1.668	0.672	0.103	0.043	0.040	0.040	0.040	0.035	2.95
hm-categories	2	128	OOM	OOM	21.716	12.013	11.284	10.578	10.578	10.578	2.05
ogbn-arxiv	2	128	21.473	18.829	9.086	2.431	2.380	1.794	1.200	1.073	8.47
ogbn-products	2	128	OOM	OOM	105.787	101.665	88.248	88.248	88.248	72.578	1.46
ogbn-proteins	2	128	OOM	OOM	45.036	43.470	42.251	42.251	42.243	40.166	1.12
pokec-regions	2	128	OOM	OOM	27.380	27.142	26.026	25.167	25.167	20.595	1.33
pubmed	2	128	2.370	1.720	0.190	0.144	0.123	0.109	0.109	0.104	1.82
tolokers-2	2	128	10.938	15.876	1.591	0.762	0.575	0.555	0.555	0.555	2.87
twitch-views	2	128	149.390	OOM	27.621	11.737	10.019	7.880	7.880	7.152	3.86
web-fraud	2	128	326.356	OOM	169.721	39.450	39.441	30.518	14.375	13.667	12.42
artnet-exp	4	16	4.476	5.963	0.749	0.715	0.583	0.583	0.583	0.578	1.30
avazu-ctr	4	16	167.345	233.207	31.576	15.902	15.011	12.808	12.808	12.808	2.47
citeseer	4	16	1.730	0.758	0.064	0.042	0.041	0.041	0.041	0.037	1.75
city-reviews	4	16	18.613	21.162	6.076	3.070	2.679	2.328	2.325	2.155	2.82
city-roads-L	4	16	3.920	3.829	0.872	0.872	0.823	0.815	0.813	0.775	1.12
city-roads-M	4	16	2.423	1.814	0.367	0.367	0.339	0.339	0.339	0.315	1.17
cora	4	16	1.725	0.708	0.088	0.045	0.043	0.043	0.043	0.038	2.31
hm-categories	4	16	154.606	213.721	21.546	14.873	13.169	12.458	12.458	12.458	1.73

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graph	h	d_h	DGL	PyG	TurboGNN	+ bucketing	+ ordering	+ concurrent	+ edge slicing	+ async	gain
ogbn-arxiv	4	16	17.656	12.572	7.484	2.647	2.452	1.855	1.701	1.507	4.96
ogbn-products	4	16	OOM	OOM	144.534	141.479	116.986	116.976	116.976	94.524	1.53
ogbn-proteins	4	16	OOM	OOM	55.458	54.662	50.811	50.811	50.811	50.811	1.09
pokec-regions	4	16	223.719	OOM	37.466	37.466	35.135	34.366	34.366	27.042	1.39
pubmed	4	16	2.012	1.144	0.224	0.188	0.167	0.161	0.161	0.146	1.53
tolokers-2	4	16	7.322	10.567	1.443	0.789	0.661	0.650	0.650	0.650	2.22
twitch-views	4	16	116.342	130.227	24.510	13.417	11.847	10.576	10.131	9.833	2.49
web-fraud	4	16	298.880	158.516	145.210	40.338	40.273	27.582	21.605	20.398	7.12
artnet-exp	4	32	7.206	8.982	0.850	0.811	0.667	0.667	0.666	0.665	1.28
avazu-ctr	4	32	OOM	OOM	35.738	17.931	17.063	14.381	14.381	14.381	2.49
citeseer	4	32	1.731	0.684	0.067	0.044	0.042	0.042	0.042	0.039	1.71
city-reviews	4	32	31.656	34.257	6.645	3.471	3.041	2.592	2.592	2.498	2.66
city-roads-L	4	32	6.231	5.921	0.924	0.924	0.894	0.865	0.863	0.822	1.12
city-roads-M	4	32	3.381	2.801	0.395	0.395	0.372	0.372	0.369	0.344	1.15
cora	4	32	1.736	0.665	0.091	0.047	0.045	0.045	0.045	0.041	2.25
hm-categories	4	32	OOM	OOM	24.254	16.923	15.699	14.653	14.653	14.653	1.66
ogbn-arxiv	4	32	22.538	18.709	8.323	3.061	2.878	1.905	1.905	1.730	4.81
ogbn-products	4	32	OOM	OOM	160.201	156.502	131.038	131.033	131.033	110.416	1.45
ogbn-proteins	4	32	OOM	OOM	63.423	62.237	60.114	60.091	60.091	60.091	1.06
pokec-regions	4	32	OOM	OOM	41.607	41.607	39.079	38.215	38.215	31.197	1.33
pubmed	4	32	2.450	1.720	0.241	0.203	0.179	0.169	0.169	0.163	1.48
tolokers-2	4	32	11.253	14.541	1.635	0.931	0.774	0.757	0.757	0.757	2.16
twitch-views	4	32	168.794	OOM	28.650	15.713	13.836	11.730	11.730	11.497	2.49
web-fraud	4	32	368.834	OOM	155.169	45.267	44.625	30.085	23.597	22.505	6.89
artnet-exp	4	64	11.840	16.831	1.089	1.031	0.858	0.855	0.850	0.811	1.34
avazu-ctr	4	64	OOM	OOM	48.326	24.491	23.479	20.829	20.829	20.829	2.32
citeseer	4	64	1.785	0.649	0.083	0.052	0.050	0.048	0.048	0.047	1.75
city-reviews	4	64	51.387	67.107	8.224	4.391	4.006	3.360	3.360	3.058	2.69
city-roads-L	4	64	10.579	11.517	1.059	1.059	1.027	0.992	0.986	0.983	1.08
city-roads-M	4	64	5.440	5.378	0.454	0.454	0.440	0.427	0.424	0.412	1.10
cora	4	64	1.726	0.627	0.115	0.056	0.054	0.049	0.049	0.047	2.45
hm-categories	4	64	OOM	OOM	33.239	23.692	22.532	21.157	21.157	21.112	1.57
ogbn-arxiv	4	64	36.176	37.534	11.123	3.853	3.586	2.450	2.396	2.137	5.21
ogbn-products	4	64	OOM	OOM	208.469	203.005	176.635	176.635	176.635	145.351	1.43
ogbn-proteins	4	64	OOM	OOM	88.511	86.474	84.526	84.526	84.526	80.344	1.10
pokec-regions	4	64	OOM	OOM	53.137	53.137	51.413	50.410	50.410	41.158	1.29
pubmed	4	64	3.405	3.226	0.303	0.251	0.218	0.205	0.205	0.196	1.55
tolokers-2	4	64	20.428	28.697	2.297	1.323	1.101	1.070	1.070	1.070	2.15
twitch-views	4	64	OOM	OOM	37.753	21.069	18.425	15.805	15.805	14.293	2.64
web-fraud	4	64	OOM	OOM	185.371	54.365	53.659	36.309	28.902	27.500	6.74
artnet-exp	8	8	7.874	11.160	1.451	1.392	1.153	1.153	1.151	1.147	1.26
avazu-ctr	8	8	OOM	OOM	46.611	30.691	27.581	25.361	25.361	25.361	1.84
citeseer	8	8	1.775	0.646	0.086	0.062	0.061	0.057	0.057	0.052	1.67
city-reviews	8	8	38.791	47.504	9.056	5.886	5.012	4.657	4.653	4.316	2.10
city-roads-L	8	8	6.791	7.769	1.741	1.741	1.661	1.627	1.622	1.545	1.13
city-roads-M	8	8	3.630	3.546	0.719	0.719	0.672	0.669	0.665	0.619	1.16
cora	8	8	1.725	0.653	0.108	0.064	0.063	0.057	0.057	0.051	2.11
hm-categories	8	8	OOM	OOM	34.870	28.507	24.920	24.279	24.279	24.279	1.44
ogbn-arxiv	8	8	24.693	24.061	9.794	4.620	4.231	3.633	3.391	3.032	3.23
ogbn-products	8	8	OOM	OOM	287.288	283.134	234.109	234.098	234.077	189.046	1.52
ogbn-proteins	8	8	OOM	OOM	109.992	108.829	102.619	102.619	102.619	102.619	1.07
pokec-regions	8	8	OOM	OOM	75.307	75.307	68.963	68.795	68.795	54.129	1.39
pubmed	8	8	2.592	2.143	0.389	0.345	0.309	0.304	0.304	0.277	1.41
tolokers-2	8	8	12.487	18.970	2.217	1.450	1.275	1.261	1.261	1.261	1.76
twitch-views	8	8	204.413	OOM	38.039	25.690	22.318	20.894	20.423	19.766	1.92
web-fraud	8	8	403.771	OOM	171.223	62.619	62.553	48.977	43.431	41.077	4.17
artnet-exp	8	16	13.315	17.130	1.653	1.588	1.338	1.327	1.324	1.323	1.25
avazu-ctr	8	16	OOM	OOM	54.152	34.721	31.682	28.800	28.800	28.800	1.88
citeseer	8	16	1.752	0.669	0.091	0.066	0.065	0.058	0.058	0.056	1.62
city-reviews	8	16	58.264	71.406	10.062	6.721	5.705	5.182	5.182	4.983	2.02
city-roads-L	8	16	10.789	12.473	1.844	1.844	1.788	1.725	1.721	1.640	1.12
city-roads-M	8	16	5.710	5.747	0.782	0.782	0.743	0.733	0.729	0.681	1.15
cora	8	16	1.754	0.673	0.116	0.068	0.067	0.056	0.056	0.055	2.13
hm-categories	8	16	OOM	OOM	40.485	33.565	30.242	29.176	29.176	29.176	1.39
ogbn-arxiv	8	16	39.614	39.862	11.039	5.280	4.834	3.799	3.792	3.441	3.21
ogbn-products	8	16	OOM	OOM	318.487	313.120	262.186	262.153	262.153	220.815	1.44
ogbn-proteins	8	16	OOM	OOM	125.936	124.156	120.122	120.122	120.114	120.114	1.05
pokec-regions	8	16	OOM	OOM	83.300	83.300	76.981	76.504	76.504	62.417	1.33
pubmed	8	16	3.553	3.425	0.418	0.374	0.335	0.323	0.323	0.309	1.35
tolokers-2	8	16	22.533	30.025	2.574	1.720	1.501	1.470	1.470	1.470	1.75
twitch-views	8	16	OOM	OOM	43.820	29.593	25.580	23.512	23.512	22.969	1.91
web-fraud	8	16	OOM	OOM	178.739	69.431	69.143	47.186	47.186	45.157	3.96
artnet-exp	8	32	23.871	34.088	2.120	2.000	1.719	1.700	1.700	1.617	1.31
avazu-ctr	8	32	OOM	OOM	73.247	48.501	45.028	41.758	41.758	41.758	1.75
citeseer	8	32	1.943	0.863	0.112	0.079	0.079	0.068	0.068	0.066	1.70
city-reviews	8	32	97.538	137.915	12.671	8.500	7.452	6.729	6.729	6.107	2.07
city-roads-L	8	32	19.406	22.971	2.119	2.119	2.055	1.982	1.976	1.969	1.08
city-roads-M	8	32	9.489	10.443	0.900	0.900	0.873	0.843	0.838	0.818	1.10
cora	8	32	1.981	0.910	0.145	0.085	0.083	0.065	0.065	0.060	2.42
hm-categories	8	32	OOM	OOM	57.978	47.120	43.862	42.312	42.312	42.059	1.38
ogbn-arxiv	8	32	62.322	75.047	14.312	6.662	6.018	4.825	4.789	4.264	3.36
ogbn-products	8	32	OOM	OOM	414.520	406.159	353.363	353.363	353.363	291.106	1.42
ogbn-proteins	8	32	OOM	OOM	175.795	172.619	169.314	169.314	169.314	160.686	1.09
pokec-regions	8	32	OOM	OOM	106.703	106.703	103.129	100.921	100.921	82.408	1.29
pubmed	8	32	5.582	6.205	0.530	0.468	0.414	0.397	0.397	0.378	1.40
tolokers-2	8	32	37.679	57.701	3.740	2.443	2.139	2.093	2.093	2.093	1.79
twitch-views	8	32	OOM	OOM	58.116	39.732	34.238	31.658	31.658	28.582	2.03
web-fraud	8	32	OOM	OOM	213.122	83.285	81.940	58.194	57.729	54.899	3.88

K.3 COMPLETE G-SPMM RESULTS

Table 8: Every g-SPMM cell measured: 16 graphs $\times$ 6 message operators $\times$ 3 reducers $\times$ 4 widths $\times$ 3 passes, fp16, raw milliseconds for both arms. The seven graphs above 13M edges carry `copy_u` only, because an $[E \times d]$ operand does not fit. Speedup is t_{DGL}/t.

graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
artnet-exp	bwd	add	max	64	0.1916	0.2489	1.300
artnet-exp	bwd	add	max	128	0.3427	0.4777	1.394
artnet-exp	bwd	add	max	256	0.7015	0.9443	1.346
artnet-exp	bwd	add	max	512	1.5567	1.9021	1.222
artnet-exp	bwd	add	min	64	0.2348	0.2499	1.064
artnet-exp	bwd	add	min	128	0.3432	0.4778	1.392
artnet-exp	bwd	add	min	256	0.7018	0.9445	1.346
artnet-exp	bwd	add	min	512	1.5636	1.8964	1.213
artnet-exp	bwd	add	sum	64	0.3018	0.3849	1.275
artnet-exp	bwd	add	sum	128	0.3233	0.6837	2.115
artnet-exp	bwd	add	sum	256	0.6362	1.2995	2.043
artnet-exp	bwd	add	sum	512	1.2048	2.5989	2.157
artnet-exp	bwd	copy_e	max	64	0.1869	0.1830	0.979
artnet-exp	bwd	copy_e	max	128	0.2444	0.3478	1.423
artnet-exp	bwd	copy_e	max	256	0.4684	0.6899	1.473
artnet-exp	bwd	copy_e	max	512	0.9502	1.3688	1.441
artnet-exp	bwd	copy_e	min	64	0.1819	0.1831	1.007
artnet-exp	bwd	copy_e	min	128	0.2437	0.3478	1.427
artnet-exp	bwd	copy_e	min	256	0.4692	0.6956	1.483
artnet-exp	bwd	copy_e	min	512	0.9494	1.3786	1.452
artnet-exp	bwd	copy_e	sum	64	0.2062	0.2437	1.182
artnet-exp	bwd	copy_e	sum	128	0.2010	0.4464	2.221
artnet-exp	bwd	copy_e	sum	256	0.2924	0.8461	2.894
artnet-exp	bwd	copy_e	sum	512	0.6041	1.7290	2.862
artnet-exp	bwd	copy_u	max	64	0.2039	0.1737	0.852
artnet-exp	bwd	copy_u	max	128	0.1978	0.1831	0.926
artnet-exp	bwd	copy_u	max	256	0.2644	0.2588	0.979
artnet-exp	bwd	copy_u	max	512	0.5815	0.5327	0.916
artnet-exp	bwd	copy_u	min	64	0.2034	0.1743	0.857
artnet-exp	bwd	copy_u	min	128	0.2296	0.1873	0.816
artnet-exp	bwd	copy_u	min	256	0.2647	0.2590	0.979
artnet-exp	bwd	copy_u	min	512	0.5817	0.5327	0.916
artnet-exp	bwd	copy_u	sum	64	0.2448	0.2686	1.097
artnet-exp	bwd	copy_u	sum	128	0.2664	0.2955	1.109
artnet-exp	bwd	copy_u	sum	256	0.3375	0.4620	1.369
artnet-exp	bwd	copy_u	sum	512	0.6122	0.8933	1.459
artnet-exp	bwd	div	max	64	0.2148	0.8347	3.886
artnet-exp	bwd	div	max	128	0.4240	1.6200	3.820
artnet-exp	bwd	div	max	256	0.8784	3.1850	3.626
artnet-exp	bwd	div	max	512	1.9724	6.2687	3.178
artnet-exp	bwd	div	min	64	0.2274	0.8360	3.676
artnet-exp	bwd	div	min	128	0.4237	1.6247	3.834
artnet-exp	bwd	div	min	256	0.8751	3.1815	3.635
artnet-exp	bwd	div	min	512	1.9644	6.2613	3.187
artnet-exp	bwd	div	sum	64	0.4886	0.9842	2.014
artnet-exp	bwd	div	sum	128	0.8772	1.8160	2.070
artnet-exp	bwd	div	sum	256	1.6723	3.4922	2.088
artnet-exp	bwd	div	sum	512	3.2054	6.8201	2.128
artnet-exp	bwd	mul	max	64	0.2148	0.3781	1.760
artnet-exp	bwd	mul	max	128	0.4244	0.7123	1.678
artnet-exp	bwd	mul	max	256	0.8727	1.3962	1.600
artnet-exp	bwd	mul	max	512	1.9565	2.7818	1.422
artnet-exp	bwd	mul	min	64	0.2146	0.3775	1.759
artnet-exp	bwd	mul	min	128	0.4241	0.7099	1.674
artnet-exp	bwd	mul	min	256	0.8800	1.3952	1.586
artnet-exp	bwd	mul	min	512	1.9542	2.7764	1.421
artnet-exp	bwd	mul	sum	64	0.3649	0.5321	1.458
artnet-exp	bwd	mul	sum	128	0.6538	0.9162	1.402
artnet-exp	bwd	mul	sum	256	1.2434	1.6999	1.367
artnet-exp	bwd	mul	sum	512	2.3023	3.3399	1.451
artnet-exp	bwd	sub	max	64	0.2015	0.3488	1.731
artnet-exp	bwd	sub	max	128	0.3451	0.6753	1.957
artnet-exp	bwd	sub	max	256	0.7010	1.3306	1.898
artnet-exp	bwd	sub	max	512	1.5597	2.6725	1.714
artnet-exp	bwd	sub	min	64	0.2005	0.3535	1.763
artnet-exp	bwd	sub	min	128	0.3436	0.6798	1.979
artnet-exp	bwd	sub	min	256	0.7028	1.3247	1.885
artnet-exp	bwd	sub	min	512	1.5665	2.6710	1.705
artnet-exp	bwd	sub	sum	64	0.2572	0.4833	1.879
artnet-exp	bwd	sub	sum	128	0.3267	0.8767	2.684

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
artnet-exp	bwd	sub	sum	256	0.6373	1.6981	2.665
artnet-exp	bwd	sub	sum	512	1.1972	3.3944	2.835
artnet-exp	fb	add	max	64	0.5123	0.6520	1.273
artnet-exp	fb	add	max	128	0.6605	1.1254	1.704
artnet-exp	fb	add	max	256	1.3061	2.1178	1.622
artnet-exp	fb	add	max	512	2.7451	4.2487	1.548
artnet-exp	fb	add	min	64	0.4940	0.6523	1.320
artnet-exp	fb	add	min	128	0.6572	1.1255	1.713
artnet-exp	fb	add	min	256	1.3071	2.1257	1.626
artnet-exp	fb	add	min	512	2.7415	4.2540	1.552
artnet-exp	fb	add	sum	64	0.5275	0.6886	1.306
artnet-exp	fb	add	sum	128	0.7052	1.0843	1.538
artnet-exp	fb	add	sum	256	1.3606	2.0339	1.495
artnet-exp	fb	add	sum	512	2.9775	4.0348	1.355
artnet-exp	fb	copy_e	max	64	0.4805	0.4550	0.947
artnet-exp	fb	copy_e	max	128	0.4434	0.7817	1.763
artnet-exp	fb	copy_e	max	256	0.8528	1.4779	1.733
artnet-exp	fb	copy_e	max	512	1.7314	2.9347	1.695
artnet-exp	fb	copy_e	min	64	0.4351	0.4508	1.036
artnet-exp	fb	copy_e	min	128	0.4446	0.7791	1.753
artnet-exp	fb	copy_e	min	256	0.8552	1.4694	1.718
artnet-exp	fb	copy_e	min	512	1.7141	2.9438	1.717
artnet-exp	fb	copy_e	sum	64	0.4287	0.4875	1.137
artnet-exp	fb	copy_e	sum	128	0.4066	0.7813	1.921
artnet-exp	fb	copy_e	sum	256	0.7609	1.4422	1.895
artnet-exp	fb	copy_e	sum	512	1.5090	2.8769	1.906
artnet-exp	fb	copy_u	max	64	0.4471	0.4384	0.981
artnet-exp	fb	copy_u	max	128	0.4769	0.4771	1.000
artnet-exp	fb	copy_u	max	256	0.6381	0.8963	1.405
artnet-exp	fb	copy_u	max	512	1.2421	1.8070	1.455
artnet-exp	fb	copy_u	min	64	0.4626	0.4377	0.946
artnet-exp	fb	copy_u	min	128	0.4919	0.4826	0.981
artnet-exp	fb	copy_u	min	256	0.6384	0.8962	1.404
artnet-exp	fb	copy_u	min	512	1.2369	1.8074	1.461
artnet-exp	fb	copy_u	sum	64	0.4854	0.5558	1.145
artnet-exp	fb	copy_u	sum	128	0.5100	0.6102	1.197
artnet-exp	fb	copy_u	sum	256	0.6830	0.9157	1.341
artnet-exp	fb	copy_u	sum	512	1.2209	1.7788	1.457
artnet-exp	fb	div	max	64	0.4204	1.4494	3.448
artnet-exp	fb	div	max	128	0.7434	2.6500	3.565
artnet-exp	fb	div	max	256	1.4940	5.1453	3.444
artnet-exp	fb	div	max	512	3.1317	10.1782	3.250
artnet-exp	fb	div	min	64	0.4234	1.4451	3.413
artnet-exp	fb	div	min	128	0.7451	2.6527	3.560
artnet-exp	fb	div	min	256	1.5028	5.1401	3.420
artnet-exp	fb	div	min	512	3.1822	10.1793	3.199
artnet-exp	fb	div	sum	64	0.6981	1.4469	2.073
artnet-exp	fb	div	sum	128	1.2630	2.6166	2.072
artnet-exp	fb	div	sum	256	2.4097	4.9998	2.075
artnet-exp	fb	div	sum	512	4.6294	9.8206	2.121
artnet-exp	fb	mul	max	64	0.4234	0.7801	1.842
artnet-exp	fb	mul	max	128	0.7406	1.3584	1.834
artnet-exp	fb	mul	max	256	1.4859	2.5554	1.720
artnet-exp	fb	mul	max	512	3.1133	5.1226	1.645
artnet-exp	fb	mul	min	64	0.4122	0.7793	1.891
artnet-exp	fb	mul	min	128	0.7436	1.3545	1.821
artnet-exp	fb	mul	min	256	1.4975	2.5630	1.711
artnet-exp	fb	mul	min	512	3.1267	5.1215	1.638
artnet-exp	fb	mul	sum	64	0.5592	0.7882	1.410
artnet-exp	fb	mul	sum	128	1.0152	1.3176	1.298
artnet-exp	fb	mul	sum	256	1.9188	2.4279	1.265
artnet-exp	fb	mul	sum	512	3.6147	4.7767	1.321
artnet-exp	fb	sub	max	64	0.4087	0.8449	2.067
artnet-exp	fb	sub	max	128	0.6582	1.5158	2.303
artnet-exp	fb	sub	max	256	1.2952	2.9023	2.241
artnet-exp	fb	sub	max	512	2.7428	5.8023	2.115
artnet-exp	fb	sub	min	64	0.4004	0.8449	2.110
artnet-exp	fb	sub	min	128	0.6597	1.5194	2.303
artnet-exp	fb	sub	min	256	1.3043	2.9041	2.227
artnet-exp	fb	sub	min	512	2.7351	5.8008	2.121
artnet-exp	fb	sub	sum	64	0.4861	0.8327	1.713
artnet-exp	fb	sub	sum	128	0.8401	1.4769	1.758
artnet-exp	fb	sub	sum	256	1.3578	2.8273	2.082
artnet-exp	fb	sub	sum	512	2.6000	5.5853	2.148
artnet-exp	fwd	add	max	64	0.1729	0.4074	2.356
artnet-exp	fwd	add	max	128	0.3280	0.6540	1.994
artnet-exp	fwd	add	max	256	0.6153	1.1867	1.929
artnet-exp	fwd	add	max	512	1.1827	2.3665	2.001

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
artnet-exp	fwd	add	min	64	0.1770	0.4067	2.298
artnet-exp	fwd	add	min	128	0.3231	0.6541	2.025
artnet-exp	fwd	add	min	256	0.6306	1.1855	1.880
artnet-exp	fwd	add	min	512	1.2087	2.3614	1.954
artnet-exp	fwd	add	sum	64	0.2135	0.2582	1.209
artnet-exp	fwd	add	sum	128	0.3957	0.4055	1.025
artnet-exp	fwd	add	sum	256	0.7361	0.7346	0.998
artnet-exp	fwd	add	sum	512	1.4036	1.4379	1.024
artnet-exp	fwd	copy_e	max	64	0.1145	0.2714	2.370
artnet-exp	fwd	copy_e	max	128	0.2144	0.4347	2.027
artnet-exp	fwd	copy_e	max	256	0.3955	0.7935	2.007
artnet-exp	fwd	copy_e	max	512	0.7763	1.5715	2.024
artnet-exp	fwd	copy_e	min	64	0.1139	0.2727	2.393
artnet-exp	fwd	copy_e	min	128	0.2132	0.4349	2.040
artnet-exp	fwd	copy_e	min	256	0.4247	0.7916	1.864
artnet-exp	fwd	copy_e	min	512	0.7986	1.5721	1.968
artnet-exp	fwd	copy_e	sum	64	0.1420	0.2232	1.571
artnet-exp	fwd	copy_e	sum	128	0.2533	0.3381	1.335
artnet-exp	fwd	copy_e	sum	256	0.4897	0.6028	1.231
artnet-exp	fwd	copy_e	sum	512	0.9142	1.1725	1.283
artnet-exp	fwd	copy_u	max	64	0.1014	0.2090	2.060
artnet-exp	fwd	copy_u	max	128	0.1960	0.3468	1.769
artnet-exp	fwd	copy_u	max	256	0.3791	0.6408	1.690
artnet-exp	fwd	copy_u	max	512	0.7532	1.2754	1.693
artnet-exp	fwd	copy_u	min	64	0.1022	0.2088	2.044
artnet-exp	fwd	copy_u	min	128	0.1951	0.3474	1.781
artnet-exp	fwd	copy_u	min	256	0.3741	0.6419	1.716
artnet-exp	fwd	copy_u	min	512	0.6610	1.2747	1.929
artnet-exp	fwd	copy_u	sum	64	0.0898	0.0972	1.083
artnet-exp	fwd	copy_u	sum	128	0.1643	0.2324	1.415
artnet-exp	fwd	copy_u	sum	256	0.3337	0.4590	1.375
artnet-exp	fwd	copy_u	sum	512	0.6109	0.8935	1.463
artnet-exp	fwd	div	max	64	0.1739	0.6017	3.459
artnet-exp	fwd	div	max	128	0.3262	1.0555	3.235
artnet-exp	fwd	div	max	256	0.6253	2.0067	3.209
artnet-exp	fwd	div	max	512	1.1865	3.9293	3.312
artnet-exp	fwd	div	min	64	0.1784	0.6072	3.402
artnet-exp	fwd	div	min	128	0.3296	1.0548	3.200
artnet-exp	fwd	div	min	256	0.6341	2.0014	3.156
artnet-exp	fwd	div	min	512	1.2283	3.9270	3.197
artnet-exp	fwd	div	sum	64	0.2160	0.4546	2.104
artnet-exp	fwd	div	sum	128	0.3879	0.8029	2.070
artnet-exp	fwd	div	sum	256	0.7436	1.5301	2.058
artnet-exp	fwd	div	sum	512	1.4184	2.9997	2.115
artnet-exp	fwd	mul	max	64	0.1736	0.4071	2.345
artnet-exp	fwd	mul	max	128	0.3923	0.6527	1.664
artnet-exp	fwd	mul	max	256	0.6182	1.1861	1.919
artnet-exp	fwd	mul	max	512	1.1690	2.3608	2.020
artnet-exp	fwd	mul	min	64	0.1806	0.4074	2.255
artnet-exp	fwd	mul	min	128	0.3311	0.6529	1.972
artnet-exp	fwd	mul	min	256	0.8611	1.1857	1.377
artnet-exp	fwd	mul	min	512	1.2192	2.3602	1.936
artnet-exp	fwd	mul	sum	64	0.2022	0.2589	1.281
artnet-exp	fwd	mul	sum	128	0.3647	0.4065	1.115
artnet-exp	fwd	mul	sum	256	0.6778	0.7333	1.082
artnet-exp	fwd	mul	sum	512	1.3106	1.4474	1.104
artnet-exp	fwd	sub	max	64	0.1740	0.5019	2.884
artnet-exp	fwd	sub	max	128	0.3213	0.8425	2.622
artnet-exp	fwd	sub	max	256	0.6140	1.5823	2.577
artnet-exp	fwd	sub	max	512	1.1846	3.1313	2.643
artnet-exp	fwd	sub	min	64	0.1739	0.5012	2.882
artnet-exp	fwd	sub	min	128	0.3228	0.8426	2.610
artnet-exp	fwd	sub	min	256	0.6345	1.5827	2.495
artnet-exp	fwd	sub	min	512	1.2636	3.1344	2.480
artnet-exp	fwd	sub	sum	64	0.2148	0.3515	1.636
artnet-exp	fwd	sub	sum	128	0.3851	0.5939	1.542
artnet-exp	fwd	sub	sum	256	0.7318	1.1220	1.533
artnet-exp	fwd	sub	sum	512	1.4055	2.2033	1.568
avazu-ctr	bwd	copy_u	max	64	0.2630	47.6774	181.262
avazu-ctr	bwd	copy_u	max	128	0.4053	39.6075	97.732
avazu-ctr	bwd	copy_u	max	256	0.7147	40.1728	56.213
avazu-ctr	bwd	copy_u	max	512	1.2005	36.4323	30.347
avazu-ctr	bwd	copy_u	min	64	0.2812	34.4864	122.659
avazu-ctr	bwd	copy_u	min	128	0.4146	37.4498	90.324
avazu-ctr	bwd	copy_u	min	256	0.7269	17.2073	23.672
avazu-ctr	bwd	copy_u	min	512	1.2457	26.1417	20.986
avazu-ctr	bwd	copy_u	sum	64	3.6112	13.9323	3.858
avazu-ctr	bwd	copy_u	sum	128	7.2122	15.3017	2.122

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
avazu-ctr	bwd	copy_u	sum	256	14.8422	16.1080	1.085
avazu-ctr	bwd	copy_u	sum	512	30.4540	23.5950	0.775
avazu-ctr	fb	copy_u	max	64	2.9174	59.4270	20.370
avazu-ctr	fb	copy_u	max	128	5.5951	51.9083	9.277
avazu-ctr	fb	copy_u	max	256	11.2733	52.9492	4.697
avazu-ctr	fb	copy_u	max	512	22.6107	57.7614	2.555
avazu-ctr	fb	copy_u	min	64	2.9609	46.2346	15.615
avazu-ctr	fb	copy_u	min	128	5.5243	49.6948	8.996
avazu-ctr	fb	copy_u	min	256	11.2188	29.9295	2.668
avazu-ctr	fb	copy_u	min	512	21.9430	47.7675	2.177
avazu-ctr	fb	copy_u	sum	64	7.2759	27.8746	3.831
avazu-ctr	fb	copy_u	sum	128	14.5191	30.6048	2.108
avazu-ctr	fb	copy_u	sum	256	30.1132	32.2176	1.070
avazu-ctr	fb	copy_u	sum	512	60.6918	47.1986	0.778
avazu-ctr	fwd	copy_u	max	64	2.5988	11.7057	4.504
avazu-ctr	fwd	copy_u	max	128	5.2039	12.3434	2.372
avazu-ctr	fwd	copy_u	max	256	10.3586	12.8843	1.244
avazu-ctr	fwd	copy_u	max	512	21.4633	21.4545	1.000
avazu-ctr	fwd	copy_u	min	64	2.5724	11.7203	4.556
avazu-ctr	fwd	copy_u	min	128	5.2965	12.3399	2.330
avazu-ctr	fwd	copy_u	min	256	10.2659	12.8783	1.254
avazu-ctr	fwd	copy_u	min	512	21.4109	21.4347	1.001
avazu-ctr	fwd	copy_u	sum	64	3.5313	13.9662	3.955
avazu-ctr	fwd	copy_u	sum	128	7.2027	15.3402	2.130
avazu-ctr	fwd	copy_u	sum	256	14.9378	16.1266	1.080
avazu-ctr	fwd	copy_u	sum	512	29.8641	23.5865	0.790
citeseer	bwd	add	max	64	0.2281	0.2147	0.941
citeseer	bwd	add	max	128	0.1903	0.2345	1.233
citeseer	bwd	add	max	256	0.1983	0.2286	1.152
citeseer	bwd	add	max	512	0.2390	0.1905	0.797
citeseer	bwd	add	min	64	0.2218	0.2150	0.969
citeseer	bwd	add	min	128	0.1929	0.2223	1.152
citeseer	bwd	add	min	256	0.1880	0.2036	1.083
citeseer	bwd	add	min	512	0.2363	0.1910	0.808
citeseer	bwd	add	sum	64	0.3161	0.3613	1.143
citeseer	bwd	add	sum	128	0.2526	0.3991	1.580
citeseer	bwd	add	sum	256	0.2392	0.3424	1.432
citeseer	bwd	add	sum	512	0.2995	0.3215	1.074
citeseer	bwd	copy_e	max	64	0.2036	0.1489	0.732
citeseer	bwd	copy_e	max	128	0.1686	0.1627	0.965
citeseer	bwd	copy_e	max	256	0.1779	0.1452	0.816
citeseer	bwd	copy_e	max	512	0.1992	0.1310	0.658
citeseer	bwd	copy_e	min	64	0.2023	0.1527	0.755
citeseer	bwd	copy_e	min	128	0.1728	0.1551	0.897
citeseer	bwd	copy_e	min	256	0.1788	0.1415	0.792
citeseer	bwd	copy_e	min	512	0.2047	0.1339	0.654
citeseer	bwd	copy_e	sum	64	0.2040	0.2027	0.994
citeseer	bwd	copy_e	sum	128	0.1656	0.2143	1.294
citeseer	bwd	copy_e	sum	256	0.1729	0.1905	1.102
citeseer	bwd	copy_e	sum	512	0.2004	0.1885	0.941
citeseer	bwd	copy_u	max	64	0.2082	0.1727	0.830
citeseer	bwd	copy_u	max	128	0.1803	0.1850	1.027
citeseer	bwd	copy_u	max	256	0.1730	0.1619	0.936
citeseer	bwd	copy_u	max	512	0.1950	0.1534	0.787
citeseer	bwd	copy_u	min	64	0.2053	0.1759	0.857
citeseer	bwd	copy_u	min	128	0.1675	0.1878	1.121
citeseer	bwd	copy_u	min	256	0.1703	0.1616	0.949
citeseer	bwd	copy_u	min	512	0.1968	0.1631	0.829
citeseer	bwd	copy_u	sum	64	0.2270	0.2877	1.268
citeseer	bwd	copy_u	sum	128	0.1952	0.2612	1.338
citeseer	bwd	copy_u	sum	256	0.1995	0.2407	1.207
citeseer	bwd	copy_u	sum	512	0.2242	0.2416	1.078
citeseer	bwd	div	max	64	0.2383	0.3447	1.446
citeseer	bwd	div	max	128	0.1989	0.3682	1.852
citeseer	bwd	div	max	256	0.1872	0.3537	1.890
citeseer	bwd	div	max	512	0.2855	0.3683	1.290
citeseer	bwd	div	min	64	0.2261	0.3730	1.650
citeseer	bwd	div	min	128	0.1978	0.3681	1.861
citeseer	bwd	div	min	256	0.1947	0.3493	1.794
citeseer	bwd	div	min	512	0.3075	0.3707	1.205
citeseer	bwd	div	sum	64	0.2686	0.4561	1.698
citeseer	bwd	div	sum	128	0.2291	0.4566	1.993
citeseer	bwd	div	sum	256	0.2157	0.4331	2.008
citeseer	bwd	div	sum	512	0.2722	0.4526	1.663
citeseer	bwd	mul	max	64	0.2469	0.3089	1.251
citeseer	bwd	mul	max	128	0.1894	0.3074	1.623
citeseer	bwd	mul	max	256	0.1898	0.3032	1.597
citeseer	bwd	mul	max	512	0.2764	0.2848	1.030

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
citeseer	bwd	mul	min	64	0.2250	0.3037	1.350
citeseer	bwd	mul	min	128	0.1966	0.3072	1.562
citeseer	bwd	mul	min	256	0.1865	0.2972	1.594
citeseer	bwd	mul	min	512	0.2735	0.2847	1.041
citeseer	bwd	mul	sum	64	0.2598	0.3815	1.469
citeseer	bwd	mul	sum	128	0.2177	0.3841	1.764
citeseer	bwd	mul	sum	256	0.2325	0.3696	1.590
citeseer	bwd	mul	sum	512	0.2482	0.3426	1.380
citeseer	bwd	sub	max	64	0.2391	0.2352	0.984
citeseer	bwd	sub	max	128	0.1954	0.2350	1.203
citeseer	bwd	sub	max	256	0.1890	0.2211	1.170
citeseer	bwd	sub	max	512	0.2258	0.2213	0.980
citeseer	bwd	sub	min	64	0.2250	0.2672	1.187
citeseer	bwd	sub	min	128	0.1911	0.2439	1.276
citeseer	bwd	sub	min	256	0.1964	0.2271	1.156
citeseer	bwd	sub	min	512	0.2241	0.2203	0.983
citeseer	bwd	sub	sum	64	0.3182	0.4072	1.280
citeseer	bwd	sub	sum	128	0.2460	0.4783	1.944
citeseer	bwd	sub	sum	256	0.2526	0.3813	1.509
citeseer	bwd	sub	sum	512	0.2863	0.3573	1.248
citeseer	fb	add	max	64	0.4873	0.5954	1.222
citeseer	fb	add	max	128	0.4022	0.5476	1.362
citeseer	fb	add	max	256	0.4002	0.5147	1.286
citeseer	fb	add	max	512	0.4757	0.4755	1.000
citeseer	fb	add	min	64	0.4679	0.5516	1.179
citeseer	fb	add	min	128	0.4106	0.5488	1.337
citeseer	fb	add	min	256	0.3893	0.5124	1.316
citeseer	fb	add	min	512	0.4689	0.4726	1.008
citeseer	fb	add	sum	64	0.6091	0.6591	1.082
citeseer	fb	add	sum	128	0.4586	0.6758	1.474
citeseer	fb	add	sum	256	0.4606	0.6338	1.376
citeseer	fb	add	sum	512	0.5014	0.5634	1.124
citeseer	fb	copy_e	max	64	0.4485	0.4186	0.933
citeseer	fb	copy_e	max	128	0.3707	0.4217	1.138
citeseer	fb	copy_e	max	256	0.3804	0.4002	1.052
citeseer	fb	copy_e	max	512	0.4395	0.3679	0.837
citeseer	fb	copy_e	min	64	0.4399	0.4070	0.925
citeseer	fb	copy_e	min	128	0.3814	0.4053	1.063
citeseer	fb	copy_e	min	256	0.3907	0.3827	0.980
citeseer	fb	copy_e	min	512	0.4336	0.3673	0.847
citeseer	fb	copy_e	sum	64	0.4450	0.4830	1.085
citeseer	fb	copy_e	sum	128	0.3616	0.4864	1.345
citeseer	fb	copy_e	sum	256	0.3598	0.4415	1.227
citeseer	fb	copy_e	sum	512	0.4139	0.3971	0.960
citeseer	fb	copy_u	max	64	0.4446	0.4454	1.002
citeseer	fb	copy_u	max	128	0.3757	0.4384	1.167
citeseer	fb	copy_u	max	256	0.3783	0.4111	1.087
citeseer	fb	copy_u	max	512	0.4393	0.4021	0.915
citeseer	fb	copy_u	min	64	0.4765	0.4577	0.960
citeseer	fb	copy_u	min	128	0.3714	0.4590	1.236
citeseer	fb	copy_u	min	256	0.3795	0.4106	1.082
citeseer	fb	copy_u	min	512	0.4438	0.4221	0.951
citeseer	fb	copy_u	sum	64	0.5366	0.5481	1.021
citeseer	fb	copy_u	sum	128	0.3886	0.4665	1.201
citeseer	fb	copy_u	sum	256	0.4042	0.5284	1.307
citeseer	fb	copy_u	sum	512	0.4423	0.5070	1.146
citeseer	fb	div	max	64	0.4933	0.7266	1.473
citeseer	fb	div	max	128	0.4110	0.7565	1.840
citeseer	fb	div	max	256	0.3851	0.7094	1.842
citeseer	fb	div	max	512	0.4973	0.7734	1.555
citeseer	fb	div	min	64	0.4671	0.7912	1.694
citeseer	fb	div	min	128	0.4085	0.7574	1.854
citeseer	fb	div	min	256	0.4006	0.7232	1.805
citeseer	fb	div	min	512	0.5929	0.7800	1.316
citeseer	fb	div	sum	64	0.5263	0.8428	1.601
citeseer	fb	div	sum	128	0.4303	0.8116	1.886
citeseer	fb	div	sum	256	0.4023	0.7620	1.894
citeseer	fb	div	sum	512	0.5116	0.8192	1.601
citeseer	fb	mul	max	64	0.4976	0.6464	1.299
citeseer	fb	mul	max	128	0.4755	0.6291	1.323
citeseer	fb	mul	max	256	0.3864	0.6333	1.639
citeseer	fb	mul	max	512	0.4993	0.5885	1.179
citeseer	fb	mul	min	64	0.5012	0.6603	1.317
citeseer	fb	mul	min	128	0.4116	0.6560	1.594
citeseer	fb	mul	min	256	0.3829	0.6106	1.595
citeseer	fb	mul	min	512	0.4892	0.5700	1.165
citeseer	fb	mul	sum	64	0.5194	0.7228	1.392
citeseer	fb	mul	sum	128	0.4120	0.6648	1.614

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
citeseer	fb	mul	sum	256	0.4074	0.6598	1.620
citeseer	fb	mul	sum	512	0.4751	0.6072	1.278
citeseer	fb	sub	max	64	0.5078	0.6122	1.205
citeseer	fb	sub	max	128	0.3915	0.5919	1.512
citeseer	fb	sub	max	256	0.4149	0.5622	1.355
citeseer	fb	sub	max	512	0.4651	0.5495	1.181
citeseer	fb	sub	min	64	0.4855	0.6243	1.286
citeseer	fb	sub	min	128	0.3957	0.6038	1.526
citeseer	fb	sub	min	256	0.3988	0.5605	1.406
citeseer	fb	sub	min	512	0.4634	0.5542	1.196
citeseer	fb	sub	sum	64	0.5313	0.7329	1.380
citeseer	fb	sub	sum	128	0.4607	0.7089	1.539
citeseer	fb	sub	sum	256	0.4536	0.6752	1.489
citeseer	fb	sub	sum	512	0.5172	0.6331	1.224
citeseer	fwd	add	max	64	0.0890	0.1760	1.979
citeseer	fwd	add	max	128	0.0911	0.1803	1.980
citeseer	fwd	add	max	256	0.0856	0.1778	2.078
citeseer	fwd	add	max	512	0.1215	0.1741	1.432
citeseer	fwd	add	min	64	0.0985	0.1819	1.847
citeseer	fwd	add	min	128	0.0935	0.1795	1.919
citeseer	fwd	add	min	256	0.0880	0.1759	1.999
citeseer	fwd	add	min	512	0.1215	0.1752	1.442
citeseer	fwd	add	sum	64	0.0813	0.0968	1.191
citeseer	fwd	add	sum	128	0.0802	0.1009	1.257
citeseer	fwd	add	sum	256	0.0805	0.1081	1.343
citeseer	fwd	add	sum	512	0.0920	0.0973	1.059
citeseer	fwd	copy_e	max	64	0.0887	0.1406	1.585
citeseer	fwd	copy_e	max	128	0.0905	0.1421	1.571
citeseer	fwd	copy_e	max	256	0.0866	0.1356	1.566
citeseer	fwd	copy_e	max	512	0.0870	0.1397	1.605
citeseer	fwd	copy_e	min	64	0.0884	0.1379	1.560
citeseer	fwd	copy_e	min	128	0.0853	0.1364	1.599
citeseer	fwd	copy_e	min	256	0.0829	0.1377	1.660
citeseer	fwd	copy_e	min	512	0.0915	0.1352	1.477
citeseer	fwd	copy_e	sum	64	0.0818	0.0873	1.068
citeseer	fwd	copy_e	sum	128	0.0785	0.0901	1.148
citeseer	fwd	copy_e	sum	256	0.0762	0.0940	1.234
citeseer	fwd	copy_e	sum	512	0.0817	0.0893	1.092
citeseer	fwd	copy_u	max	64	0.0954	0.1421	1.489
citeseer	fwd	copy_u	max	128	0.0848	0.1350	1.592
citeseer	fwd	copy_u	max	256	0.0834	0.1371	1.645
citeseer	fwd	copy_u	max	512	0.0914	0.1360	1.488
citeseer	fwd	copy_u	min	64	0.0975	0.1394	1.430
citeseer	fwd	copy_u	min	128	0.0861	0.1378	1.600
citeseer	fwd	copy_u	min	256	0.0848	0.1374	1.619
citeseer	fwd	copy_u	min	512	0.0861	0.1359	1.578
citeseer	fwd	copy_u	sum	64	0.0920	0.0881	0.958
citeseer	fwd	copy_u	sum	128	0.0790	0.0873	1.106
citeseer	fwd	copy_u	sum	256	0.0765	0.0868	1.135
citeseer	fwd	copy_u	sum	512	0.0795	0.0868	1.092
citeseer	fwd	div	max	64	0.0877	0.2283	2.602
citeseer	fwd	div	max	128	0.0865	0.2189	2.531
citeseer	fwd	div	max	256	0.0849	0.2178	2.566
citeseer	fwd	div	max	512	0.1230	0.2218	1.804
citeseer	fwd	div	min	64	0.0897	0.2392	2.667
citeseer	fwd	div	min	128	0.0869	0.2211	2.545
citeseer	fwd	div	min	256	0.0841	0.2193	2.609
citeseer	fwd	div	min	512	0.1220	0.2205	1.807
citeseer	fwd	div	sum	64	0.0906	0.1505	1.661
citeseer	fwd	div	sum	128	0.0807	0.1414	1.753
citeseer	fwd	div	sum	256	0.0787	0.1462	1.857
citeseer	fwd	div	sum	512	0.0886	0.1424	1.607
citeseer	fwd	mul	max	64	0.0867	0.1791	2.065
citeseer	fwd	mul	max	128	0.0874	0.1763	2.017
citeseer	fwd	mul	max	256	0.0837	0.1792	2.141
citeseer	fwd	mul	max	512	0.1208	0.1768	1.464
citeseer	fwd	mul	min	64	0.0894	0.1782	1.993
citeseer	fwd	mul	min	128	0.0870	0.1752	2.013
citeseer	fwd	mul	min	256	0.0842	0.1755	2.084
citeseer	fwd	mul	min	512	0.1224	0.1759	1.437
citeseer	fwd	mul	sum	64	0.0817	0.0995	1.217
citeseer	fwd	mul	sum	128	0.0863	0.1001	1.161
citeseer	fwd	mul	sum	256	0.0776	0.1002	1.293
citeseer	fwd	mul	sum	512	0.0854	0.0985	1.153
citeseer	fwd	sub	max	64	0.0880	0.1953	2.220
citeseer	fwd	sub	max	128	0.0876	0.1987	2.269
citeseer	fwd	sub	max	256	0.0902	0.1980	2.194
citeseer	fwd	sub	max	512	0.1220	0.1940	1.590

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
citeseer	fwd	sub	min	64	0.0898	0.2105	2.343
citeseer	fwd	sub	min	128	0.0921	0.1985	2.156
citeseer	fwd	sub	min	256	0.0848	0.1977	2.331
citeseer	fwd	sub	min	512	0.1199	0.1948	1.624
citeseer	fwd	sub	sum	64	0.0822	0.1195	1.453
citeseer	fwd	sub	sum	128	0.0861	0.1204	1.399
citeseer	fwd	sub	sum	256	0.0829	0.1181	1.424
citeseer	fwd	sub	sum	512	0.0914	0.1163	1.273
city-reviews	bwd	add	max	64	0.6338	0.8160	1.288
city-reviews	bwd	add	max	128	1.3897	1.5668	1.127
city-reviews	bwd	add	max	256	3.0436	3.1904	1.048
city-reviews	bwd	add	max	512	6.7927	6.6931	0.985
city-reviews	bwd	add	min	64	0.6352	0.8194	1.290
city-reviews	bwd	add	min	128	1.3912	1.5735	1.131
city-reviews	bwd	add	min	256	3.0474	3.1928	1.048
city-reviews	bwd	add	min	512	6.7881	6.6895	0.985
city-reviews	bwd	add	sum	64	0.8802	2.5616	2.910
city-reviews	bwd	add	sum	128	1.7032	3.7309	2.190
city-reviews	bwd	add	sum	256	3.4864	6.2064	1.780
city-reviews	bwd	add	sum	512	7.5080	11.4028	1.519
city-reviews	bwd	copy_e	max	64	0.4018	0.6201	1.543
city-reviews	bwd	copy_e	max	128	0.7714	1.1645	1.510
city-reviews	bwd	copy_e	max	256	1.5089	2.3038	1.527
city-reviews	bwd	copy_e	max	512	3.1265	4.6713	1.494
city-reviews	bwd	copy_e	min	64	0.4002	0.6217	1.553
city-reviews	bwd	copy_e	min	128	0.7733	1.1592	1.499
city-reviews	bwd	copy_e	min	256	1.5136	2.3098	1.526
city-reviews	bwd	copy_e	min	512	3.1144	4.6671	1.499
city-reviews	bwd	copy_e	sum	64	0.4334	0.9035	2.085
city-reviews	bwd	copy_e	sum	128	0.5689	1.7583	3.091
city-reviews	bwd	copy_e	sum	256	1.0621	3.4385	3.237
city-reviews	bwd	copy_e	sum	512	2.3528	6.9216	2.942
city-reviews	bwd	copy_u	max	64	0.2142	0.2010	0.938
city-reviews	bwd	copy_u	max	128	0.5104	0.4087	0.801
city-reviews	bwd	copy_u	max	256	1.1946	0.8874	0.743
city-reviews	bwd	copy_u	max	512	2.9253	2.0174	0.690
city-reviews	bwd	copy_u	min	64	0.2161	0.2012	0.931
city-reviews	bwd	copy_u	min	128	0.5130	0.4102	0.800
city-reviews	bwd	copy_u	min	256	1.1576	0.8864	0.766
city-reviews	bwd	copy_u	min	512	2.9301	2.0177	0.689
city-reviews	bwd	copy_u	sum	64	0.5205	1.6664	3.202
city-reviews	bwd	copy_u	sum	128	1.1231	1.9732	1.757
city-reviews	bwd	copy_u	sum	256	2.4380	2.7751	1.138
city-reviews	bwd	copy_u	sum	512	5.1277	4.5052	0.879
city-reviews	bwd	div	max	64	0.7908	2.9548	3.737
city-reviews	bwd	div	max	128	1.6842	5.8369	3.466
city-reviews	bwd	div	max	256	3.5436	11.7815	3.325
city-reviews	bwd	div	max	512	7.8901	23.5909	2.990
city-reviews	bwd	div	min	64	0.7933	2.9334	3.698
city-reviews	bwd	div	min	128	1.6763	5.8284	3.477
city-reviews	bwd	div	min	256	3.4990	11.7944	3.371
city-reviews	bwd	div	min	512	7.9002	23.5987	2.987
city-reviews	bwd	div	sum	64	2.2805	5.2253	2.291
city-reviews	bwd	div	sum	128	4.2206	8.3074	1.968
city-reviews	bwd	div	sum	256	8.2809	14.2326	1.719
city-reviews	bwd	div	sum	512	35.0477	27.3567	0.781
city-reviews	bwd	mul	max	64	0.7880	1.1892	1.509
city-reviews	bwd	mul	max	128	1.6662	2.3104	1.387
city-reviews	bwd	mul	max	256	3.5354	4.7231	1.336
city-reviews	bwd	mul	max	512	7.8875	9.7550	1.237
city-reviews	bwd	mul	min	64	0.7989	1.1875	1.486
city-reviews	bwd	mul	min	128	1.6762	2.3069	1.376
city-reviews	bwd	mul	min	256	3.5364	4.7200	1.335
city-reviews	bwd	mul	min	512	7.8837	9.7724	1.240
city-reviews	bwd	mul	sum	64	1.8219	3.4970	1.919
city-reviews	bwd	mul	sum	128	3.4167	4.7643	1.394
city-reviews	bwd	mul	sum	256	6.6588	7.1911	1.080
city-reviews	bwd	mul	sum	512	39.6287	13.5181	0.341
city-reviews	bwd	sub	max	64	0.6309	1.2027	1.907
city-reviews	bwd	sub	max	128	1.3984	2.3367	1.671
city-reviews	bwd	sub	max	256	3.0476	4.7377	1.555
city-reviews	bwd	sub	max	512	6.8098	9.7820	1.436
city-reviews	bwd	sub	min	64	0.6325	1.2083	1.910
city-reviews	bwd	sub	min	128	1.3930	2.3352	1.676
city-reviews	bwd	sub	min	256	2.9968	4.7322	1.579
city-reviews	bwd	sub	min	512	6.8136	9.7846	1.436
city-reviews	bwd	sub	sum	64	0.8932	2.9429	3.295
city-reviews	bwd	sub	sum	128	1.7054	4.4891	2.632

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-reviews	bwd	sub	sum	256	3.4982	7.7792	2.224
city-reviews	bwd	sub	sum	512	29.0129	14.4879	0.499
city-reviews	fb	add	max	64	1.7362	4.2939	2.473
city-reviews	fb	add	max	128	3.6067	5.5647	1.543
city-reviews	fb	add	max	256	7.4640	8.3214	1.115
city-reviews	fb	add	max	512	15.8097	16.1346	1.021
city-reviews	fb	add	min	64	1.7458	4.2886	2.456
city-reviews	fb	add	min	128	3.5930	5.5779	1.552
city-reviews	fb	add	min	256	7.4707	8.3277	1.115
city-reviews	fb	add	min	512	15.9319	16.1237	1.012
city-reviews	fb	add	sum	64	2.2693	5.0708	2.234
city-reviews	fb	add	sum	128	4.3664	6.5679	1.504
city-reviews	fb	add	sum	256	8.6967	9.6777	1.113
city-reviews	fb	add	sum	512	18.0748	17.5981	0.974
city-reviews	fb	copy_e	max	64	0.8627	2.8573	3.312
city-reviews	fb	copy_e	max	128	1.6974	3.6873	2.172
city-reviews	fb	copy_e	max	256	3.3509	5.5365	1.652
city-reviews	fb	copy_e	max	512	7.0893	10.6900	1.508
city-reviews	fb	copy_e	min	64	0.8643	2.8634	3.313
city-reviews	fb	copy_e	min	128	1.7183	3.6919	2.149
city-reviews	fb	copy_e	min	256	3.4096	5.5373	1.624
city-reviews	fb	copy_e	min	512	7.0789	10.6968	1.511
city-reviews	fb	copy_e	sum	64	1.4027	3.6895	2.630
city-reviews	fb	copy_e	sum	128	2.6400	4.7096	1.784
city-reviews	fb	copy_e	sum	256	5.2504	6.8886	1.312
city-reviews	fb	copy_e	sum	512	10.5094	12.4912	1.189
city-reviews	fb	copy_u	max	64	0.7016	1.7551	2.502
city-reviews	fb	copy_u	max	128	1.4592	2.3795	1.631
city-reviews	fb	copy_u	max	256	3.1004	3.6665	1.183
city-reviews	fb	copy_u	max	512	6.7766	7.1528	1.056
city-reviews	fb	copy_u	min	64	0.7062	1.7598	2.492
city-reviews	fb	copy_u	min	128	1.4582	2.3822	1.634
city-reviews	fb	copy_u	min	256	3.0771	3.6617	1.190
city-reviews	fb	copy_u	min	512	6.6884	7.1459	1.068
city-reviews	fb	copy_u	sum	64	1.0873	3.3153	3.049
city-reviews	fb	copy_u	sum	128	2.2559	3.9381	1.746
city-reviews	fb	copy_u	sum	256	4.9132	5.5410	1.128
city-reviews	fb	copy_u	sum	512	10.2676	8.9737	0.874
city-reviews	fb	div	max	64	1.9272	7.1831	3.727
city-reviews	fb	div	max	128	3.8912	11.4103	2.932
city-reviews	fb	div	max	256	7.9632	20.0616	2.519
city-reviews	fb	div	max	512	16.9879	39.2725	2.312
city-reviews	fb	div	min	64	1.9243	7.1903	3.737
city-reviews	fb	div	min	128	3.8735	11.4015	2.943
city-reviews	fb	div	min	256	7.9821	20.0500	2.512
city-reviews	fb	div	min	512	16.9804	39.2846	2.314
city-reviews	fb	div	sum	64	3.6276	8.5001	2.343
city-reviews	fb	div	sum	128	6.9209	12.7695	1.845
city-reviews	fb	div	sum	256	13.6333	20.8864	1.532
city-reviews	fb	div	sum	512	26.9111	39.7779	1.478
city-reviews	fb	mul	max	64	1.8912	4.6581	2.463
city-reviews	fb	mul	max	128	3.8765	6.2575	1.614
city-reviews	fb	mul	max	256	7.9078	9.8013	1.239
city-reviews	fb	mul	max	512	16.8319	19.1611	1.138
city-reviews	fb	mul	min	64	1.9022	4.6496	2.444
city-reviews	fb	mul	min	128	3.8691	6.2621	1.618
city-reviews	fb	mul	min	256	7.9140	9.8011	1.238
city-reviews	fb	mul	min	512	16.9212	19.1736	1.133
city-reviews	fb	mul	sum	64	3.0020	5.9967	1.998
city-reviews	fb	mul	sum	128	5.6864	7.6402	1.344
city-reviews	fb	mul	sum	256	11.1614	10.6530	0.954
city-reviews	fb	mul	sum	512	22.1662	19.7286	0.890
city-reviews	fb	sub	max	64	1.7288	5.0632	2.929
city-reviews	fb	sub	max	128	3.5739	7.1348	1.996
city-reviews	fb	sub	max	256	7.4608	11.4365	1.533
city-reviews	fb	sub	max	512	15.7610	22.3145	1.416
city-reviews	fb	sub	min	64	1.7300	5.0718	2.932
city-reviews	fb	sub	min	128	3.5874	7.1291	1.987
city-reviews	fb	sub	min	256	7.4112	11.4393	1.544
city-reviews	fb	sub	min	512	15.7485	22.3277	1.418
city-reviews	fb	sub	sum	64	2.2200	5.8498	2.635
city-reviews	fb	sub	sum	128	4.3783	8.1469	1.861
city-reviews	fb	sub	sum	256	8.7767	12.8423	1.463
city-reviews	fb	sub	sum	512	18.0978	23.7641	1.313
city-reviews	fwd	add	max	64	1.1196	3.4835	3.111
city-reviews	fwd	add	max	128	2.2050	4.0130	1.820
city-reviews	fwd	add	max	256	4.4090	5.1293	1.163
city-reviews	fwd	add	max	512	8.9977	9.4471	1.050

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-reviews	fwd	add	min	64	1.1359	3.4807	3.064
city-reviews	fwd	add	min	128	2.2715	4.0091	1.765
city-reviews	fwd	add	min	256	4.5730	5.1237	1.120
city-reviews	fwd	add	min	512	9.3003	9.4541	1.017
city-reviews	fwd	add	sum	64	1.3162	2.5151	1.911
city-reviews	fwd	add	sum	128	2.5510	2.8695	1.125
city-reviews	fwd	add	sum	256	5.2288	3.4859	0.667
city-reviews	fwd	add	sum	512	10.4733	6.2249	0.594
city-reviews	fwd	copy_e	max	64	0.4872	2.2465	4.611
city-reviews	fwd	copy_e	max	128	0.9561	2.5435	2.660
city-reviews	fwd	copy_e	max	256	1.8830	3.2484	1.725
city-reviews	fwd	copy_e	max	512	3.9732	6.0301	1.518
city-reviews	fwd	copy_e	min	64	0.5359	2.2455	4.190
city-reviews	fwd	copy_e	min	128	0.9987	2.5408	2.544
city-reviews	fwd	copy_e	min	256	1.8965	3.2573	1.718
city-reviews	fwd	copy_e	min	512	4.0946	6.0352	1.474
city-reviews	fwd	copy_e	sum	64	1.0820	2.7936	2.582
city-reviews	fwd	copy_e	sum	128	2.1098	2.9720	1.409
city-reviews	fwd	copy_e	sum	256	4.1811	3.4570	0.827
city-reviews	fwd	copy_e	sum	512	8.2123	5.5999	0.682
city-reviews	fwd	copy_u	max	64	0.4686	1.5594	3.328
city-reviews	fwd	copy_u	max	128	0.9209	1.9773	2.147
city-reviews	fwd	copy_u	max	256	1.9304	2.7868	1.444
city-reviews	fwd	copy_u	max	512	3.8819	5.1498	1.327
city-reviews	fwd	copy_u	min	64	0.4633	1.5648	3.378
city-reviews	fwd	copy_u	min	128	0.9327	1.9745	2.117
city-reviews	fwd	copy_u	min	256	1.9121	2.7791	1.453
city-reviews	fwd	copy_u	min	512	3.8874	5.1402	1.322
city-reviews	fwd	copy_u	sum	64	0.5340	1.6572	3.103
city-reviews	fwd	copy_u	sum	128	1.1121	1.9720	1.773
city-reviews	fwd	copy_u	sum	256	2.4219	2.7597	1.140
city-reviews	fwd	copy_u	sum	512	5.0675	4.4705	0.882
city-reviews	fwd	div	max	64	1.1209	4.2667	3.807
city-reviews	fwd	div	max	128	2.2186	5.6096	2.528
city-reviews	fwd	div	max	256	4.4818	8.3461	1.862
city-reviews	fwd	div	max	512	9.1828	15.6366	1.703
city-reviews	fwd	div	min	64	1.1687	4.2475	3.634
city-reviews	fwd	div	min	128	2.3144	5.6066	2.423
city-reviews	fwd	div	min	256	4.6450	8.3349	1.794
city-reviews	fwd	div	min	512	9.1031	15.6276	1.717
city-reviews	fwd	div	sum	64	1.3190	3.2983	2.501
city-reviews	fwd	div	sum	128	2.6435	4.4613	1.688
city-reviews	fwd	div	sum	256	5.1788	6.6730	1.289
city-reviews	fwd	div	sum	512	10.5206	12.4501	1.183
city-reviews	fwd	mul	max	64	1.1109	3.4820	3.134
city-reviews	fwd	mul	max	128	2.2006	4.0105	1.822
city-reviews	fwd	mul	max	256	4.3840	5.1239	1.169
city-reviews	fwd	mul	max	512	8.8606	9.4470	1.066
city-reviews	fwd	mul	min	64	1.1231	3.4846	3.103
city-reviews	fwd	mul	min	128	2.2511	4.0000	1.777
city-reviews	fwd	mul	min	256	4.5265	5.1331	1.134
city-reviews	fwd	mul	min	512	9.0958	9.4580	1.040
city-reviews	fwd	mul	sum	64	1.1233	2.5168	2.241
city-reviews	fwd	mul	sum	128	2.2527	2.8701	1.274
city-reviews	fwd	mul	sum	256	4.3449	3.4872	0.803
city-reviews	fwd	mul	sum	512	8.8674	6.2145	0.701
city-reviews	fwd	sub	max	64	1.1091	3.8613	3.482
city-reviews	fwd	sub	max	128	2.2003	4.7885	2.176
city-reviews	fwd	sub	max	256	4.4158	6.6940	1.516
city-reviews	fwd	sub	max	512	9.0384	12.5255	1.386
city-reviews	fwd	sub	min	64	1.1494	3.8614	3.359
city-reviews	fwd	sub	min	128	2.2931	4.7916	2.090
city-reviews	fwd	sub	min	256	4.5561	6.6993	1.470
city-reviews	fwd	sub	min	512	9.0353	12.5337	1.387
city-reviews	fwd	sub	sum	64	1.3382	2.8958	2.164
city-reviews	fwd	sub	sum	128	2.5859	3.6467	1.410
city-reviews	fwd	sub	sum	256	5.2021	5.0484	0.970
city-reviews	fwd	sub	sum	512	10.4049	9.2882	0.893
city-roads-L	bwd	add	max	64	0.5158	0.4165	0.807
city-roads-L	bwd	add	max	128	0.9262	0.7811	0.843
city-roads-L	bwd	add	max	256	1.7280	1.5315	0.886
city-roads-L	bwd	add	max	512	3.0203	3.0685	1.016
city-roads-L	bwd	add	min	64	0.5189	0.4162	0.802
city-roads-L	bwd	add	min	128	0.9272	0.7813	0.843
city-roads-L	bwd	add	min	256	1.7269	1.5318	0.887
city-roads-L	bwd	add	min	512	3.0256	3.0759	1.017
city-roads-L	bwd	add	sum	64	0.4036	0.4152	1.029
city-roads-L	bwd	add	sum	128	0.6983	0.7735	1.108

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-L	bwd	add	sum	256	1.2609	1.4915	1.183
city-roads-L	bwd	add	sum	512	2.0423	2.9188	1.429
city-roads-L	bwd	copy_e	max	64	0.3571	0.2513	0.704
city-roads-L	bwd	copy_e	max	128	0.6349	0.4734	0.746
city-roads-L	bwd	copy_e	max	256	1.1720	0.9301	0.794
city-roads-L	bwd	copy_e	max	512	2.0261	1.8598	0.918
city-roads-L	bwd	copy_e	min	64	0.3573	0.2513	0.703
city-roads-L	bwd	copy_e	min	128	0.6343	0.4737	0.747
city-roads-L	bwd	copy_e	min	256	1.1760	0.9326	0.793
city-roads-L	bwd	copy_e	min	512	2.0244	1.8603	0.919
city-roads-L	bwd	copy_e	sum	64	0.2191	0.2366	1.080
city-roads-L	bwd	copy_e	sum	128	0.2938	0.4184	1.424
city-roads-L	bwd	copy_e	sum	256	0.5235	0.8086	1.545
city-roads-L	bwd	copy_e	sum	512	0.8338	1.5735	1.887
city-roads-L	bwd	copy_u	max	64	0.1952	0.1682	0.862
city-roads-L	bwd	copy_u	max	128	0.2987	0.3171	1.061
city-roads-L	bwd	copy_u	max	256	0.5743	0.6084	1.059
city-roads-L	bwd	copy_u	max	512	1.1147	1.2220	1.096
city-roads-L	bwd	copy_u	min	64	0.2020	0.1660	0.822
city-roads-L	bwd	copy_u	min	128	0.2992	0.3118	1.042
city-roads-L	bwd	copy_u	min	256	0.5716	0.6093	1.066
city-roads-L	bwd	copy_u	min	512	1.1149	1.2188	1.093
city-roads-L	bwd	copy_u	sum	64	0.2316	0.2340	1.011
city-roads-L	bwd	copy_u	sum	128	0.4005	0.3574	0.892
city-roads-L	bwd	copy_u	sum	256	0.7386	0.6908	0.935
city-roads-L	bwd	copy_u	sum	512	1.2110	1.3514	1.116
city-roads-L	bwd	div	max	64	0.6222	1.0792	1.734
city-roads-L	bwd	div	max	128	1.1476	2.0562	1.792
city-roads-L	bwd	div	max	256	2.1691	4.0441	1.864
city-roads-L	bwd	div	max	512	4.0207	8.0274	1.997
city-roads-L	bwd	div	min	64	0.6211	1.0751	1.731
city-roads-L	bwd	div	min	128	1.1484	2.0558	1.790
city-roads-L	bwd	div	min	256	2.1682	4.0508	1.868
city-roads-L	bwd	div	min	512	4.0167	8.0266	1.998
city-roads-L	bwd	div	sum	64	1.1240	0.9161	0.815
city-roads-L	bwd	div	sum	128	1.2613	1.7464	1.385
city-roads-L	bwd	div	sum	256	2.3077	3.4157	1.480
city-roads-L	bwd	div	sum	512	4.0104	6.6873	1.667
city-roads-L	bwd	mul	max	64	0.6184	0.6804	1.100
city-roads-L	bwd	mul	max	128	1.1369	1.2774	1.124
city-roads-L	bwd	mul	max	256	2.1600	2.5154	1.165
city-roads-L	bwd	mul	max	512	3.9738	5.0225	1.264
city-roads-L	bwd	mul	min	64	0.6208	0.6804	1.096
city-roads-L	bwd	mul	min	128	1.1377	1.2782	1.123
city-roads-L	bwd	mul	min	256	2.1498	2.5115	1.168
city-roads-L	bwd	mul	min	512	3.9717	5.0405	1.269
city-roads-L	bwd	mul	sum	64	0.6476	0.5300	0.818
city-roads-L	bwd	mul	sum	128	1.1251	0.9862	0.877
city-roads-L	bwd	mul	sum	256	2.0351	1.9069	0.937
city-roads-L	bwd	mul	sum	512	3.4104	3.7205	1.091
city-roads-L	bwd	sub	max	64	0.5170	0.5002	0.968
city-roads-L	bwd	sub	max	128	0.9341	0.9513	1.018
city-roads-L	bwd	sub	max	256	1.7431	1.8900	1.084
city-roads-L	bwd	sub	max	512	3.0509	3.7320	1.223
city-roads-L	bwd	sub	min	64	0.5173	0.4997	0.966
city-roads-L	bwd	sub	min	128	0.9343	0.9515	1.018
city-roads-L	bwd	sub	min	256	1.7464	1.8806	1.077
city-roads-L	bwd	sub	min	512	3.0502	3.7317	1.223
city-roads-L	bwd	sub	sum	64	0.4038	0.4966	1.230
city-roads-L	bwd	sub	sum	128	0.6970	0.9300	1.334
city-roads-L	bwd	sub	sum	256	1.2634	1.8352	1.453
city-roads-L	bwd	sub	sum	512	2.0477	3.6125	1.764
city-roads-L	fb	add	max	64	0.8099	0.9255	1.143
city-roads-L	fb	add	max	128	1.4494	1.7538	1.210
city-roads-L	fb	add	max	256	2.7029	3.4533	1.278
city-roads-L	fb	add	max	512	4.7223	6.8493	1.450
city-roads-L	fb	add	min	64	0.8100	0.9253	1.142
city-roads-L	fb	add	min	128	1.4535	1.7602	1.211
city-roads-L	fb	add	min	256	2.7039	3.4596	1.279
city-roads-L	fb	add	min	512	4.7241	6.8535	1.451
city-roads-L	fb	add	sum	64	0.7407	0.6857	0.926
city-roads-L	fb	add	sum	128	1.2440	1.2716	1.022
city-roads-L	fb	add	sum	256	2.2640	2.4932	1.101
city-roads-L	fb	add	sum	512	3.8601	4.8672	1.261
city-roads-L	fb	copy_e	max	64	0.5945	0.6029	1.014
city-roads-L	fb	copy_e	max	128	1.0642	1.1437	1.075
city-roads-L	fb	copy_e	max	256	1.9778	2.2445	1.135
city-roads-L	fb	copy_e	max	512	3.4769	4.4396	1.277

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-L	fb	copy_e	min	64	0.5949	0.6029	1.014
city-roads-L	fb	copy_e	min	128	1.0629	1.1474	1.079
city-roads-L	fb	copy_e	min	256	1.9909	2.2389	1.125
city-roads-L	fb	copy_e	min	512	3.4749	4.4400	1.278
city-roads-L	fb	copy_e	sum	64	0.4225	0.4588	1.086
city-roads-L	fb	copy_e	sum	128	0.6621	0.8415	1.271
city-roads-L	fb	copy_e	sum	256	1.2042	1.6294	1.353
city-roads-L	fb	copy_e	sum	512	2.0343	3.1869	1.567
city-roads-L	fb	copy_u	max	64	0.4423	0.4705	1.064
city-roads-L	fb	copy_u	max	128	0.7662	0.8966	1.170
city-roads-L	fb	copy_u	max	256	1.4469	1.7547	1.213
city-roads-L	fb	copy_u	max	512	2.5725	3.4858	1.355
city-roads-L	fb	copy_u	min	64	0.4426	0.4702	1.062
city-roads-L	fb	copy_u	min	128	0.7669	0.9026	1.177
city-roads-L	fb	copy_u	min	256	1.4460	1.7497	1.210
city-roads-L	fb	copy_u	min	512	2.5757	3.4811	1.352
city-roads-L	fb	copy_u	sum	64	0.4623	0.4868	1.053
city-roads-L	fb	copy_u	sum	128	0.8045	0.7078	0.880
city-roads-L	fb	copy_u	sum	256	1.4737	1.3726	0.931
city-roads-L	fb	copy_u	sum	512	2.4228	2.6902	1.110
city-roads-L	fb	div	max	64	0.9178	1.7519	1.909
city-roads-L	fb	div	max	128	1.6728	3.3657	2.012
city-roads-L	fb	div	max	256	3.1511	6.6109	2.098
city-roads-L	fb	div	max	512	5.7079	13.1492	2.304
city-roads-L	fb	div	min	64	0.9180	1.7558	1.913
city-roads-L	fb	div	min	128	1.6729	3.3672	2.013
city-roads-L	fb	div	min	256	3.1483	6.6151	2.101
city-roads-L	fb	div	min	512	5.7139	13.1532	2.302
city-roads-L	fb	div	sum	64	1.1275	1.3500	1.197
city-roads-L	fb	div	sum	128	1.8122	2.5971	1.433
city-roads-L	fb	div	sum	256	3.3195	5.0791	1.530
city-roads-L	fb	div	sum	512	5.7660	9.9656	1.728
city-roads-L	fb	mul	max	64	0.9120	1.1871	1.302
city-roads-L	fb	mul	max	128	1.6651	2.2419	1.346
city-roads-L	fb	mul	max	256	3.1280	4.4200	1.413
city-roads-L	fb	mul	max	512	5.6592	8.7952	1.554
city-roads-L	fb	mul	min	64	0.9139	1.1847	1.296
city-roads-L	fb	mul	min	128	1.6603	2.2498	1.355
city-roads-L	fb	mul	min	256	3.1348	4.4188	1.410
city-roads-L	fb	mul	min	512	5.6816	8.8062	1.550
city-roads-L	fb	mul	sum	64	0.9642	0.7982	0.828
city-roads-L	fb	mul	sum	128	1.6682	1.4872	0.892
city-roads-L	fb	mul	sum	256	3.0359	2.9013	0.956
city-roads-L	fb	mul	sum	512	5.1569	5.6621	1.098
city-roads-L	fb	sub	max	64	0.8129	1.0871	1.337
city-roads-L	fb	sub	max	128	1.4581	2.0870	1.431
city-roads-L	fb	sub	max	256	2.7333	4.1459	1.517
city-roads-L	fb	sub	max	512	4.7454	8.2290	1.734
city-roads-L	fb	sub	min	64	1.2709	1.0869	0.855
city-roads-L	fb	sub	min	128	1.4585	2.0887	1.432
city-roads-L	fb	sub	min	256	2.7240	4.1412	1.520
city-roads-L	fb	sub	min	512	4.7522	8.2290	1.732
city-roads-L	fb	sub	sum	64	0.7182	0.8447	1.176
city-roads-L	fb	sub	sum	128	1.2436	1.6096	1.294
city-roads-L	fb	sub	sum	256	2.2661	3.1421	1.387
city-roads-L	fb	sub	sum	512	3.7972	6.1819	1.628
city-roads-L	fwd	add	max	64	0.2996	0.5128	1.712
city-roads-L	fwd	add	max	128	0.5637	0.9766	1.732
city-roads-L	fwd	add	max	256	1.0863	1.9257	1.773
city-roads-L	fwd	add	max	512	2.1069	3.7901	1.799
city-roads-L	fwd	add	min	64	0.2999	0.5130	1.710
city-roads-L	fwd	add	min	128	0.5633	0.9774	1.735
city-roads-L	fwd	add	min	256	1.1115	1.9268	1.734
city-roads-L	fwd	add	min	512	2.0626	3.7871	1.836
city-roads-L	fwd	add	sum	64	0.3158	0.2699	0.855
city-roads-L	fwd	add	sum	128	0.5625	0.5076	0.902
city-roads-L	fwd	add	sum	256	1.0269	0.9998	0.974
city-roads-L	fwd	add	sum	512	1.8349	1.9485	1.062
city-roads-L	fwd	copy_e	max	64	0.2416	0.3546	1.468
city-roads-L	fwd	copy_e	max	128	0.5121	0.6737	1.316
city-roads-L	fwd	copy_e	max	256	1.0287	1.3156	1.279
city-roads-L	fwd	copy_e	max	512	2.3231	2.5876	1.114
city-roads-L	fwd	copy_e	min	64	0.2413	0.3555	1.473
city-roads-L	fwd	copy_e	min	128	0.4332	0.6748	1.558
city-roads-L	fwd	copy_e	min	256	0.9719	1.3134	1.351
city-roads-L	fwd	copy_e	min	512	1.7135	2.5924	1.513
city-roads-L	fwd	copy_e	sum	64	0.2108	0.2267	1.076
city-roads-L	fwd	copy_e	sum	128	0.3840	0.4290	1.117

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-L	fwd	copy_e	sum	256	0.9472	0.8268	0.873
city-roads-L	fwd	copy_e	sum	512	1.2179	1.6203	1.330
city-roads-L	fwd	copy_u	max	64	0.2642	0.3082	1.167
city-roads-L	fwd	copy_u	max	128	0.4756	0.5932	1.247
city-roads-L	fwd	copy_u	max	256	0.8844	1.1448	1.294
city-roads-L	fwd	copy_u	max	512	1.7151	2.2669	1.322
city-roads-L	fwd	copy_u	min	64	0.2619	0.3078	1.175
city-roads-L	fwd	copy_u	min	128	0.4753	0.5886	1.238
city-roads-L	fwd	copy_u	min	256	0.8797	1.1446	1.301
city-roads-L	fwd	copy_u	min	512	1.4691	2.2662	1.543
city-roads-L	fwd	copy_u	sum	64	0.2236	0.1799	0.804
city-roads-L	fwd	copy_u	sum	128	0.3978	0.3553	0.893
city-roads-L	fwd	copy_u	sum	256	0.7394	0.6879	0.930
city-roads-L	fwd	copy_u	sum	512	1.2130	1.3472	1.111
city-roads-L	fwd	div	max	64	0.3081	0.6784	2.202
city-roads-L	fwd	div	max	128	0.5461	1.3162	2.410
city-roads-L	fwd	div	max	256	1.0817	2.6043	2.408
city-roads-L	fwd	div	max	512	2.5395	5.1655	2.034
city-roads-L	fwd	div	min	64	0.3003	0.6783	2.259
city-roads-L	fwd	div	min	128	0.5338	1.3163	2.466
city-roads-L	fwd	div	min	256	0.9818	2.6049	2.653
city-roads-L	fwd	div	min	512	2.0052	5.1627	2.575
city-roads-L	fwd	div	sum	64	0.3250	0.4364	1.343
city-roads-L	fwd	div	sum	128	0.5686	0.8392	1.476
city-roads-L	fwd	div	sum	256	1.0355	1.6661	1.609
city-roads-L	fwd	div	sum	512	1.8013	3.2818	1.822
city-roads-L	fwd	mul	max	64	0.3066	0.5128	1.672
city-roads-L	fwd	mul	max	128	0.8107	0.9766	1.205
city-roads-L	fwd	mul	max	256	1.2435	1.9266	1.549
city-roads-L	fwd	mul	max	512	2.0427	3.7903	1.856
city-roads-L	fwd	mul	min	64	0.2999	0.5133	1.711
city-roads-L	fwd	mul	min	128	0.5311	0.9769	1.839
city-roads-L	fwd	mul	min	256	1.0179	1.9264	1.892
city-roads-L	fwd	mul	min	512	2.0617	3.7874	1.837
city-roads-L	fwd	mul	sum	64	0.3274	0.2699	0.824
city-roads-L	fwd	mul	sum	128	0.5624	0.5078	0.903
city-roads-L	fwd	mul	sum	256	1.0245	1.0076	0.984
city-roads-L	fwd	mul	sum	512	1.7833	1.9497	1.093
city-roads-L	fwd	sub	max	64	0.3002	0.5933	1.976
city-roads-L	fwd	sub	max	128	0.7930	1.1327	1.428
city-roads-L	fwd	sub	max	256	2.1698	2.2770	1.049
city-roads-L	fwd	sub	max	512	2.0417	4.4973	2.203
city-roads-L	fwd	sub	min	64	0.4181	0.5942	1.421
city-roads-L	fwd	sub	min	128	0.5448	1.1362	2.085
city-roads-L	fwd	sub	min	256	1.4285	2.2703	1.589
city-roads-L	fwd	sub	min	512	2.3094	4.4991	1.948
city-roads-L	fwd	sub	sum	64	0.3232	0.3456	1.069
city-roads-L	fwd	sub	sum	128	0.5636	0.6625	1.175
city-roads-L	fwd	sub	sum	256	1.0276	1.3208	1.285
city-roads-L	fwd	sub	sum	512	1.7910	2.6018	1.453
city-roads-M	bwd	add	max	64	0.2239	0.2256	1.008
city-roads-M	bwd	add	max	128	0.3276	0.3432	1.048
city-roads-M	bwd	add	max	256	0.6211	0.6653	1.071
city-roads-M	bwd	add	max	512	1.0694	1.2823	1.199
city-roads-M	bwd	add	min	64	0.2287	0.2211	0.967
city-roads-M	bwd	add	min	128	0.3273	0.3428	1.047
city-roads-M	bwd	add	min	256	0.6269	0.6633	1.058
city-roads-M	bwd	add	min	512	1.0697	1.2865	1.203
city-roads-M	bwd	add	sum	64	0.2937	0.3628	1.235
city-roads-M	bwd	add	sum	128	0.3060	0.3467	1.133
city-roads-M	bwd	add	sum	256	0.4461	0.6558	1.470
city-roads-M	bwd	add	sum	512	0.6981	1.2958	1.856
city-roads-M	bwd	copy_e	max	64	0.1967	0.1542	0.784
city-roads-M	bwd	copy_e	max	128	0.2423	0.2117	0.874
city-roads-M	bwd	copy_e	max	256	0.4631	0.4068	0.879
city-roads-M	bwd	copy_e	max	512	0.8022	0.7803	0.973
city-roads-M	bwd	copy_e	min	64	0.1946	0.1545	0.794
city-roads-M	bwd	copy_e	min	128	0.2920	0.2112	0.723
city-roads-M	bwd	copy_e	min	256	0.4682	0.4046	0.864
city-roads-M	bwd	copy_e	min	512	0.8075	0.7815	0.968
city-roads-M	bwd	copy_e	sum	64	0.1893	0.2086	1.102
city-roads-M	bwd	copy_e	sum	128	0.2100	0.2022	0.963
city-roads-M	bwd	copy_e	sum	256	0.1930	0.3631	1.881
city-roads-M	bwd	copy_e	sum	512	0.3066	0.7276	2.373
city-roads-M	bwd	copy_u	max	64	0.1935	0.1769	0.914
city-roads-M	bwd	copy_u	max	128	0.1907	0.1587	0.832
city-roads-M	bwd	copy_u	max	256	0.2533	0.2587	1.021
city-roads-M	bwd	copy_u	max	512	0.4786	0.5073	1.060

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-M	bwd	copy_u	min	64	0.1871	0.1749	0.935
city-roads-M	bwd	copy_u	min	128	0.1876	0.1626	0.867
city-roads-M	bwd	copy_u	min	256	0.2457	0.2591	1.054
city-roads-M	bwd	copy_u	min	512	0.4790	0.5077	1.060
city-roads-M	bwd	copy_u	sum	64	0.2310	0.2775	1.201
city-roads-M	bwd	copy_u	sum	128	0.2242	0.2378	1.060
city-roads-M	bwd	copy_u	sum	256	0.2512	0.3016	1.201
city-roads-M	bwd	copy_u	sum	512	0.3928	0.5809	1.479
city-roads-M	bwd	div	max	64	0.2324	0.4922	2.117
city-roads-M	bwd	div	max	128	0.4317	0.9155	2.121
city-roads-M	bwd	div	max	256	0.8176	1.7683	2.163
city-roads-M	bwd	div	max	512	1.4911	3.4394	2.307
city-roads-M	bwd	div	min	64	0.2279	0.4909	2.153
city-roads-M	bwd	div	min	128	0.4303	0.9151	2.127
city-roads-M	bwd	div	min	256	0.8181	1.7728	2.167
city-roads-M	bwd	div	min	512	1.4928	3.4482	2.310
city-roads-M	bwd	div	sum	64	0.2605	0.4533	1.740
city-roads-M	bwd	div	sum	128	0.4626	0.7741	1.673
city-roads-M	bwd	div	sum	256	0.8596	1.4933	1.737
city-roads-M	bwd	div	sum	512	1.4740	2.9760	2.019
city-roads-M	bwd	mul	max	64	0.2247	0.3238	1.441
city-roads-M	bwd	mul	max	128	0.4258	0.5656	1.328
city-roads-M	bwd	mul	max	256	0.8077	1.0736	1.329
city-roads-M	bwd	mul	max	512	1.4740	2.0881	1.417
city-roads-M	bwd	mul	min	64	0.2469	0.3246	1.315
city-roads-M	bwd	mul	min	128	0.4255	0.5660	1.330
city-roads-M	bwd	mul	min	256	0.8107	1.0726	1.323
city-roads-M	bwd	mul	min	512	1.4770	2.0886	1.414
city-roads-M	bwd	mul	sum	64	0.2880	0.3868	1.343
city-roads-M	bwd	mul	sum	128	0.3965	0.4390	1.107
city-roads-M	bwd	mul	sum	256	0.7358	0.8379	1.139
city-roads-M	bwd	mul	sum	512	1.2003	1.6388	1.365
city-roads-M	bwd	sub	max	64	0.2437	0.2523	1.035
city-roads-M	bwd	sub	max	128	0.3314	0.4159	1.255
city-roads-M	bwd	sub	max	256	0.6354	0.8052	1.267
city-roads-M	bwd	sub	max	512	1.0811	1.5804	1.462
city-roads-M	bwd	sub	min	64	0.2295	0.2469	1.076
city-roads-M	bwd	sub	min	128	0.3316	0.4154	1.253
city-roads-M	bwd	sub	min	256	0.6405	0.8030	1.254
city-roads-M	bwd	sub	min	512	1.0818	1.5794	1.460
city-roads-M	bwd	sub	sum	64	0.2948	0.3943	1.338
city-roads-M	bwd	sub	sum	128	0.2948	0.4152	1.408
city-roads-M	bwd	sub	sum	256	0.4457	0.8163	1.832
city-roads-M	bwd	sub	sum	512	0.6998	1.5915	2.274
city-roads-M	fb	add	max	64	0.4464	0.5559	1.245
city-roads-M	fb	add	max	128	0.5052	0.7573	1.499
city-roads-M	fb	add	max	256	0.9526	1.4650	1.538
city-roads-M	fb	add	max	512	1.6148	2.8482	1.764
city-roads-M	fb	add	min	64	0.4521	0.5579	1.234
city-roads-M	fb	add	min	128	0.5041	0.7611	1.510
city-roads-M	fb	add	min	256	0.9473	1.4692	1.551
city-roads-M	fb	add	min	512	1.6165	2.8517	1.764
city-roads-M	fb	add	sum	64	0.5102	0.6721	1.317
city-roads-M	fb	add	sum	128	0.5094	0.6447	1.266
city-roads-M	fb	add	sum	256	0.7954	1.0924	1.373
city-roads-M	fb	add	sum	512	1.2986	2.1210	1.633
city-roads-M	fb	copy_e	max	64	0.4179	0.4008	0.959
city-roads-M	fb	copy_e	max	128	0.4404	0.4968	1.128
city-roads-M	fb	copy_e	max	256	0.7217	0.9597	1.330
city-roads-M	fb	copy_e	max	512	1.2629	1.8533	1.468
city-roads-M	fb	copy_e	min	64	0.4159	0.4026	0.968
city-roads-M	fb	copy_e	min	128	0.4414	0.4966	1.125
city-roads-M	fb	copy_e	min	256	0.7224	0.9532	1.320
city-roads-M	fb	copy_e	min	512	1.2622	1.8591	1.473
city-roads-M	fb	copy_e	sum	64	0.3866	0.4993	1.292
city-roads-M	fb	copy_e	sum	128	0.3977	0.4680	1.177
city-roads-M	fb	copy_e	sum	256	0.4266	0.7176	1.682
city-roads-M	fb	copy_e	sum	512	0.7194	1.4194	1.973
city-roads-M	fb	copy_u	max	64	0.4102	0.4344	1.059
city-roads-M	fb	copy_u	max	128	0.4265	0.4184	0.981
city-roads-M	fb	copy_u	max	256	0.5293	0.7340	1.387
city-roads-M	fb	copy_u	max	512	0.9348	1.4406	1.541
city-roads-M	fb	copy_u	min	64	0.4172	0.4284	1.027
city-roads-M	fb	copy_u	min	128	0.4142	0.4192	1.012
city-roads-M	fb	copy_u	min	256	0.5343	0.7385	1.382
city-roads-M	fb	copy_u	min	512	0.9350	1.4400	1.540
city-roads-M	fb	copy_u	sum	64	0.4308	0.5354	1.243
city-roads-M	fb	copy_u	sum	128	0.4310	0.5476	1.271

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-M	fb	copy_u	sum	256	0.5010	0.5932	1.184
city-roads-M	fb	copy_u	sum	512	0.7846	1.1505	1.466
city-roads-M	fb	div	max	64	0.4852	0.7867	1.621
city-roads-M	fb	div	max	128	0.6043	1.4738	2.439
city-roads-M	fb	div	max	256	1.1426	2.8411	2.486
city-roads-M	fb	div	max	512	2.0406	5.5969	2.743
city-roads-M	fb	div	min	64	0.4833	0.7868	1.628
city-roads-M	fb	div	min	128	0.6066	1.4702	2.424
city-roads-M	fb	div	min	256	1.1448	2.8451	2.485
city-roads-M	fb	div	min	512	2.0398	5.5902	2.741
city-roads-M	fb	div	sum	64	0.4981	0.8200	1.646
city-roads-M	fb	div	sum	128	0.6512	1.1403	1.751
city-roads-M	fb	div	sum	256	1.2073	2.2128	1.833
city-roads-M	fb	div	sum	512	2.0806	4.3947	2.112
city-roads-M	fb	mul	max	64	0.4411	0.6380	1.446
city-roads-M	fb	mul	max	128	0.6008	0.9732	1.620
city-roads-M	fb	mul	max	256	1.1318	1.8679	1.650
city-roads-M	fb	mul	max	512	2.0223	3.6396	1.800
city-roads-M	fb	mul	min	64	0.5353	0.6432	1.201
city-roads-M	fb	mul	min	128	0.6029	0.9737	1.615
city-roads-M	fb	mul	min	256	1.1329	1.8680	1.649
city-roads-M	fb	mul	min	512	2.0219	3.6368	1.799
city-roads-M	fb	mul	sum	64	0.5386	0.6748	1.253
city-roads-M	fb	mul	sum	128	0.5830	0.7180	1.232
city-roads-M	fb	mul	sum	256	1.0793	1.2691	1.176
city-roads-M	fb	mul	sum	512	1.7994	2.4634	1.369
city-roads-M	fb	sub	max	64	0.4975	0.6229	1.252
city-roads-M	fb	sub	max	128	0.5092	0.9068	1.781
city-roads-M	fb	sub	max	256	0.9553	1.7575	1.840
city-roads-M	fb	sub	max	512	1.6261	3.4398	2.115
city-roads-M	fb	sub	min	64	0.4420	0.6232	1.410
city-roads-M	fb	sub	min	128	1.3003	0.9016	0.693
city-roads-M	fb	sub	min	256	0.9558	1.7617	1.843
city-roads-M	fb	sub	min	512	1.6279	3.4395	2.113
city-roads-M	fb	sub	sum	64	0.4968	0.7320	1.473
city-roads-M	fb	sub	sum	128	0.5260	0.7022	1.335
city-roads-M	fb	sub	sum	256	0.7953	1.3772	1.732
city-roads-M	fb	sub	sum	512	1.3026	2.7160	2.085
city-roads-M	fwd	add	max	64	0.1003	0.2216	2.209
city-roads-M	fwd	add	max	128	0.3839	0.4182	1.089
city-roads-M	fwd	add	max	256	0.3573	0.8113	2.271
city-roads-M	fwd	add	max	512	0.7871	1.5692	1.994
city-roads-M	fwd	add	min	64	0.1028	0.2215	2.155
city-roads-M	fwd	add	min	128	0.1767	0.4187	2.370
city-roads-M	fwd	add	min	256	0.4632	0.8110	1.751
city-roads-M	fwd	add	min	512	0.7957	1.5698	1.973
city-roads-M	fwd	add	sum	64	0.1064	0.1129	1.061
city-roads-M	fwd	add	sum	128	0.1907	0.2171	1.138
city-roads-M	fwd	add	sum	256	0.3570	0.4288	1.201
city-roads-M	fwd	add	sum	512	0.6144	0.8295	1.350
city-roads-M	fwd	copy_e	max	64	0.0882	0.1552	1.760
city-roads-M	fwd	copy_e	max	128	0.1399	0.2885	2.062
city-roads-M	fwd	copy_e	max	256	0.2999	0.5530	1.844
city-roads-M	fwd	copy_e	max	512	0.6451	1.0753	1.667
city-roads-M	fwd	copy_e	min	64	0.0886	0.1551	1.749
city-roads-M	fwd	copy_e	min	128	0.1396	0.2885	2.066
city-roads-M	fwd	copy_e	min	256	0.3872	0.5539	1.430
city-roads-M	fwd	copy_e	min	512	0.7195	1.0749	1.494
city-roads-M	fwd	copy_e	sum	64	0.0799	0.0933	1.167
city-roads-M	fwd	copy_e	sum	128	0.1255	0.1849	1.473
city-roads-M	fwd	copy_e	sum	256	0.2489	0.3635	1.461
city-roads-M	fwd	copy_e	sum	512	0.4073	0.7011	1.721
city-roads-M	fwd	copy_u	max	64	0.0866	0.1381	1.594
city-roads-M	fwd	copy_u	max	128	0.1534	0.2526	1.647
city-roads-M	fwd	copy_u	max	256	0.2878	0.4795	1.666
city-roads-M	fwd	copy_u	max	512	0.4620	0.9391	2.033
city-roads-M	fwd	copy_u	min	64	0.0917	0.1400	1.526
city-roads-M	fwd	copy_u	min	128	0.1538	0.2526	1.642
city-roads-M	fwd	copy_u	min	256	0.7273	0.4794	0.659
city-roads-M	fwd	copy_u	min	512	0.5247	0.9368	1.785
city-roads-M	fwd	copy_u	sum	64	0.0788	0.0895	1.135
city-roads-M	fwd	copy_u	sum	128	0.1323	0.1385	1.047
city-roads-M	fwd	copy_u	sum	256	0.2489	0.2971	1.194
city-roads-M	fwd	copy_u	sum	512	0.3908	0.5769	1.476
city-roads-M	fwd	div	max	64	0.0995	0.2988	3.002
city-roads-M	fwd	div	max	128	0.1769	0.5651	3.195
city-roads-M	fwd	div	max	256	0.5287	1.1037	2.088
city-roads-M	fwd	div	max	512	0.7283	2.1626	2.969

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
city-roads-M	fwd	div	min	64	0.1000	0.3009	3.007
city-roads-M	fwd	div	min	128	0.2047	0.5656	2.763
city-roads-M	fwd	div	min	256	0.3870	1.1042	2.853
city-roads-M	fwd	div	min	512	0.7608	2.1640	2.844
city-roads-M	fwd	div	sum	64	0.1071	0.1910	1.784
city-roads-M	fwd	div	sum	128	0.1952	0.3631	1.860
city-roads-M	fwd	div	sum	256	0.3653	0.7154	1.959
city-roads-M	fwd	div	sum	512	0.6206	1.4175	2.284
city-roads-M	fwd	mul	max	64	0.1027	0.2216	2.158
city-roads-M	fwd	mul	max	128	0.1801	0.4180	2.321
city-roads-M	fwd	mul	max	256	0.3916	0.8116	2.072
city-roads-M	fwd	mul	max	512	0.7415	1.5696	2.117
city-roads-M	fwd	mul	min	64	0.0998	0.2241	2.244
city-roads-M	fwd	mul	min	128	0.1772	0.4177	2.358
city-roads-M	fwd	mul	min	256	0.3781	0.8108	2.144
city-roads-M	fwd	mul	min	512	0.5545	1.5693	2.830
city-roads-M	fwd	mul	sum	64	0.1064	0.1130	1.062
city-roads-M	fwd	mul	sum	128	0.1912	0.2190	1.145
city-roads-M	fwd	mul	sum	256	0.3541	0.4307	1.217
city-roads-M	fwd	mul	sum	512	0.6144	0.8327	1.355
city-roads-M	fwd	sub	max	64	0.1038	0.2597	2.503
city-roads-M	fwd	sub	max	128	0.1767	0.4906	2.777
city-roads-M	fwd	sub	max	256	0.3531	0.9516	2.695
city-roads-M	fwd	sub	max	512	0.7708	1.8658	2.420
city-roads-M	fwd	sub	min	64	0.0975	0.2596	2.664
city-roads-M	fwd	sub	min	128	0.1764	0.4902	2.779
city-roads-M	fwd	sub	min	256	0.3284	0.9523	2.900
city-roads-M	fwd	sub	min	512	0.7796	1.8634	2.390
city-roads-M	fwd	sub	sum	64	0.1064	0.1501	1.411
city-roads-M	fwd	sub	sum	128	0.1908	0.2849	1.493
city-roads-M	fwd	sub	sum	256	0.3572	0.5635	1.578
city-roads-M	fwd	sub	sum	512	0.6264	1.1155	1.781
cora	bwd	add	max	64	0.2107	0.2115	1.004
cora	bwd	add	max	128	0.2198	0.2308	1.050
cora	bwd	add	max	256	0.2217	0.2267	1.022
cora	bwd	add	max	512	0.2398	0.2224	0.928
cora	bwd	add	min	64	0.2068	0.2149	1.039
cora	bwd	add	min	128	0.2207	0.2160	0.979
cora	bwd	add	min	256	0.2264	0.2215	0.978
cora	bwd	add	min	512	0.2310	0.2235	0.968
cora	bwd	add	sum	64	0.2606	0.3812	1.463
cora	bwd	add	sum	128	0.2813	0.3749	1.333
cora	bwd	add	sum	256	0.2910	0.3800	1.306
cora	bwd	add	sum	512	0.3007	0.3739	1.243
cora	bwd	copy_e	max	64	0.1823	0.1577	0.865
cora	bwd	copy_e	max	128	0.2093	0.1507	0.720
cora	bwd	copy_e	max	256	0.2016	0.1594	0.791
cora	bwd	copy_e	max	512	0.1963	0.1557	0.793
cora	bwd	copy_e	min	64	0.1940	0.1562	0.805
cora	bwd	copy_e	min	128	0.1907	0.1549	0.812
cora	bwd	copy_e	min	256	0.1993	0.1520	0.763
cora	bwd	copy_e	min	512	0.2052	0.1661	0.809
cora	bwd	copy_e	sum	64	0.1833	0.2094	1.142
cora	bwd	copy_e	sum	128	0.3437	0.2030	0.591
cora	bwd	copy_e	sum	256	0.2152	0.2040	0.948
cora	bwd	copy_e	sum	512	0.1985	0.2062	1.039
cora	bwd	copy_u	max	64	0.1769	0.1815	1.026
cora	bwd	copy_u	max	128	0.2249	0.1750	0.778
cora	bwd	copy_u	max	256	0.1963	0.1777	0.905
cora	bwd	copy_u	max	512	0.1962	0.1791	0.913
cora	bwd	copy_u	min	64	0.1827	0.1782	0.976
cora	bwd	copy_u	min	128	0.1980	0.1746	0.882
cora	bwd	copy_u	min	256	0.1971	0.1784	0.905
cora	bwd	copy_u	min	512	0.1907	0.2007	1.053
cora	bwd	copy_u	sum	64	0.2075	0.2689	1.296
cora	bwd	copy_u	sum	128	0.2240	0.2765	1.235
cora	bwd	copy_u	sum	256	0.2272	0.2937	1.293
cora	bwd	copy_u	sum	512	0.2165	0.2731	1.261
cora	bwd	div	max	64	0.2159	0.3695	1.712
cora	bwd	div	max	128	0.2237	0.4040	1.806
cora	bwd	div	max	256	0.2193	0.3819	1.742
cora	bwd	div	max	512	0.4314	0.3938	0.913
cora	bwd	div	min	64	0.2057	0.3851	1.872
cora	bwd	div	min	128	0.2218	0.3761	1.696
cora	bwd	div	min	256	0.2249	0.3785	1.683
cora	bwd	div	min	512	0.4316	0.3711	0.860
cora	bwd	div	sum	64	0.2707	0.4586	1.694
cora	bwd	div	sum	128	0.2513	0.4846	1.928

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
cora	bwd	div	sum	256	0.2566	0.4597	1.791
cora	bwd	div	sum	512	0.3362	0.4680	1.392
cora	bwd	mul	max	64	0.2180	0.3094	1.419
cora	bwd	mul	max	128	0.2216	0.3131	1.413
cora	bwd	mul	max	256	0.2286	0.3107	1.359
cora	bwd	mul	max	512	0.4152	0.3214	0.774
cora	bwd	mul	min	64	0.2280	0.3105	1.362
cora	bwd	mul	min	128	0.2251	0.3096	1.375
cora	bwd	mul	min	256	0.2206	0.3183	1.443
cora	bwd	mul	min	512	0.4161	0.3204	0.770
cora	bwd	mul	sum	64	0.2466	0.4136	1.677
cora	bwd	mul	sum	128	0.2645	0.3694	1.397
cora	bwd	mul	sum	256	0.2779	0.3830	1.378
cora	bwd	mul	sum	512	0.2376	0.3907	1.644
cora	bwd	sub	max	64	0.2159	0.2472	1.145
cora	bwd	sub	max	128	0.2355	0.2349	0.997
cora	bwd	sub	max	256	0.2276	0.2503	1.100
cora	bwd	sub	max	512	0.2063	0.2458	1.191
cora	bwd	sub	min	64	0.2161	0.2399	1.110
cora	bwd	sub	min	128	0.2173	0.2407	1.108
cora	bwd	sub	min	256	0.2213	0.2662	1.203
cora	bwd	sub	min	512	0.2066	0.2441	1.182
cora	bwd	sub	sum	64	0.2947	0.3842	1.304
cora	bwd	sub	sum	128	0.2938	0.3866	1.316
cora	bwd	sub	sum	256	0.2890	0.3990	1.380
cora	bwd	sub	sum	512	0.3056	0.4023	1.316
cora	fb	add	max	64	0.4254	0.5759	1.354
cora	fb	add	max	128	0.4517	0.5733	1.269
cora	fb	add	max	256	0.4894	0.5707	1.166
cora	fb	add	max	512	0.4781	0.5715	1.195
cora	fb	add	min	64	0.4364	0.5383	1.234
cora	fb	add	min	128	0.4355	0.5537	1.271
cora	fb	add	min	256	0.4617	0.5790	1.254
cora	fb	add	min	512	0.4804	0.5684	1.183
cora	fb	add	sum	64	0.5032	0.6677	1.327
cora	fb	add	sum	128	0.4995	0.6772	1.356
cora	fb	add	sum	256	0.5123	0.7081	1.382
cora	fb	add	sum	512	0.5511	0.6805	1.235
cora	fb	copy_e	max	64	0.4120	0.4136	1.004
cora	fb	copy_e	max	128	0.4205	0.4097	0.974
cora	fb	copy_e	max	256	0.4271	0.4246	0.994
cora	fb	copy_e	max	512	0.4247	0.4338	1.021
cora	fb	copy_e	min	64	0.4183	0.4183	1.000
cora	fb	copy_e	min	128	0.4128	0.4190	1.015
cora	fb	copy_e	min	256	0.4259	0.4077	0.957
cora	fb	copy_e	min	512	0.4357	0.4176	0.958
cora	fb	copy_e	sum	64	0.4162	0.4919	1.182
cora	fb	copy_e	sum	128	0.5725	0.4791	0.837
cora	fb	copy_e	sum	256	0.4154	0.4844	1.166
cora	fb	copy_e	sum	512	0.4110	0.5206	1.267
cora	fb	copy_u	max	64	0.4104	0.4768	1.162
cora	fb	copy_u	max	128	0.4254	0.4477	1.052
cora	fb	copy_u	max	256	0.4228	0.4706	1.113
cora	fb	copy_u	max	512	0.4347	0.4670	1.074
cora	fb	copy_u	min	64	0.4411	0.4519	1.024
cora	fb	copy_u	min	128	0.4268	0.4484	1.051
cora	fb	copy_u	min	256	0.5021	0.4727	0.941
cora	fb	copy_u	min	512	0.4162	0.4505	1.083
cora	fb	copy_u	sum	64	0.4104	0.5869	1.430
cora	fb	copy_u	sum	128	0.4719	0.5619	1.191
cora	fb	copy_u	sum	256	0.4524	0.5864	1.296
cora	fb	copy_u	sum	512	0.4472	0.5972	1.335
cora	fb	div	max	64	0.4196	0.8300	1.978
cora	fb	div	max	128	0.4726	0.7789	1.648
cora	fb	div	max	256	0.4534	0.8195	1.808
cora	fb	div	max	512	0.6031	0.8175	1.355
cora	fb	div	min	64	0.4462	0.8219	1.842
cora	fb	div	min	128	0.4588	0.7773	1.694
cora	fb	div	min	256	0.4649	0.8203	1.764
cora	fb	div	min	512	0.6110	0.8064	1.320
cora	fb	div	sum	64	0.4859	0.8950	1.842
cora	fb	div	sum	128	0.4865	0.9048	1.860
cora	fb	div	sum	256	0.4893	0.8827	1.804
cora	fb	div	sum	512	0.5285	0.8316	1.574
cora	fb	mul	max	64	0.4651	0.6668	1.434
cora	fb	mul	max	128	0.4739	0.6529	1.378
cora	fb	mul	max	256	0.4675	0.6743	1.442
cora	fb	mul	max	512	0.5912	0.6633	1.122

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
cora	fb	mul	min	64	0.4482	0.6918	1.544
cora	fb	mul	min	128	0.4600	0.6274	1.364
cora	fb	mul	min	256	0.4555	0.6431	1.412
cora	fb	mul	min	512	0.5896	0.6590	1.118
cora	fb	mul	sum	64	0.5049	0.7391	1.464
cora	fb	mul	sum	128	0.5004	0.6754	1.350
cora	fb	mul	sum	256	0.4944	0.7026	1.421
cora	fb	mul	sum	512	0.3811	0.7132	1.871
cora	fb	sub	max	64	0.5294	0.6480	1.224
cora	fb	sub	max	128	0.4460	0.5961	1.337
cora	fb	sub	max	256	0.4521	0.6244	1.381
cora	fb	sub	max	512	0.3851	0.6122	1.590
cora	fb	sub	min	64	0.4468	0.6264	1.402
cora	fb	sub	min	128	0.4511	0.6014	1.333
cora	fb	sub	min	256	0.4671	0.6452	1.381
cora	fb	sub	min	512	0.4734	0.6430	1.358
cora	fb	sub	sum	64	0.4889	0.7456	1.525
cora	fb	sub	sum	128	0.5074	0.7669	1.512
cora	fb	sub	sum	256	0.5104	0.7333	1.437
cora	fb	sub	sum	512	0.5079	0.7220	1.422
cora	fwd	add	max	64	0.0941	0.1811	1.925
cora	fwd	add	max	128	0.0884	0.1784	2.019
cora	fwd	add	max	256	0.0968	0.1772	1.830
cora	fwd	add	max	512	0.1555	0.1797	1.155
cora	fwd	add	min	64	0.0890	0.1816	2.041
cora	fwd	add	min	128	0.0869	0.1793	2.063
cora	fwd	add	min	256	0.0882	0.1899	2.153
cora	fwd	add	min	512	0.1558	0.1834	1.177
cora	fwd	add	sum	64	0.0809	0.0993	1.228
cora	fwd	add	sum	128	0.0818	0.1015	1.242
cora	fwd	add	sum	256	0.0887	0.1094	1.234
cora	fwd	add	sum	512	0.1158	0.1010	0.872
cora	fwd	copy_e	max	64	0.0854	0.1452	1.700
cora	fwd	copy_e	max	128	0.0866	0.1376	1.589
cora	fwd	copy_e	max	256	0.0877	0.1366	1.559
cora	fwd	copy_e	max	512	0.0929	0.1378	1.483
cora	fwd	copy_e	min	64	0.0861	0.1351	1.570
cora	fwd	copy_e	min	128	0.0882	0.1375	1.558
cora	fwd	copy_e	min	256	0.0874	0.1349	1.544
cora	fwd	copy_e	min	512	0.0914	0.1524	1.667
cora	fwd	copy_e	sum	64	0.0799	0.0877	1.098
cora	fwd	copy_e	sum	128	0.0799	0.0886	1.109
cora	fwd	copy_e	sum	256	0.0788	0.0874	1.109
cora	fwd	copy_e	sum	512	0.0934	0.0946	1.013
cora	fwd	copy_u	max	64	0.0854	0.1359	1.591
cora	fwd	copy_u	max	128	0.0882	0.1378	1.562
cora	fwd	copy_u	max	256	0.0833	0.1368	1.643
cora	fwd	copy_u	max	512	0.0895	0.1371	1.532
cora	fwd	copy_u	min	64	0.0882	0.1366	1.549
cora	fwd	copy_u	min	128	0.0867	0.1480	1.706
cora	fwd	copy_u	min	256	0.0842	0.1437	1.706
cora	fwd	copy_u	min	512	0.0902	0.1388	1.538
cora	fwd	copy_u	sum	64	0.0809	0.0872	1.078
cora	fwd	copy_u	sum	128	0.0781	0.0898	1.150
cora	fwd	copy_u	sum	256	0.0811	0.0935	1.153
cora	fwd	copy_u	sum	512	0.0866	0.0898	1.037
cora	fwd	div	max	64	0.0866	0.2414	2.788
cora	fwd	div	max	128	0.0910	0.2239	2.459
cora	fwd	div	max	256	0.0926	0.2217	2.395
cora	fwd	div	max	512	0.1557	0.2328	1.495
cora	fwd	div	min	64	0.0860	0.2453	2.852
cora	fwd	div	min	128	0.0899	0.2395	2.664
cora	fwd	div	min	256	0.0865	0.2445	2.826
cora	fwd	div	min	512	0.1573	0.2303	1.464
cora	fwd	div	sum	64	0.0791	0.1570	1.986
cora	fwd	div	sum	128	0.0801	0.1439	1.796
cora	fwd	div	sum	256	0.0797	0.1553	1.949
cora	fwd	div	sum	512	0.1227	0.1532	1.249
cora	fwd	mul	max	64	0.0881	0.1975	2.241
cora	fwd	mul	max	128	0.0908	0.1782	1.963
cora	fwd	mul	max	256	0.0850	0.1783	2.099
cora	fwd	mul	max	512	0.1546	0.1863	1.205
cora	fwd	mul	min	64	0.0861	0.1970	2.289
cora	fwd	mul	min	128	0.0875	0.1784	2.039
cora	fwd	mul	min	256	0.0868	0.1776	2.047
cora	fwd	mul	min	512	0.1541	0.1838	1.192
cora	fwd	mul	sum	64	0.0816	0.1064	1.304
cora	fwd	mul	sum	128	0.0847	0.0995	1.175

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
cora	fwd	mul	sum	256	0.0807	0.1051	1.303
cora	fwd	mul	sum	512	0.1012	0.0998	0.986
cora	fwd	sub	max	64	0.0875	0.2189	2.503
cora	fwd	sub	max	128	0.0874	0.1964	2.247
cora	fwd	sub	max	256	0.0851	0.1980	2.327
cora	fwd	sub	max	512	0.1587	0.2003	1.262
cora	fwd	sub	min	64	0.0891	0.2166	2.431
cora	fwd	sub	min	128	0.0873	0.1971	2.257
cora	fwd	sub	min	256	0.0871	0.1959	2.250
cora	fwd	sub	min	512	0.1548	0.2089	1.349
cora	fwd	sub	sum	64	0.0809	0.1207	1.492
cora	fwd	sub	sum	128	0.0807	0.1183	1.467
cora	fwd	sub	sum	256	0.0824	0.1193	1.448
cora	fwd	sub	sum	512	0.1154	0.1206	1.045
hm-categories	bwd	copy_u	max	64	0.1891	0.1940	1.026
hm-categories	bwd	copy_u	max	128	0.2520	0.2822	1.120
hm-categories	bwd	copy_u	max	256	0.4226	0.4600	1.089
hm-categories	bwd	copy_u	max	512	0.7180	0.8181	1.139
hm-categories	bwd	copy_u	min	64	0.1840	0.1856	1.009
hm-categories	bwd	copy_u	min	128	0.2481	0.2778	1.120
hm-categories	bwd	copy_u	min	256	0.4555	0.4684	1.028
hm-categories	bwd	copy_u	min	512	0.7583	0.8309	1.096
hm-categories	bwd	copy_u	sum	64	2.2221	7.1503	3.218
hm-categories	bwd	copy_u	sum	128	4.2229	7.3078	1.731
hm-categories	bwd	copy_u	sum	256	8.7640	8.5935	0.981
hm-categories	bwd	copy_u	sum	512	19.0305	16.4477	0.864
hm-categories	fb	copy_u	max	64	2.1660	5.6038	2.587
hm-categories	fb	copy_u	max	128	3.7514	6.4637	1.723
hm-categories	fb	copy_u	max	256	7.4696	8.6747	1.161
hm-categories	fb	copy_u	max	512	16.1316	17.1936	1.066
hm-categories	fb	copy_u	min	64	2.1381	5.6367	2.636
hm-categories	fb	copy_u	min	128	3.8477	6.4654	1.680
hm-categories	fb	copy_u	min	256	7.6801	8.6794	1.130
hm-categories	fb	copy_u	min	512	15.9780	17.2207	1.078
hm-categories	fb	copy_u	sum	64	4.5294	13.5397	2.989
hm-categories	fb	copy_u	sum	128	8.5041	14.1009	1.658
hm-categories	fb	copy_u	sum	256	17.9019	16.9837	0.949
hm-categories	fb	copy_u	sum	512	39.3782	32.3738	0.822
hm-categories	fwd	copy_u	max	64	1.9096	5.5152	2.888
hm-categories	fwd	copy_u	max	128	3.6437	6.1897	1.699
hm-categories	fwd	copy_u	max	256	7.2628	8.2193	1.132
hm-categories	fwd	copy_u	max	512	15.5890	16.3864	1.051
hm-categories	fwd	copy_u	min	64	1.9039	5.4825	2.880
hm-categories	fwd	copy_u	min	128	3.6275	6.1906	1.707
hm-categories	fwd	copy_u	min	256	7.3107	8.2220	1.125
hm-categories	fwd	copy_u	min	512	15.6775	16.3936	1.046
hm-categories	fwd	copy_u	sum	64	2.2186	6.4025	2.886
hm-categories	fwd	copy_u	sum	128	4.1597	6.7863	1.631
hm-categories	fwd	copy_u	sum	256	8.8532	8.4146	0.950
hm-categories	fwd	copy_u	sum	512	19.5086	15.8604	0.813
ogbn-arxiv	bwd	add	max	64	0.9456	0.6343	0.671
ogbn-arxiv	bwd	add	max	128	1.7240	1.2382	0.718
ogbn-arxiv	bwd	add	max	256	3.2709	2.4949	0.763
ogbn-arxiv	bwd	add	max	512	6.0940	5.0471	0.828
ogbn-arxiv	bwd	add	min	64	0.9459	0.6347	0.671
ogbn-arxiv	bwd	add	min	128	1.7189	1.2384	0.720
ogbn-arxiv	bwd	add	min	256	3.2813	2.4898	0.759
ogbn-arxiv	bwd	add	min	512	6.1023	5.0579	0.829
ogbn-arxiv	bwd	add	sum	64	0.5812	0.9202	1.583
ogbn-arxiv	bwd	add	sum	128	0.9683	1.6573	1.712
ogbn-arxiv	bwd	add	sum	256	1.8017	3.2369	1.797
ogbn-arxiv	bwd	add	sum	512	3.1461	6.4037	2.035
ogbn-arxiv	bwd	copy_e	max	64	0.6667	0.4301	0.645
ogbn-arxiv	bwd	copy_e	max	128	1.2372	0.8041	0.650
ogbn-arxiv	bwd	copy_e	max	256	2.4019	1.6044	0.668
ogbn-arxiv	bwd	copy_e	max	512	4.5920	3.1832	0.693
ogbn-arxiv	bwd	copy_e	min	64	0.6673	0.4261	0.638
ogbn-arxiv	bwd	copy_e	min	128	1.2405	0.8016	0.646
ogbn-arxiv	bwd	copy_e	min	256	2.4076	1.6079	0.668
ogbn-arxiv	bwd	copy_e	min	512	4.6135	3.1744	0.688
ogbn-arxiv	bwd	copy_e	sum	64	0.4247	0.5388	1.269
ogbn-arxiv	bwd	copy_e	sum	128	0.4564	1.0042	2.200
ogbn-arxiv	bwd	copy_e	sum	256	0.8437	1.9691	2.334
ogbn-arxiv	bwd	copy_e	sum	512	1.5267	3.9317	2.575
ogbn-arxiv	bwd	copy_u	max	64	0.2280	0.2127	0.933
ogbn-arxiv	bwd	copy_u	max	128	0.5141	0.4330	0.842
ogbn-arxiv	bwd	copy_u	max	256	1.1058	0.9144	0.827
ogbn-arxiv	bwd	copy_u	max	512	2.2650	1.8809	0.830

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
ogbn-arxiv	bwd	copy_u	min	64	0.2264	0.2142	0.946
ogbn-arxiv	bwd	copy_u	min	128	0.5217	0.4332	0.830
ogbn-arxiv	bwd	copy_u	min	256	1.1059	0.9187	0.831
ogbn-arxiv	bwd	copy_u	min	512	2.2647	1.8827	0.831
ogbn-arxiv	bwd	copy_u	sum	64	0.2649	0.3907	1.475
ogbn-arxiv	bwd	copy_u	sum	128	0.4895	0.6648	1.358
ogbn-arxiv	bwd	copy_u	sum	256	0.9396	1.2581	1.339
ogbn-arxiv	bwd	copy_u	sum	512	1.6186	2.4733	1.528
ogbn-arxiv	bwd	div	max	64	1.1226	2.0152	1.795
ogbn-arxiv	bwd	div	max	128	2.0532	3.9518	1.925
ogbn-arxiv	bwd	div	max	256	3.9687	7.9285	1.998
ogbn-arxiv	bwd	div	max	512	7.5105	15.9432	2.123
ogbn-arxiv	bwd	div	min	64	1.1192	2.0169	1.802
ogbn-arxiv	bwd	div	min	128	2.0507	3.9520	1.927
ogbn-arxiv	bwd	div	min	256	3.9628	7.9364	2.003
ogbn-arxiv	bwd	div	min	512	7.5535	15.9427	2.111
ogbn-arxiv	bwd	div	sum	64	1.2971	2.2644	1.746
ogbn-arxiv	bwd	div	sum	128	2.3194	4.1917	1.807
ogbn-arxiv	bwd	div	sum	256	4.3375	8.1222	1.873
ogbn-arxiv	bwd	div	sum	512	8.1347	16.2196	1.994
ogbn-arxiv	bwd	mul	max	64	1.1025	0.9866	0.895
ogbn-arxiv	bwd	mul	max	128	2.0312	1.9254	0.948
ogbn-arxiv	bwd	mul	max	256	3.9212	3.9227	1.000
ogbn-arxiv	bwd	mul	max	512	7.5075	7.8538	1.046
ogbn-arxiv	bwd	mul	min	64	1.1039	0.9950	0.901
ogbn-arxiv	bwd	mul	min	128	2.0315	1.9247	0.947
ogbn-arxiv	bwd	mul	min	256	3.9253	3.9244	1.000
ogbn-arxiv	bwd	mul	min	512	7.5019	7.8525	1.047
ogbn-arxiv	bwd	mul	sum	64	1.0688	1.2261	1.147
ogbn-arxiv	bwd	mul	sum	128	1.8695	2.1845	1.168
ogbn-arxiv	bwd	mul	sum	256	3.4578	4.1469	1.199
ogbn-arxiv	bwd	mul	sum	512	6.2707	8.1426	1.299
ogbn-arxiv	bwd	sub	max	64	0.9575	0.8604	0.899
ogbn-arxiv	bwd	sub	max	128	1.7425	1.6850	0.967
ogbn-arxiv	bwd	sub	max	256	3.3259	3.4169	1.027
ogbn-arxiv	bwd	sub	max	512	6.1502	6.8503	1.114
ogbn-arxiv	bwd	sub	min	64	0.9570	0.8633	0.902
ogbn-arxiv	bwd	sub	min	128	1.7383	1.6845	0.969
ogbn-arxiv	bwd	sub	min	256	3.3188	3.4074	1.027
ogbn-arxiv	bwd	sub	min	512	6.1501	6.8580	1.115
ogbn-arxiv	bwd	sub	sum	64	0.5805	1.1410	1.965
ogbn-arxiv	bwd	sub	sum	128	0.9697	2.1014	2.167
ogbn-arxiv	bwd	sub	sum	256	1.7901	4.0914	2.286
ogbn-arxiv	bwd	sub	sum	512	3.1591	8.2119	2.599
ogbn-arxiv	fb	add	max	64	2.5991	5.7178	2.200
ogbn-arxiv	fb	add	max	128	5.0470	6.7438	1.336
ogbn-arxiv	fb	add	max	256	9.9519	9.1940	0.924
ogbn-arxiv	fb	add	max	512	19.6261	14.9395	0.761
ogbn-arxiv	fb	add	min	64	2.5856	5.7198	2.212
ogbn-arxiv	fb	add	min	128	5.0310	6.7147	1.335
ogbn-arxiv	fb	add	min	256	9.9587	9.1708	0.921
ogbn-arxiv	fb	add	min	512	19.4889	14.9335	0.766
ogbn-arxiv	fb	add	sum	64	2.5467	5.4270	2.131
ogbn-arxiv	fb	add	sum	128	4.8919	6.3103	1.290
ogbn-arxiv	fb	add	sum	256	9.7537	8.4926	0.871
ogbn-arxiv	fb	add	sum	512	18.9156	13.4735	0.712
ogbn-arxiv	fb	copy_e	max	64	1.2854	3.9827	3.098
ogbn-arxiv	fb	copy_e	max	128	2.4760	4.6525	1.879
ogbn-arxiv	fb	copy_e	max	256	4.8729	6.3057	1.294
ogbn-arxiv	fb	copy_e	max	512	9.6217	9.9794	1.037
ogbn-arxiv	fb	copy_e	min	64	1.2845	3.9821	3.100
ogbn-arxiv	fb	copy_e	min	128	2.4768	4.6364	1.872
ogbn-arxiv	fb	copy_e	min	256	4.8248	6.3134	1.309
ogbn-arxiv	fb	copy_e	min	512	9.6936	9.9815	1.030
ogbn-arxiv	fb	copy_e	sum	64	1.9990	5.2054	2.604
ogbn-arxiv	fb	copy_e	sum	128	3.7835	5.8153	1.537
ogbn-arxiv	fb	copy_e	sum	256	7.3806	7.3128	0.991
ogbn-arxiv	fb	copy_e	sum	512	14.4278	10.7352	0.744
ogbn-arxiv	fb	copy_u	max	64	0.8940	2.6505	2.965
ogbn-arxiv	fb	copy_u	max	128	1.9023	3.2794	1.724
ogbn-arxiv	fb	copy_u	max	256	4.0360	4.9736	1.232
ogbn-arxiv	fb	copy_u	max	512	8.3144	7.8938	0.949
ogbn-arxiv	fb	copy_u	min	64	0.8947	2.6483	2.960
ogbn-arxiv	fb	copy_u	min	128	1.8961	3.2925	1.736
ogbn-arxiv	fb	copy_u	min	256	4.0530	4.9736	1.227
ogbn-arxiv	fb	copy_u	min	512	8.3529	7.8878	0.944
ogbn-arxiv	fb	copy_u	sum	64	1.0832	3.0826	2.846
ogbn-arxiv	fb	copy_u	sum	128	2.2655	3.7717	1.665

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
ogbn-arxiv	fb	copy_u	sum	256	4.9199	5.5587	1.130
ogbn-arxiv	fb	copy_u	sum	512	10.1110	8.2050	0.811
ogbn-arxiv	fb	div	max	64	2.7760	7.5585	2.723
ogbn-arxiv	fb	div	max	128	5.4006	10.3277	1.912
ogbn-arxiv	fb	div	max	256	10.7123	16.4297	1.534
ogbn-arxiv	fb	div	max	512	21.2377	29.4205	1.385
ogbn-arxiv	fb	div	min	64	2.7910	7.5539	2.706
ogbn-arxiv	fb	div	min	128	5.4378	10.3367	1.901
ogbn-arxiv	fb	div	min	256	10.7335	16.4278	1.531
ogbn-arxiv	fb	div	min	512	21.2331	29.4118	1.385
ogbn-arxiv	fb	div	sum	64	3.2960	7.2050	2.186
ogbn-arxiv	fb	div	sum	128	6.3285	9.7450	1.540
ogbn-arxiv	fb	div	sum	256	12.3551	15.1945	1.230
ogbn-arxiv	fb	div	sum	512	24.2653	26.9274	1.110
ogbn-arxiv	fb	mul	max	64	2.7396	6.0710	2.216
ogbn-arxiv	fb	mul	max	128	5.3497	7.3946	1.382
ogbn-arxiv	fb	mul	max	256	10.5515	10.5922	1.004
ogbn-arxiv	fb	mul	max	512	20.9334	17.6726	0.844
ogbn-arxiv	fb	mul	min	64	2.7445	6.0810	2.216
ogbn-arxiv	fb	mul	min	128	5.3610	7.3756	1.376
ogbn-arxiv	fb	mul	min	256	10.6142	10.5934	0.998
ogbn-arxiv	fb	mul	min	512	21.0824	17.6888	0.839
ogbn-arxiv	fb	mul	sum	64	2.6955	5.7260	2.124
ogbn-arxiv	fb	mul	sum	128	5.1149	6.8463	1.338
ogbn-arxiv	fb	mul	sum	256	10.1125	9.3958	0.929
ogbn-arxiv	fb	mul	sum	512	19.3992	15.1987	0.783
ogbn-arxiv	fb	sub	max	64	2.5852	6.1699	2.387
ogbn-arxiv	fb	sub	max	128	5.0330	7.6208	1.514
ogbn-arxiv	fb	sub	max	256	9.9968	10.9736	1.098
ogbn-arxiv	fb	sub	max	512	19.6816	18.5172	0.941
ogbn-arxiv	fb	sub	min	64	2.5883	6.1861	2.390
ogbn-arxiv	fb	sub	min	128	5.0914	7.6238	1.497
ogbn-arxiv	fb	sub	min	256	10.0364	10.9795	1.094
ogbn-arxiv	fb	sub	min	512	19.6196	18.5250	0.944
ogbn-arxiv	fb	sub	sum	64	2.5599	5.8806	2.297
ogbn-arxiv	fb	sub	sum	128	4.9152	7.1642	1.458
ogbn-arxiv	fb	sub	sum	256	9.7548	10.2763	1.053
ogbn-arxiv	fb	sub	sum	512	19.1975	17.0583	0.889
ogbn-arxiv	fwd	add	max	64	1.6874	5.0868	3.014
ogbn-arxiv	fwd	add	max	128	3.3659	5.5056	1.636
ogbn-arxiv	fwd	add	max	256	6.8843	6.6891	0.972
ogbn-arxiv	fwd	add	max	512	14.0076	9.9000	0.707
ogbn-arxiv	fwd	add	min	64	1.6450	5.0901	3.094
ogbn-arxiv	fwd	add	min	128	3.3448	5.4988	1.644
ogbn-arxiv	fwd	add	min	256	6.9045	6.6845	0.968
ogbn-arxiv	fwd	add	min	512	13.6259	9.8950	0.726
ogbn-arxiv	fwd	add	sum	64	1.9632	4.5068	2.296
ogbn-arxiv	fwd	add	sum	128	3.9308	4.6450	1.182
ogbn-arxiv	fwd	add	sum	256	8.0230	5.2679	0.657
ogbn-arxiv	fwd	add	sum	512	16.0676	7.0822	0.441
ogbn-arxiv	fwd	copy_e	max	64	0.6195	3.5611	5.749
ogbn-arxiv	fwd	copy_e	max	128	1.2822	3.8408	2.995
ogbn-arxiv	fwd	copy_e	max	256	2.5132	4.7241	1.880
ogbn-arxiv	fwd	copy_e	max	512	5.1131	6.8104	1.332
ogbn-arxiv	fwd	copy_e	min	64	0.6410	3.5602	5.554
ogbn-arxiv	fwd	copy_e	min	128	1.2645	3.8499	3.045
ogbn-arxiv	fwd	copy_e	min	256	2.4973	4.7136	1.887
ogbn-arxiv	fwd	copy_e	min	512	5.1870	6.7906	1.309
ogbn-arxiv	fwd	copy_e	sum	64	1.6642	4.6773	2.811
ogbn-arxiv	fwd	copy_e	sum	128	3.3058	4.8243	1.459
ogbn-arxiv	fwd	copy_e	sum	256	6.4325	5.3590	0.833
ogbn-arxiv	fwd	copy_e	sum	512	12.8759	6.7951	0.528
ogbn-arxiv	fwd	copy_u	max	64	0.6641	2.4373	3.670
ogbn-arxiv	fwd	copy_u	max	128	1.3941	2.8645	2.055
ogbn-arxiv	fwd	copy_u	max	256	2.9820	4.0651	1.363
ogbn-arxiv	fwd	copy_u	max	512	6.1267	6.0146	0.982
ogbn-arxiv	fwd	copy_u	min	64	0.6596	2.4332	3.689
ogbn-arxiv	fwd	copy_u	min	128	1.3951	2.8609	2.051
ogbn-arxiv	fwd	copy_u	min	256	2.9909	4.0636	1.359
ogbn-arxiv	fwd	copy_u	min	512	6.1151	6.0175	0.984
ogbn-arxiv	fwd	copy_u	sum	64	0.7919	2.6981	3.407
ogbn-arxiv	fwd	copy_u	sum	128	1.7787	3.1214	1.755
ogbn-arxiv	fwd	copy_u	sum	256	3.9717	4.3017	1.083
ogbn-arxiv	fwd	copy_u	sum	512	8.4831	5.7471	0.677
ogbn-arxiv	fwd	div	max	64	1.6944	5.5572	3.280
ogbn-arxiv	fwd	div	max	128	3.4148	6.3991	1.874
ogbn-arxiv	fwd	div	max	256	7.0291	8.4870	1.207
ogbn-arxiv	fwd	div	max	512	14.0726	13.5478	0.963

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
ogbn-arxiv	fwd	div	min	64	1.6967	5.5516	3.272
ogbn-arxiv	fwd	div	min	128	3.4164	6.3984	1.873
ogbn-arxiv	fwd	div	min	256	6.9703	8.4922	1.218
ogbn-arxiv	fwd	div	min	512	13.8942	13.5353	0.974
ogbn-arxiv	fwd	div	sum	64	1.9678	4.9664	2.524
ogbn-arxiv	fwd	div	sum	128	4.0336	5.5594	1.378
ogbn-arxiv	fwd	div	sum	256	8.1353	7.0683	0.869
ogbn-arxiv	fwd	div	sum	512	16.5794	10.7079	0.646
ogbn-arxiv	fwd	mul	max	64	1.6933	5.0909	3.006
ogbn-arxiv	fwd	mul	max	128	3.3867	5.4950	1.623
ogbn-arxiv	fwd	mul	max	256	6.9037	6.6789	0.967
ogbn-arxiv	fwd	mul	max	512	13.8496	9.8678	0.713
ogbn-arxiv	fwd	mul	min	64	1.6341	5.0928	3.117
ogbn-arxiv	fwd	mul	min	128	3.3477	5.5054	1.645
ogbn-arxiv	fwd	mul	min	256	6.8764	6.6785	0.971
ogbn-arxiv	fwd	mul	min	512	13.7838	9.8823	0.717
ogbn-arxiv	fwd	mul	sum	64	1.6680	4.5108	2.704
ogbn-arxiv	fwd	mul	sum	128	3.3512	4.6491	1.387
ogbn-arxiv	fwd	mul	sum	256	6.7623	5.2608	0.778
ogbn-arxiv	fwd	mul	sum	512	13.5287	7.0817	0.523
ogbn-arxiv	fwd	sub	max	64	1.6771	5.3044	3.163
ogbn-arxiv	fwd	sub	max	128	3.4631	5.9414	1.716
ogbn-arxiv	fwd	sub	max	256	6.9181	7.5691	1.094
ogbn-arxiv	fwd	sub	max	512	13.9384	11.6693	0.837
ogbn-arxiv	fwd	sub	min	64	1.6608	5.3184	3.202
ogbn-arxiv	fwd	sub	min	128	3.3440	5.9264	1.772
ogbn-arxiv	fwd	sub	min	256	6.7608	7.5713	1.120
ogbn-arxiv	fwd	sub	min	512	13.8048	11.6555	0.844
ogbn-arxiv	fwd	sub	sum	64	1.9980	4.7414	2.373
ogbn-arxiv	fwd	sub	sum	128	3.9948	5.0892	1.274
ogbn-arxiv	fwd	sub	sum	256	8.1937	6.1543	0.751
ogbn-arxiv	fwd	sub	sum	512	16.4284	8.8695	0.540
ogbn-products	bwd	copy_u	max	64	13.7501	9.8667	0.718
ogbn-products	bwd	copy_u	max	128	29.6977	21.2524	0.716
ogbn-products	bwd	copy_u	max	256	58.9270	46.0251	0.781
ogbn-products	bwd	copy_u	max	512	123.1265	96.4661	0.783
ogbn-products	bwd	copy_u	min	64	13.7391	9.8698	0.718
ogbn-products	bwd	copy_u	min	128	29.6818	21.2677	0.717
ogbn-products	bwd	copy_u	min	256	58.9533	46.0063	0.780
ogbn-products	bwd	copy_u	min	512	123.1409	96.3336	0.782
ogbn-products	bwd	copy_u	sum	64	16.5686	27.6778	1.670
ogbn-products	bwd	copy_u	sum	128	30.8622	46.4077	1.504
ogbn-products	bwd	copy_u	sum	256	61.2247	87.1511	1.423
ogbn-products	bwd	copy_u	sum	512	123.7424	172.3736	1.393
ogbn-products	fb	copy_u	max	64	30.7156	41.3400	1.346
ogbn-products	fb	copy_u	max	128	61.2342	73.8402	1.206
ogbn-products	fb	copy_u	max	256	149.2710	144.1120	0.965
ogbn-products	fb	copy_u	max	512	304.3282	291.3079	0.957
ogbn-products	fb	copy_u	min	64	30.7266	41.3441	1.346
ogbn-products	fb	copy_u	min	128	61.2311	73.8414	1.206
ogbn-products	fb	copy_u	min	256	153.2847	144.0788	0.940
ogbn-products	fb	copy_u	min	512	303.6015	291.1748	0.959
ogbn-products	fb	copy_u	sum	64	33.1601	55.3183	1.668
ogbn-products	fb	copy_u	sum	128	61.8012	92.7533	1.501
ogbn-products	fb	copy_u	sum	256	122.5419	174.2549	1.422
ogbn-products	fb	copy_u	sum	512	269.3409	344.6732	1.280
ogbn-products	fwd	copy_u	max	64	17.0203	31.4855	1.850
ogbn-products	fwd	copy_u	max	128	31.5998	52.6092	1.665
ogbn-products	fwd	copy_u	max	256	90.4307	98.1104	1.085
ogbn-products	fwd	copy_u	max	512	171.5782	194.8705	1.136
ogbn-products	fwd	copy_u	min	64	16.9978	31.4900	1.853
ogbn-products	fwd	copy_u	min	128	31.5408	52.6065	1.668
ogbn-products	fwd	copy_u	min	256	63.1958	98.0984	1.552
ogbn-products	fwd	copy_u	min	512	158.8181	194.8720	1.227
ogbn-products	fwd	copy_u	sum	64	16.5551	27.6545	1.670
ogbn-products	fwd	copy_u	sum	128	30.8180	46.3801	1.505
ogbn-products	fwd	copy_u	sum	256	61.1012	87.1328	1.426
ogbn-products	fwd	copy_u	sum	512	120.6923	172.3364	1.428
ogbn-proteins	bwd	copy_u	max	64	0.3365	0.2656	0.789
ogbn-proteins	bwd	copy_u	max	128	0.5705	0.4996	0.876
ogbn-proteins	bwd	copy_u	max	256	1.0172	0.9616	0.945
ogbn-proteins	bwd	copy_u	max	512	2.0967	1.9116	0.912
ogbn-proteins	bwd	copy_u	min	64	0.3369	0.2693	0.800
ogbn-proteins	bwd	copy_u	min	128	0.5705	0.4996	0.876
ogbn-proteins	bwd	copy_u	min	256	1.0214	0.9592	0.939
ogbn-proteins	bwd	copy_u	min	512	2.0749	1.9197	0.925
ogbn-proteins	bwd	copy_u	sum	64	5.2808	10.1963	1.931
ogbn-proteins	bwd	copy_u	sum	128	9.6071	16.4192	1.709

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
ogbn-proteins	bwd	copy_u	sum	256	19.2390	29.4616	1.531
ogbn-proteins	bwd	copy_u	sum	512	40.8700	58.7281	1.437
ogbn-proteins	fb	copy_u	max	64	6.4688	10.7955	1.669
ogbn-proteins	fb	copy_u	max	128	12.0288	17.7806	1.478
ogbn-proteins	fb	copy_u	max	256	23.5973	31.9535	1.354
ogbn-proteins	fb	copy_u	max	512	48.0453	63.8444	1.329
ogbn-proteins	fb	copy_u	min	64	6.4630	10.7904	1.670
ogbn-proteins	fb	copy_u	min	128	12.0092	17.7814	1.481
ogbn-proteins	fb	copy_u	min	256	23.6102	31.9512	1.353
ogbn-proteins	fb	copy_u	min	512	48.0589	63.8590	1.329
ogbn-proteins	fb	copy_u	sum	64	10.4929	20.3381	1.938
ogbn-proteins	fb	copy_u	sum	128	19.1858	32.7867	1.709
ogbn-proteins	fb	copy_u	sum	256	38.3152	58.8429	1.536
ogbn-proteins	fb	copy_u	sum	512	81.9283	117.4138	1.433
ogbn-proteins	fwd	copy_u	max	64	6.1327	10.5417	1.719
ogbn-proteins	fwd	copy_u	max	128	11.4427	17.2871	1.511
ogbn-proteins	fwd	copy_u	max	256	22.5803	31.0016	1.373
ogbn-proteins	fwd	copy_u	max	512	45.9952	61.9432	1.347
ogbn-proteins	fwd	copy_u	min	64	6.1331	10.5452	1.719
ogbn-proteins	fwd	copy_u	min	128	11.4472	17.2830	1.510
ogbn-proteins	fwd	copy_u	min	256	22.5778	31.0035	1.373
ogbn-proteins	fwd	copy_u	min	512	45.9558	61.9434	1.348
ogbn-proteins	fwd	copy_u	sum	64	5.2516	10.1717	1.937
ogbn-proteins	fwd	copy_u	sum	128	9.5946	16.3926	1.709
ogbn-proteins	fwd	copy_u	sum	256	19.0995	29.4069	1.540
ogbn-proteins	fwd	copy_u	sum	512	40.7025	58.7141	1.443
pokec-regions	bwd	copy_u	max	64	5.1667	3.5924	0.695
pokec-regions	bwd	copy_u	max	128	11.1779	7.5406	0.675
pokec-regions	bwd	copy_u	max	256	21.8430	16.4113	0.751
pokec-regions	bwd	copy_u	max	512	46.1982	34.1433	0.739
pokec-regions	bwd	copy_u	min	64	5.1547	3.5968	0.698
pokec-regions	bwd	copy_u	min	128	11.1667	7.5487	0.676
pokec-regions	bwd	copy_u	min	256	23.5766	16.4202	0.696
pokec-regions	bwd	copy_u	min	512	46.2444	34.1377	0.738
pokec-regions	bwd	copy_u	sum	64	4.7302	7.2172	1.526
pokec-regions	bwd	copy_u	sum	128	8.7691	12.6201	1.439
pokec-regions	bwd	copy_u	sum	256	17.0448	24.0515	1.411
pokec-regions	bwd	copy_u	sum	512	31.9027	48.1251	1.508
pokec-regions	fb	copy_u	max	64	10.1908	12.8253	1.259
pokec-regions	fb	copy_u	max	128	20.4596	23.6287	1.155
pokec-regions	fb	copy_u	max	256	40.7090	47.0339	1.155
pokec-regions	fb	copy_u	max	512	104.5971	95.1975	0.910
pokec-regions	fb	copy_u	min	64	10.1960	12.8106	1.256
pokec-regions	fb	copy_u	min	128	20.4620	23.6388	1.155
pokec-regions	fb	copy_u	min	256	40.7338	47.0253	1.154
pokec-regions	fb	copy_u	min	512	104.1012	95.1874	0.914
pokec-regions	fb	copy_u	sum	64	9.4634	14.9228	1.577
pokec-regions	fb	copy_u	sum	128	17.6538	25.1646	1.425
pokec-regions	fb	copy_u	sum	256	34.4201	48.0478	1.396
pokec-regions	fb	copy_u	sum	512	91.7780	96.1854	1.048
pokec-regions	fwd	copy_u	max	64	5.0708	9.2390	1.822
pokec-regions	fwd	copy_u	max	128	9.3695	16.1110	1.720
pokec-regions	fwd	copy_u	max	256	18.2178	30.6397	1.682
pokec-regions	fwd	copy_u	max	512	65.2315	61.0729	0.936
pokec-regions	fwd	copy_u	min	64	5.0499	9.2368	1.829
pokec-regions	fwd	copy_u	min	128	9.3288	16.1111	1.727
pokec-regions	fwd	copy_u	min	256	18.0694	30.6356	1.695
pokec-regions	fwd	copy_u	min	512	66.6299	61.0784	0.917
pokec-regions	fwd	copy_u	sum	64	4.7386	7.7037	1.626
pokec-regions	fwd	copy_u	sum	128	8.8878	12.5896	1.416
pokec-regions	fwd	copy_u	sum	256	17.4521	24.0238	1.377
pokec-regions	fwd	copy_u	sum	512	32.9303	48.0972	1.461
pubmed	bwd	add	max	64	0.2279	0.1891	0.830
pubmed	bwd	add	max	128	0.1884	0.2017	1.071
pubmed	bwd	add	max	256	0.3638	0.2697	0.741
pubmed	bwd	add	max	512	0.7140	0.5369	0.752
pubmed	bwd	add	min	64	0.2148	0.1913	0.891
pubmed	bwd	add	min	128	0.2251	0.2032	0.903
pubmed	bwd	add	min	256	0.3600	0.2697	0.749
pubmed	bwd	add	min	512	0.6823	0.5370	0.787
pubmed	bwd	add	sum	64	0.2889	0.3287	1.138
pubmed	bwd	add	sum	128	0.2956	0.3917	1.325
pubmed	bwd	add	sum	256	0.3170	0.3682	1.162
pubmed	bwd	add	sum	512	0.3124	0.6152	1.969
pubmed	bwd	copy_e	max	64	0.2116	0.1379	0.652
pubmed	bwd	copy_e	max	128	0.2125	0.1689	0.795
pubmed	bwd	copy_e	max	256	0.2641	0.1760	0.666
pubmed	bwd	copy_e	max	512	0.5020	0.3437	0.685

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
pubmed	bwd	copy_e	min	64	0.2054	0.1326	0.646
pubmed	bwd	copy_e	min	128	0.2091	0.1664	0.796
pubmed	bwd	copy_e	min	256	0.2636	0.1764	0.669
pubmed	bwd	copy_e	min	512	0.4988	0.3440	0.690
pubmed	bwd	copy_e	sum	64	0.1987	0.1952	0.982
pubmed	bwd	copy_e	sum	128	0.1969	0.2083	1.058
pubmed	bwd	copy_e	sum	256	0.2003	0.2159	1.078
pubmed	bwd	copy_e	sum	512	0.2080	0.3891	1.871
pubmed	bwd	copy_u	max	64	0.2008	0.1550	0.772
pubmed	bwd	copy_u	max	128	0.2076	0.1824	0.879
pubmed	bwd	copy_u	max	256	0.2076	0.1823	0.878
pubmed	bwd	copy_u	max	512	0.2185	0.1978	0.905
pubmed	bwd	copy_u	min	64	0.1919	0.1691	0.881
pubmed	bwd	copy_u	min	128	0.2075	0.1772	0.854
pubmed	bwd	copy_u	min	256	0.1935	0.1737	0.898
pubmed	bwd	copy_u	min	512	0.2328	0.1978	0.850
pubmed	bwd	copy_u	sum	64	0.2211	0.2655	1.201
pubmed	bwd	copy_u	sum	128	0.2489	0.2742	1.102
pubmed	bwd	copy_u	sum	256	0.2279	0.2829	1.242
pubmed	bwd	copy_u	sum	512	0.2732	0.2756	1.009
pubmed	bwd	div	max	64	0.2222	0.3782	1.702
pubmed	bwd	div	max	128	0.3523	0.4256	1.208
pubmed	bwd	div	max	256	0.4500	0.8097	1.799
pubmed	bwd	div	max	512	0.8638	1.5752	1.823
pubmed	bwd	div	min	64	0.2300	0.3593	1.562
pubmed	bwd	div	min	128	0.2568	0.4289	1.670
pubmed	bwd	div	min	256	0.4514	0.8091	1.792
pubmed	bwd	div	min	512	0.8616	1.5762	1.829
pubmed	bwd	div	sum	64	0.2500	0.4521	1.809
pubmed	bwd	div	sum	128	0.2668	0.4434	1.662
pubmed	bwd	div	sum	256	0.4479	0.7753	1.731
pubmed	bwd	div	sum	512	0.8007	1.5265	1.906
pubmed	bwd	mul	max	64	0.2167	0.3148	1.453
pubmed	bwd	mul	max	128	0.2464	0.3204	1.300
pubmed	bwd	mul	max	256	0.4572	0.4455	0.974
pubmed	bwd	mul	max	512	0.8515	0.8689	1.020
pubmed	bwd	mul	min	64	0.2275	0.3098	1.362
pubmed	bwd	mul	min	128	0.2544	0.2994	1.177
pubmed	bwd	mul	min	256	0.4507	0.4495	0.997
pubmed	bwd	mul	min	512	0.8684	0.8699	1.002
pubmed	bwd	mul	sum	64	0.2482	0.3716	1.497
pubmed	bwd	mul	sum	128	0.2357	0.3555	1.508
pubmed	bwd	mul	sum	256	0.3584	0.4221	1.178
pubmed	bwd	mul	sum	512	0.6127	0.8209	1.340
pubmed	bwd	sub	max	64	0.2280	0.2298	1.008
pubmed	bwd	sub	max	128	0.1925	0.2234	1.161
pubmed	bwd	sub	max	256	0.3640	0.3531	0.970
pubmed	bwd	sub	max	512	0.6722	0.6888	1.025
pubmed	bwd	sub	min	64	0.2150	0.2329	1.084
pubmed	bwd	sub	min	128	0.1852	0.2304	1.244
pubmed	bwd	sub	min	256	0.3579	0.3476	0.971
pubmed	bwd	sub	min	512	0.6844	0.6915	1.010
pubmed	bwd	sub	sum	64	0.2866	0.3570	1.246
pubmed	bwd	sub	sum	128	0.2384	0.3784	1.587
pubmed	bwd	sub	sum	256	0.3370	0.3886	1.153
pubmed	bwd	sub	sum	512	0.3180	0.7658	2.408
pubmed	fb	add	max	64	0.4660	0.4697	1.008
pubmed	fb	add	max	128	0.3901	0.5124	1.314
pubmed	fb	add	max	256	0.5485	0.6223	1.134
pubmed	fb	add	max	512	0.9942	1.2102	1.217
pubmed	fb	add	min	64	0.4615	0.4728	1.024
pubmed	fb	add	min	128	0.4762	0.5725	1.202
pubmed	fb	add	min	256	0.5403	0.6226	1.152
pubmed	fb	add	min	512	1.0117	1.2111	1.197
pubmed	fb	add	sum	64	0.5171	0.5640	1.091
pubmed	fb	add	sum	128	0.5211	0.7040	1.351
pubmed	fb	add	sum	256	0.5558	0.6833	1.229
pubmed	fb	add	sum	512	0.6821	1.0002	1.466
pubmed	fb	copy_e	max	64	0.4328	0.3740	0.864
pubmed	fb	copy_e	max	128	0.5001	0.4134	0.827
pubmed	fb	copy_e	max	256	0.4746	0.4164	0.877
pubmed	fb	copy_e	max	512	0.7095	0.8030	1.132
pubmed	fb	copy_e	min	64	0.4357	0.3614	0.829
pubmed	fb	copy_e	min	128	0.4812	0.4258	0.885
pubmed	fb	copy_e	min	256	0.4569	0.4166	0.912
pubmed	fb	copy_e	min	512	0.7233	0.8060	1.114
pubmed	fb	copy_e	sum	64	0.4075	0.4022	0.987
pubmed	fb	copy_e	sum	128	0.4425	0.5216	1.179

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
pubmed	fb	copy_e	sum	256	0.4181	0.5038	1.205
pubmed	fb	copy_e	sum	512	0.4310	0.6965	1.616
pubmed	fb	copy_u	max	64	0.4147	0.4428	1.068
pubmed	fb	copy_u	max	128	0.4613	0.4590	0.995
pubmed	fb	copy_u	max	256	0.4565	0.4575	1.002
pubmed	fb	copy_u	max	512	0.4356	0.5840	1.341
pubmed	fb	copy_u	min	64	0.4276	0.4506	1.054
pubmed	fb	copy_u	min	128	0.4641	0.4393	0.947
pubmed	fb	copy_u	min	256	0.4294	0.4314	1.005
pubmed	fb	copy_u	min	512	0.4987	0.5848	1.173
pubmed	fb	copy_u	sum	64	0.4354	0.4690	1.077
pubmed	fb	copy_u	sum	128	0.4726	0.6225	1.317
pubmed	fb	copy_u	sum	256	0.4670	0.5678	1.216
pubmed	fb	copy_u	sum	512	0.4835	0.5452	1.128
pubmed	fb	div	max	64	0.4693	0.7701	1.641
pubmed	fb	div	max	128	0.4647	0.8542	1.838
pubmed	fb	div	max	256	0.6276	1.3126	2.091
pubmed	fb	div	max	512	1.1970	2.5324	2.116
pubmed	fb	div	min	64	0.4393	0.7456	1.697
pubmed	fb	div	min	128	0.5023	0.7298	1.453
pubmed	fb	div	min	256	0.6396	1.3088	2.046
pubmed	fb	div	min	512	1.1626	2.5325	2.178
pubmed	fb	div	sum	64	0.4918	0.8370	1.702
pubmed	fb	div	sum	128	0.5244	0.7837	1.495
pubmed	fb	div	sum	256	0.6392	1.1249	1.760
pubmed	fb	div	sum	512	1.1549	2.1991	1.904
pubmed	fb	mul	max	64	0.4427	0.6359	1.437
pubmed	fb	mul	max	128	0.4090	0.6221	1.521
pubmed	fb	mul	max	256	0.6440	0.7908	1.228
pubmed	fb	mul	max	512	1.1788	1.5276	1.296
pubmed	fb	mul	min	64	0.4428	0.6388	1.443
pubmed	fb	mul	min	128	0.3942	0.5975	1.516
pubmed	fb	mul	min	256	0.6231	0.7914	1.270
pubmed	fb	mul	min	512	1.1450	1.5274	1.334
pubmed	fb	mul	sum	64	0.4897	0.6750	1.378
pubmed	fb	mul	sum	128	0.4210	0.6336	1.505
pubmed	fb	mul	sum	256	0.5504	0.7134	1.296
pubmed	fb	mul	sum	512	0.9583	1.2009	1.253
pubmed	fb	sub	max	64	0.4453	0.5818	1.307
pubmed	fb	sub	max	128	0.3931	0.5805	1.477
pubmed	fb	sub	max	256	0.5566	0.7710	1.385
pubmed	fb	sub	max	512	1.0002	1.5168	1.516
pubmed	fb	sub	min	64	0.4408	0.5845	1.326
pubmed	fb	sub	min	128	0.3810	0.5860	1.538
pubmed	fb	sub	min	256	0.5362	0.7708	1.438
pubmed	fb	sub	min	512	0.9825	1.5169	1.544
pubmed	fb	sub	sum	64	0.5046	0.6221	1.233
pubmed	fb	sub	sum	128	0.4510	0.6826	1.513
pubmed	fb	sub	sum	256	0.5855	0.7621	1.302
pubmed	fb	sub	sum	512	0.6790	1.2995	1.914
pubmed	fwd	add	max	64	0.0868	0.1725	1.987
pubmed	fwd	add	max	128	0.1156	0.2061	1.782
pubmed	fwd	add	max	256	0.1834	0.3574	1.949
pubmed	fwd	add	max	512	0.3266	0.6773	2.074
pubmed	fwd	add	min	64	0.0888	0.1738	1.958
pubmed	fwd	add	min	128	0.1076	0.2062	1.917
pubmed	fwd	add	min	256	0.1825	0.3571	1.957
pubmed	fwd	add	min	512	0.3327	0.6776	2.037
pubmed	fwd	add	sum	64	0.0787	0.0965	1.226
pubmed	fwd	add	sum	128	0.1049	0.1226	1.169
pubmed	fwd	add	sum	256	0.2078	0.2014	0.969
pubmed	fwd	add	sum	512	0.3760	0.3845	1.023
pubmed	fwd	copy_e	max	64	0.0870	0.1303	1.497
pubmed	fwd	copy_e	max	128	0.0985	0.1406	1.428
pubmed	fwd	copy_e	max	256	0.1220	0.2442	2.002
pubmed	fwd	copy_e	max	512	0.2214	0.4623	2.088
pubmed	fwd	copy_e	min	64	0.0850	0.1382	1.625
pubmed	fwd	copy_e	min	128	0.0961	0.1406	1.464
pubmed	fwd	copy_e	min	256	0.1235	0.2440	1.977
pubmed	fwd	copy_e	min	512	0.2190	0.4627	2.113
pubmed	fwd	copy_e	sum	64	0.0770	0.0860	1.116
pubmed	fwd	copy_e	sum	128	0.1005	0.1114	1.109
pubmed	fwd	copy_e	sum	256	0.1428	0.1686	1.180
pubmed	fwd	copy_e	sum	512	0.2764	0.3141	1.136
pubmed	fwd	copy_u	max	64	0.0841	0.1390	1.652
pubmed	fwd	copy_u	max	128	0.0957	0.1381	1.442
pubmed	fwd	copy_u	max	256	0.1178	0.2046	1.736
pubmed	fwd	copy_u	max	512	0.2050	0.3900	1.903

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
pubmed	fwd	copy_u	min	64	0.0873	0.1433	1.642
pubmed	fwd	copy_u	min	128	0.0964	0.1377	1.429
pubmed	fwd	copy_u	min	256	0.1177	0.2049	1.741
pubmed	fwd	copy_u	min	512	0.2022	0.3899	1.928
pubmed	fwd	copy_u	sum	64	0.0864	0.0908	1.050
pubmed	fwd	copy_u	sum	128	0.0866	0.0887	1.024
pubmed	fwd	copy_u	sum	256	0.0916	0.0875	0.955
pubmed	fwd	copy_u	sum	512	0.1779	0.2308	1.297
pubmed	fwd	div	max	64	0.0877	0.2177	2.484
pubmed	fwd	div	max	128	0.2470	0.2837	1.149
pubmed	fwd	div	max	256	0.1986	0.5092	2.564
pubmed	fwd	div	max	512	0.3491	0.9798	2.807
pubmed	fwd	div	min	64	0.0869	0.2175	2.504
pubmed	fwd	div	min	128	0.1012	0.2836	2.803
pubmed	fwd	div	min	256	0.1846	0.5095	2.760
pubmed	fwd	div	min	512	0.3216	0.9859	3.065
pubmed	fwd	div	sum	64	0.0784	0.1421	1.811
pubmed	fwd	div	sum	128	0.1075	0.2030	1.889
pubmed	fwd	div	sum	256	0.2095	0.3542	1.691
pubmed	fwd	div	sum	512	0.3807	0.6875	1.806
pubmed	fwd	mul	max	64	0.0847	0.1741	2.056
pubmed	fwd	mul	max	128	0.0994	0.2061	2.073
pubmed	fwd	mul	max	256	0.1839	0.3570	1.941
pubmed	fwd	mul	max	512	0.3334	0.6779	2.033
pubmed	fwd	mul	min	64	0.0858	0.1733	2.019
pubmed	fwd	mul	min	128	0.1007	0.2063	2.050
pubmed	fwd	mul	min	256	0.1798	0.3569	1.984
pubmed	fwd	mul	min	512	0.3359	0.6775	2.017
pubmed	fwd	mul	sum	64	0.0817	0.0964	1.179
pubmed	fwd	mul	sum	128	0.1041	0.1222	1.174
pubmed	fwd	mul	sum	256	0.1862	0.2016	1.083
pubmed	fwd	mul	sum	512	0.3432	0.3845	1.120
pubmed	fwd	sub	max	64	0.0858	0.1980	2.306
pubmed	fwd	sub	max	128	0.1003	0.2447	2.440
pubmed	fwd	sub	max	256	0.1819	0.4296	2.362
pubmed	fwd	sub	max	512	0.3427	0.8253	2.408
pubmed	fwd	sub	min	64	0.0863	0.1994	2.311
pubmed	fwd	sub	min	128	0.1020	0.2449	2.401
pubmed	fwd	sub	min	256	0.1865	0.4293	2.302
pubmed	fwd	sub	min	512	0.3196	0.8259	2.584
pubmed	fwd	sub	sum	64	0.0858	0.1170	1.364
pubmed	fwd	sub	sum	128	0.1075	0.1619	1.506
pubmed	fwd	sub	sum	256	0.1932	0.2735	1.416
pubmed	fwd	sub	sum	512	0.3600	0.5257	1.460
tolokers-2	bwd	add	max	64	0.2264	0.2420	1.069
tolokers-2	bwd	add	max	128	0.2815	0.4173	1.483
tolokers-2	bwd	add	max	256	0.5429	0.7779	1.433
tolokers-2	bwd	add	max	512	1.1677	1.5189	1.301
tolokers-2	bwd	add	min	64	0.2247	0.2232	0.993
tolokers-2	bwd	add	min	128	0.2835	0.3888	1.371
tolokers-2	bwd	add	min	256	0.5427	0.7892	1.454
tolokers-2	bwd	add	min	512	1.1728	1.5416	1.314
tolokers-2	bwd	add	sum	64	0.5024	0.8027	1.598
tolokers-2	bwd	add	sum	128	0.5012	1.1574	2.309
tolokers-2	bwd	add	sum	256	0.8961	1.8667	2.083
tolokers-2	bwd	add	sum	512	1.8691	3.4090	1.824
tolokers-2	bwd	copy_e	max	64	0.1754	0.1721	0.981
tolokers-2	bwd	copy_e	max	128	0.2573	0.3370	1.310
tolokers-2	bwd	copy_e	max	256	0.4938	0.6768	1.371
tolokers-2	bwd	copy_e	max	512	1.0095	1.3474	1.335
tolokers-2	bwd	copy_e	min	64	0.1823	0.1702	0.934
tolokers-2	bwd	copy_e	min	128	0.2571	0.3372	1.311
tolokers-2	bwd	copy_e	min	256	0.4995	0.6756	1.352
tolokers-2	bwd	copy_e	min	512	1.0115	1.3435	1.328
tolokers-2	bwd	copy_e	sum	64	0.4014	0.3279	0.817
tolokers-2	bwd	copy_e	sum	128	0.4039	0.6078	1.505
tolokers-2	bwd	copy_e	sum	256	0.4570	1.1709	2.562
tolokers-2	bwd	copy_e	sum	512	1.0489	2.3618	2.252
tolokers-2	bwd	copy_u	max	64	0.1933	0.1752	0.906
tolokers-2	bwd	copy_u	max	128	0.2005	0.1808	0.902
tolokers-2	bwd	copy_u	max	256	0.2207	0.2030	0.920
tolokers-2	bwd	copy_u	max	512	0.3788	0.1799	0.475
tolokers-2	bwd	copy_u	min	64	0.2011	0.1735	0.863
tolokers-2	bwd	copy_u	min	128	0.1956	0.1728	0.883
tolokers-2	bwd	copy_u	min	256	0.2074	0.2082	1.004
tolokers-2	bwd	copy_u	min	512	0.3411	0.1882	0.552
tolokers-2	bwd	copy_u	sum	64	0.2216	0.3415	1.542
tolokers-2	bwd	copy_u	sum	128	0.2403	0.3971	1.653

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
tolokers-2	bwd	copy_u	sum	256	0.3743	0.5180	1.384
tolokers-2	bwd	copy_u	sum	512	0.7808	1.0481	1.342
tolokers-2	bwd	div	max	64	0.2030	1.0293	5.071
tolokers-2	bwd	div	max	128	0.3227	1.9295	5.979
tolokers-2	bwd	div	max	256	0.6359	3.7767	5.939
tolokers-2	bwd	div	max	512	1.4310	7.4367	5.197
tolokers-2	bwd	div	min	64	0.2159	1.0023	4.643
tolokers-2	bwd	div	min	128	0.3223	1.9025	5.903
tolokers-2	bwd	div	min	256	0.6458	3.7780	5.850
tolokers-2	bwd	div	min	512	1.4290	7.4363	5.204
tolokers-2	bwd	div	sum	64	0.8895	1.9724	2.217
tolokers-2	bwd	div	sum	128	1.4321	3.1532	2.202
tolokers-2	bwd	div	sum	256	2.6638	5.5166	2.071
tolokers-2	bwd	div	sum	512	5.5165	10.4191	1.889
tolokers-2	bwd	mul	max	64	0.2039	0.3291	1.614
tolokers-2	bwd	mul	max	128	0.3225	0.5133	1.591
tolokers-2	bwd	mul	max	256	0.6344	0.9521	1.501
tolokers-2	bwd	mul	max	512	1.4257	1.8463	1.295
tolokers-2	bwd	mul	min	64	0.2051	0.3342	1.629
tolokers-2	bwd	mul	min	128	0.3218	0.4929	1.531
tolokers-2	bwd	mul	min	256	0.6357	0.9652	1.518
tolokers-2	bwd	mul	min	512	1.4292	1.8543	1.297
tolokers-2	bwd	mul	sum	64	0.6287	1.2630	2.009
tolokers-2	bwd	mul	sum	128	1.0929	1.7333	1.586
tolokers-2	bwd	mul	sum	256	1.9952	2.7234	1.365
tolokers-2	bwd	mul	sum	512	4.1841	4.8452	1.158
tolokers-2	bwd	sub	max	64	0.2018	0.4060	2.012
tolokers-2	bwd	sub	max	128	0.2817	0.7370	2.616
tolokers-2	bwd	sub	max	256	0.5453	1.4126	2.590
tolokers-2	bwd	sub	max	512	1.1717	2.7705	2.364
tolokers-2	bwd	sub	min	64	0.2042	0.3675	1.800
tolokers-2	bwd	sub	min	128	0.2823	0.7086	2.510
tolokers-2	bwd	sub	min	256	0.5468	1.4191	2.595
tolokers-2	bwd	sub	min	512	1.1719	2.7841	2.376
tolokers-2	bwd	sub	sum	64	0.5370	0.9592	1.786
tolokers-2	bwd	sub	sum	128	0.4928	1.4766	2.996
tolokers-2	bwd	sub	sum	256	0.8955	2.4907	2.781
tolokers-2	bwd	sub	sum	512	1.8538	4.6540	2.511
tolokers-2	fb	add	max	64	0.4946	1.2804	2.589
tolokers-2	fb	add	max	128	0.9082	1.6653	1.834
tolokers-2	fb	add	max	256	1.7738	2.5019	1.410
tolokers-2	fb	add	max	512	3.7250	4.3851	1.177
tolokers-2	fb	add	min	64	0.4937	1.2494	2.531
tolokers-2	fb	add	min	128	0.9044	1.6339	1.807
tolokers-2	fb	add	min	256	1.7639	2.5112	1.424
tolokers-2	fb	add	min	512	3.7341	4.3967	1.177
tolokers-2	fb	add	sum	64	0.7377	1.6871	2.287
tolokers-2	fb	add	sum	128	1.2803	2.1867	1.708
tolokers-2	fb	add	sum	256	2.3937	3.2342	1.351
tolokers-2	fb	add	sum	512	4.8762	5.5832	1.145
tolokers-2	fb	copy_e	max	64	0.4168	0.8919	2.140
tolokers-2	fb	copy_e	max	128	0.5596	1.2050	2.153
tolokers-2	fb	copy_e	max	256	1.0869	1.8912	1.740
tolokers-2	fb	copy_e	max	512	2.2922	3.3250	1.451
tolokers-2	fb	copy_e	min	64	0.4145	0.8940	2.157
tolokers-2	fb	copy_e	min	128	0.5480	1.2090	2.206
tolokers-2	fb	copy_e	min	256	1.0868	1.8920	1.741
tolokers-2	fb	copy_e	min	512	2.3017	3.3251	1.445
tolokers-2	fb	copy_e	sum	64	0.6560	1.2080	1.841
tolokers-2	fb	copy_e	sum	128	0.9069	1.6234	1.790
tolokers-2	fb	copy_e	sum	256	1.7149	2.5028	1.459
tolokers-2	fb	copy_e	sum	512	3.5529	4.3981	1.238
tolokers-2	fb	copy_u	max	64	0.4289	0.4604	1.074
tolokers-2	fb	copy_u	max	128	0.4220	0.5829	1.381
tolokers-2	fb	copy_u	max	256	0.5172	0.8351	1.615
tolokers-2	fb	copy_u	max	512	0.9828	1.3704	1.394
tolokers-2	fb	copy_u	min	64	0.4341	0.4851	1.117
tolokers-2	fb	copy_u	min	128	0.4300	0.5512	1.282
tolokers-2	fb	copy_u	min	256	0.5017	0.8379	1.670
tolokers-2	fb	copy_u	min	512	0.9654	1.3787	1.428
tolokers-2	fb	copy_u	sum	64	0.4306	0.7056	1.639
tolokers-2	fb	copy_u	sum	128	0.4673	1.0243	2.192
tolokers-2	fb	copy_u	sum	256	0.8388	1.4050	1.675
tolokers-2	fb	copy_u	sum	512	1.6124	2.0998	1.302
tolokers-2	fb	div	max	64	0.4978	2.3788	4.778
tolokers-2	fb	div	max	128	0.9557	3.7970	3.973
tolokers-2	fb	div	max	256	1.9000	6.7290	3.542
tolokers-2	fb	div	max	512	3.9723	12.8043	3.223

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
tolokers-2	fb	div	min	64	0.4881	2.3454	4.805
tolokers-2	fb	div	min	128	0.9541	3.7813	3.963
tolokers-2	fb	div	min	256	1.9071	6.7293	3.529
tolokers-2	fb	div	min	512	4.0569	12.8008	3.155
tolokers-2	fb	div	sum	64	1.3131	3.1830	2.424
tolokers-2	fb	div	sum	128	2.2397	4.8046	2.145
tolokers-2	fb	div	sum	256	4.1856	8.1247	1.941
tolokers-2	fb	div	sum	512	8.7206	15.1040	1.732
tolokers-2	fb	mul	max	64	0.4740	1.3391	2.825
tolokers-2	fb	mul	max	128	0.9425	1.7525	1.859
tolokers-2	fb	mul	max	256	1.8797	2.6627	1.417
tolokers-2	fb	mul	max	512	3.9626	4.7036	1.187
tolokers-2	fb	mul	min	64	0.4818	1.3023	2.703
tolokers-2	fb	mul	min	128	0.9568	1.7265	1.804
tolokers-2	fb	mul	min	256	1.9137	2.6777	1.399
tolokers-2	fb	mul	min	512	3.9854	4.7100	1.182
tolokers-2	fb	mul	sum	64	0.9970	2.1462	2.153
tolokers-2	fb	mul	sum	128	1.7077	2.7628	1.618
tolokers-2	fb	mul	sum	256	3.3428	4.0656	1.216
tolokers-2	fb	mul	sum	512	6.7903	7.0133	1.033
tolokers-2	fb	sub	max	64	0.4634	1.6154	3.486
tolokers-2	fb	sub	max	128	0.9046	2.2973	2.540
tolokers-2	fb	sub	max	256	1.7963	3.7557	2.091
tolokers-2	fb	sub	max	512	3.6813	6.8785	1.868
tolokers-2	fb	sub	min	64	0.4613	1.5669	3.397
tolokers-2	fb	sub	min	128	0.9114	2.2650	2.485
tolokers-2	fb	sub	min	256	1.7877	3.7650	2.106
tolokers-2	fb	sub	min	512	3.7149	6.8891	1.854
tolokers-2	fb	sub	sum	64	0.7280	2.0142	2.767
tolokers-2	fb	sub	sum	128	1.2889	2.8070	2.178
tolokers-2	fb	sub	sum	256	2.4232	4.4710	1.845
tolokers-2	fb	sub	sum	512	4.9470	8.0680	1.631
tolokers-2	fwd	add	max	64	0.3230	1.0413	3.224
tolokers-2	fwd	add	max	128	0.6289	1.2474	1.983
tolokers-2	fwd	add	max	256	1.2258	1.7272	1.409
tolokers-2	fwd	add	max	512	2.5364	2.8662	1.130
tolokers-2	fwd	add	min	64	0.3266	1.0394	3.183
tolokers-2	fwd	add	min	128	0.6327	1.2476	1.972
tolokers-2	fwd	add	min	256	1.2963	1.7281	1.333
tolokers-2	fwd	add	min	512	2.6799	2.8689	1.071
tolokers-2	fwd	add	sum	64	0.4115	0.8895	2.162
tolokers-2	fwd	add	sum	128	0.7711	1.0377	1.346
tolokers-2	fwd	add	sum	256	1.4908	1.3692	0.918
tolokers-2	fwd	add	sum	512	3.0445	2.1874	0.718
tolokers-2	fwd	copy_e	max	64	0.1673	0.7194	4.301
tolokers-2	fwd	copy_e	max	128	0.3201	0.8740	2.730
tolokers-2	fwd	copy_e	max	256	0.5853	1.2229	2.089
tolokers-2	fwd	copy_e	max	512	1.2708	1.9895	1.566
tolokers-2	fwd	copy_e	min	64	0.1685	0.7224	4.287
tolokers-2	fwd	copy_e	min	128	0.3179	0.8693	2.735
tolokers-2	fwd	copy_e	min	256	0.6127	1.2233	1.997
tolokers-2	fwd	copy_e	min	512	1.3470	1.9860	1.474
tolokers-2	fwd	copy_e	sum	64	0.3229	0.8801	2.725
tolokers-2	fwd	copy_e	sum	128	0.6348	1.0132	1.596
tolokers-2	fwd	copy_e	sum	256	1.2606	1.3414	1.064
tolokers-2	fwd	copy_e	sum	512	2.5364	2.0461	0.807
tolokers-2	fwd	copy_u	max	64	0.1252	0.2932	2.341
tolokers-2	fwd	copy_u	max	128	0.2164	0.4510	2.084
tolokers-2	fwd	copy_u	max	256	0.4245	0.7224	1.702
tolokers-2	fwd	copy_u	max	512	0.8223	1.1939	1.452
tolokers-2	fwd	copy_u	min	64	0.1249	0.2936	2.351
tolokers-2	fwd	copy_u	min	128	0.2123	0.4497	2.119
tolokers-2	fwd	copy_u	min	256	0.4096	0.7211	1.760
tolokers-2	fwd	copy_u	min	512	0.8392	1.1967	1.426
tolokers-2	fwd	copy_u	sum	64	0.1090	0.3368	3.091
tolokers-2	fwd	copy_u	sum	128	0.1960	0.3925	2.003
tolokers-2	fwd	copy_u	sum	256	0.3720	0.5156	1.386
tolokers-2	fwd	copy_u	sum	512	0.7729	1.0396	1.345
tolokers-2	fwd	div	max	64	0.3294	1.3565	4.118
tolokers-2	fwd	div	max	128	0.6362	1.8734	2.945
tolokers-2	fwd	div	max	256	1.2754	2.9740	2.332
tolokers-2	fwd	div	max	512	2.6065	5.3760	2.063
tolokers-2	fwd	div	min	64	0.3348	1.3503	4.033
tolokers-2	fwd	div	min	128	0.6778	1.8722	2.762
tolokers-2	fwd	div	min	256	1.2993	2.9764	2.291
tolokers-2	fwd	div	min	512	2.7021	5.3778	1.990
tolokers-2	fwd	div	sum	64	0.4190	1.2000	2.864
tolokers-2	fwd	div	sum	128	0.7636	1.6591	2.173

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
tolokers-2	fwd	div	sum	256	1.4938	2.6227	1.756
tolokers-2	fwd	div	sum	512	3.0601	4.6943	1.534
tolokers-2	fwd	mul	max	64	0.3284	1.0386	3.163
tolokers-2	fwd	mul	max	128	0.6232	1.2489	2.004
tolokers-2	fwd	mul	max	256	1.2387	1.7273	1.394
tolokers-2	fwd	mul	max	512	2.5060	2.8662	1.144
tolokers-2	fwd	mul	min	64	0.3341	1.0378	3.107
tolokers-2	fwd	mul	min	128	0.6519	1.2502	1.918
tolokers-2	fwd	mul	min	256	1.2913	1.7279	1.338
tolokers-2	fwd	mul	min	512	2.6662	2.8672	1.075
tolokers-2	fwd	mul	sum	64	0.3762	0.8887	2.362
tolokers-2	fwd	mul	sum	128	0.6604	1.0314	1.562
tolokers-2	fwd	mul	sum	256	1.2765	1.3700	1.073
tolokers-2	fwd	mul	sum	512	2.5715	2.1876	0.851
tolokers-2	fwd	sub	max	64	0.3180	1.1850	3.727
tolokers-2	fwd	sub	max	128	0.6377	1.5508	2.432
tolokers-2	fwd	sub	max	256	1.2383	2.3379	1.888
tolokers-2	fwd	sub	max	512	2.5367	4.0992	1.616
tolokers-2	fwd	sub	min	64	0.3232	1.1898	3.681
tolokers-2	fwd	sub	min	128	0.6321	1.5493	2.451
tolokers-2	fwd	sub	min	256	1.2964	2.3426	1.807
tolokers-2	fwd	sub	min	512	2.7148	4.1033	1.511
tolokers-2	fwd	sub	sum	64	0.4214	1.0463	2.483
tolokers-2	fwd	sub	sum	128	0.7493	1.3426	1.792
tolokers-2	fwd	sub	sum	256	1.4471	1.9878	1.374
tolokers-2	fwd	sub	sum	512	3.0496	3.4211	1.122
twitch-views	bwd	copy_u	max	64	0.3624	0.3732	1.030
twitch-views	bwd	copy_u	max	128	0.7855	0.6912	0.880
twitch-views	bwd	copy_u	max	256	2.1162	1.3854	0.655
twitch-views	bwd	copy_u	max	512	5.4141	3.6515	0.674
twitch-views	bwd	copy_u	min	64	0.3692	0.3939	1.067
twitch-views	bwd	copy_u	min	128	0.7921	0.7283	0.920
twitch-views	bwd	copy_u	min	256	2.1203	1.4141	0.667
twitch-views	bwd	copy_u	min	512	5.4572	3.6511	0.669
twitch-views	bwd	copy_u	sum	64	2.5204	8.1559	3.236
twitch-views	bwd	copy_u	sum	128	5.7285	9.8288	1.716
twitch-views	bwd	copy_u	sum	256	12.7565	14.5402	1.140
twitch-views	bwd	copy_u	sum	512	26.6411	22.3122	0.838
twitch-views	fb	copy_u	max	64	2.4715	7.4696	3.022
twitch-views	fb	copy_u	max	128	5.2889	9.4519	1.787
twitch-views	fb	copy_u	max	256	11.7507	14.6353	1.245
twitch-views	fb	copy_u	max	512	25.4791	25.2696	0.992
twitch-views	fb	copy_u	min	64	2.4543	7.5399	3.072
twitch-views	fb	copy_u	min	128	5.2459	9.5632	1.823
twitch-views	fb	copy_u	min	256	11.7189	14.6598	1.251
twitch-views	fb	copy_u	min	512	25.3114	25.2497	0.998
twitch-views	fb	copy_u	sum	64	5.0314	16.2581	3.231
twitch-views	fb	copy_u	sum	128	11.5131	19.4857	1.692
twitch-views	fb	copy_u	sum	256	25.5881	29.0493	1.135
twitch-views	fb	copy_u	sum	512	53.9893	44.4466	0.823
twitch-views	fwd	copy_u	max	64	2.0971	7.1113	3.391
twitch-views	fwd	copy_u	max	128	4.4401	8.7954	1.981
twitch-views	fwd	copy_u	max	256	9.6130	13.2376	1.377
twitch-views	fwd	copy_u	max	512	20.4989	21.6267	1.055
twitch-views	fwd	copy_u	min	64	2.1017	7.1470	3.401
twitch-views	fwd	copy_u	min	128	4.4394	8.7930	1.981
twitch-views	fwd	copy_u	min	256	9.5850	13.2553	1.383
twitch-views	fwd	copy_u	min	512	20.1041	21.6283	1.076
twitch-views	fwd	copy_u	sum	64	2.5053	8.1246	3.243
twitch-views	fwd	copy_u	sum	128	5.7618	9.7785	1.697
twitch-views	fwd	copy_u	sum	256	12.5033	14.5171	1.161
twitch-views	fwd	copy_u	sum	512	26.5513	22.2093	0.836
web-fraud	bwd	copy_u	max	64	12.6533	17.2083	1.360
web-fraud	bwd	copy_u	max	128	16.2701	27.9982	1.721
web-fraud	bwd	copy_u	max	256	32.3781	37.2165	1.149
web-fraud	bwd	copy_u	max	512	45.5700	52.2094	1.146
web-fraud	bwd	copy_u	min	64	12.7784	17.6415	1.381
web-fraud	bwd	copy_u	min	128	16.6026	28.4773	1.715
web-fraud	bwd	copy_u	min	256	31.9456	37.0055	1.158
web-fraud	bwd	copy_u	min	512	44.8344	51.4495	1.148
web-fraud	bwd	copy_u	sum	64	74.5888	287.4118	3.853
web-fraud	bwd	copy_u	sum	128	149.9857	289.9707	1.933
web-fraud	bwd	copy_u	sum	256	301.7913	327.8977	1.087
web-fraud	bwd	copy_u	sum	512	623.9840	345.5382	0.554
web-fraud	fb	copy_u	max	64	26.2978	75.0625	2.854
web-fraud	fb	copy_u	max	128	42.7517	88.7950	2.077
web-fraud	fb	copy_u	max	256	103.8889	111.4385	1.073
web-fraud	fb	copy_u	max	512	226.4346	151.3324	0.668

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graph	pass	op	reduce	d	ours (ms)	DGL (ms)	speedup
web-fraud	fb	copy_u	min	64	26.3815	75.5131	2.862
web-fraud	fb	copy_u	min	128	43.3043	89.2763	2.062
web-fraud	fb	copy_u	min	256	104.8676	111.2300	1.061
web-fraud	fb	copy_u	min	512	219.5975	151.0874	0.688
web-fraud	fb	copy_u	sum	64	92.8230	362.7178	3.908
web-fraud	fb	copy_u	sum	128	185.2705	365.7708	1.974
web-fraud	fb	copy_u	sum	256	400.3877	415.9427	1.039
web-fraud	fb	copy_u	sum	512	792.9253	450.3341	0.568
web-fraud	fwd	copy_u	max	64	13.6663	57.8884	4.236
web-fraud	fwd	copy_u	max	128	27.1672	60.8186	2.239
web-fraud	fwd	copy_u	max	256	55.7480	74.2232	1.331
web-fraud	fwd	copy_u	max	512	188.2454	99.0773	0.526
web-fraud	fwd	copy_u	min	64	13.5791	57.8935	4.263
web-fraud	fwd	copy_u	min	128	27.0870	60.8210	2.245
web-fraud	fwd	copy_u	min	256	88.1386	74.2253	0.842
web-fraud	fwd	copy_u	min	512	190.1446	99.2607	0.522
web-fraud	fwd	copy_u	sum	64	17.5692	75.4720	4.296
web-fraud	fwd	copy_u	sum	128	35.7578	76.9288	2.151
web-fraud	fwd	copy_u	sum	256	70.1338	88.9414	1.268
web-fraud	fwd	copy_u	sum	512	166.4348	103.0768	0.619

K.4 Complete g-SDDMM results

Table 9: Every g-SDDMM configuration: 25 graphs $\times$ 32 operators $\times$ 4 widths, fp16 forward, raw milliseconds for the node-parallel kernel, the edge-parallel kernel and DGL, all timed by direct calls with the one protocol given in Appendix B. OOM: the operands or the output do not fit on the 80 GB card.

graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
amazon-computers	copy_u	32	0.099	0.069	0.106	1.07	1.54
amazon-computers	copy_u	64	0.110	0.071	0.186	1.69	2.60
amazon-computers	copy_u	128	0.156	0.099	0.332	2.13	3.35
amazon-computers	copy_u	256	0.282	0.187	0.601	2.13	3.21
amazon-computers	copy_v	32	0.063	0.064	0.102	1.63	1.61
amazon-computers	copy_v	64	0.065	0.062	0.180	2.78	2.90
amazon-computers	copy_v	128	0.115	0.101	0.319	2.78	3.14
amazon-computers	copy_v	256	0.220	0.192	0.600	2.72	3.13
amazon-computers	e_add_u	32	0.140	0.088	0.125	0.89	1.42
amazon-computers	e_add_u	64	0.156	0.105	0.224	1.44	2.14
amazon-computers	e_add_u	128	0.245	0.185	0.415	1.69	2.24
amazon-computers	e_add_u	256	0.436	0.353	0.780	1.79	2.21
amazon-computers	e_add_v	32	0.103	0.085	0.124	1.21	1.45
amazon-computers	e_add_v	64	0.133	0.104	0.223	1.68	2.15
amazon-computers	e_add_v	128	0.219	0.181	0.414	1.89	2.29
amazon-computers	e_add_v	256	0.394	0.336	0.778	1.97	2.32
amazon-computers	e_div_u	32	0.146	0.093	0.134	0.92	1.44
amazon-computers	e_div_u	64	0.173	0.114	0.235	1.36	2.06
amazon-computers	e_div_u	128	0.260	0.188	0.428	1.65	2.28
amazon-computers	e_div_u	256	0.518	0.361	0.799	1.54	2.21
amazon-computers	e_div_v	32	0.110	0.098	0.133	1.21	1.35
amazon-computers	e_div_v	64	0.143	0.120	0.234	1.63	1.96
amazon-computers	e_div_v	128	0.241	0.186	0.432	1.79	2.33
amazon-computers	e_div_v	256	0.424	0.345	0.799	1.88	2.31
amazon-computers	e_dot_u	32	0.184	0.089	0.123	0.67	1.38
amazon-computers	e_dot_u	64	0.194	0.095	0.131	0.68	1.38
amazon-computers	e_dot_u	128	0.227	0.108	0.202	0.89	1.87
amazon-computers	e_dot_u	256	0.313	0.192	0.325	1.04	1.69
amazon-computers	e_dot_v	32	0.153	0.086	0.123	0.80	1.43
amazon-computers	e_dot_v	64	0.163	0.092	0.129	0.79	1.40
amazon-computers	e_dot_v	128	0.186	0.104	0.200	1.07	1.92
amazon-computers	e_dot_v	256	0.257	0.171	0.334	1.30	1.96
amazon-computers	e_mul_u	32	0.140	0.088	0.125	0.89	1.42
amazon-computers	e_mul_u	64	0.156	0.105	0.224	1.43	2.14
amazon-computers	e_mul_u	128	0.250	0.185	0.414	1.66	2.24
amazon-computers	e_mul_u	256	0.439	0.353	0.774	1.76	2.19
amazon-computers	e_mul_v	32	0.103	0.084	0.124	1.21	1.47
amazon-computers	e_mul_v	64	0.132	0.103	0.223	1.69	2.16
amazon-computers	e_mul_v	128	0.220	0.182	0.414	1.89	2.28
amazon-computers	e_mul_v	256	0.398	0.336	0.779	1.95	2.32
amazon-computers	e_sub_u	32	0.139	0.088	0.129	0.93	1.47
amazon-computers	e_sub_u	64	0.156	0.104	0.235	1.50	2.25
amazon-computers	e_sub_u	128	0.249	0.185	0.421	1.69	2.28

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
amazon-computers	e_sub_u	256	0.440	0.353	0.789	1.79	2.23
amazon-computers	e_sub_v	32	0.102	0.084	0.128	1.25	1.52
amazon-computers	e_sub_v	64	0.133	0.103	0.229	1.72	2.22
amazon-computers	e_sub_v	128	0.219	0.182	0.422	1.92	2.32
amazon-computers	e_sub_v	256	0.396	0.336	0.789	1.99	2.34
amazon-computers	u_add_e	32	0.138	0.088	0.125	0.90	1.42
amazon-computers	u_add_e	64	0.155	0.104	0.225	1.45	2.16
amazon-computers	u_add_e	128	0.245	0.186	0.415	1.69	2.23
amazon-computers	u_add_e	256	0.433	0.353	0.776	1.79	2.20
amazon-computers	u_add_v	32	0.105	0.071	0.128	1.21	1.80
amazon-computers	u_add_v	64	0.121	0.073	0.207	1.71	2.84
amazon-computers	u_add_v	128	0.162	0.104	0.379	2.35	3.66
amazon-computers	u_add_v	256	0.293	0.197	0.713	2.43	3.61
amazon-computers	u_div_e	32	0.135	0.091	0.205	1.52	2.25
amazon-computers	u_div_e	64	0.166	0.112	0.387	2.33	3.45
amazon-computers	u_div_e	128	0.258	0.188	0.722	2.80	3.85
amazon-computers	u_div_e	256	0.514	0.353	1.392	2.71	3.95
amazon-computers	u_div_v	32	0.112	0.078	0.126	1.13	1.63
amazon-computers	u_div_v	64	0.127	0.090	0.218	1.71	2.41
amazon-computers	u_div_v	128	0.203	0.111	0.395	1.95	3.55
amazon-computers	u_div_v	256	0.326	0.200	0.734	2.25	3.68
amazon-computers	u_dot_e	32	0.194	0.090	0.123	0.63	1.36
amazon-computers	u_dot_e	64	0.200	0.098	0.130	0.65	1.33
amazon-computers	u_dot_e	128	0.219	0.113	0.200	0.91	1.78
amazon-computers	u_dot_e	256	0.301	0.195	0.327	1.08	1.68
amazon-computers	u_dot_v	32	0.104	0.070	0.101	0.97	1.46
amazon-computers	u_dot_v	64	0.109	0.070	0.104	0.96	1.50
amazon-computers	u_dot_v	128	0.120	0.080	0.146	1.21	1.82
amazon-computers	u_dot_v	256	0.150	0.089	0.251	1.67	2.83
amazon-computers	u_mul_e	32	0.138	0.089	0.125	0.90	1.41
amazon-computers	u_mul_e	64	0.155	0.104	0.226	1.45	2.17
amazon-computers	u_mul_e	128	0.244	0.186	0.415	1.70	2.23
amazon-computers	u_mul_e	256	0.434	0.357	0.775	1.79	2.17
amazon-computers	u_mul_v	32	0.104	0.071	0.118	1.13	1.66
amazon-computers	u_mul_v	64	0.117	0.073	0.207	1.76	2.83
amazon-computers	u_mul_v	128	0.166	0.103	0.383	2.31	3.70
amazon-computers	u_mul_v	256	0.291	0.197	0.719	2.47	3.65
amazon-computers	u_sub_e	32	0.140	0.088	0.164	1.17	1.87
amazon-computers	u_sub_e	64	0.155	0.104	0.298	1.93	2.86
amazon-computers	u_sub_e	128	0.244	0.186	0.562	2.31	3.03
amazon-computers	u_sub_e	256	0.439	0.349	1.077	2.46	3.09
amazon-computers	u_sub_v	32	0.104	0.071	0.129	1.23	1.82
amazon-computers	u_sub_v	64	0.116	0.074	0.213	1.83	2.89
amazon-computers	u_sub_v	128	0.165	0.103	0.395	2.39	3.82
amazon-computers	u_sub_v	256	0.296	0.197	0.731	2.47	3.71
amazon-computers	v_add_e	32	0.102	0.084	0.125	1.22	1.48
amazon-computers	v_add_e	64	0.132	0.104	0.225	1.70	2.17
amazon-computers	v_add_e	128	0.216	0.181	0.415	1.92	2.29
amazon-computers	v_add_e	256	0.398	0.336	0.779	1.96	2.32
amazon-computers	v_add_u	32	0.105	0.071	0.117	1.12	1.65
amazon-computers	v_add_u	64	0.116	0.073	0.208	1.79	2.83
amazon-computers	v_add_u	128	0.161	0.104	0.381	2.37	3.68
amazon-computers	v_add_u	256	0.294	0.198	0.717	2.44	3.62
amazon-computers	v_div_e	32	0.112	0.100	0.205	1.84	2.04
amazon-computers	v_div_e	64	0.145	0.121	0.380	2.62	3.15
amazon-computers	v_div_e	128	0.242	0.185	0.722	2.98	3.90
amazon-computers	v_div_e	256	0.437	0.337	1.396	3.19	4.14
amazon-computers	v_div_u	32	0.114	0.078	0.126	1.11	1.61
amazon-computers	v_div_u	64	0.131	0.092	0.218	1.66	2.38
amazon-computers	v_div_u	128	0.192	0.116	0.393	2.05	3.38
amazon-computers	v_div_u	256	0.344	0.198	0.735	2.13	3.72
amazon-computers	v_dot_e	32	0.154	0.086	0.123	0.80	1.43
amazon-computers	v_dot_e	64	0.163	0.095	0.129	0.79	1.36
amazon-computers	v_dot_e	128	0.186	0.109	0.202	1.08	1.85
amazon-computers	v_dot_e	256	0.253	0.182	0.335	1.33	1.84
amazon-computers	v_dot_u	32	0.105	0.069	0.102	0.97	1.47
amazon-computers	v_dot_u	64	0.109	0.069	0.104	0.95	1.50
amazon-computers	v_dot_u	128	0.120	0.080	0.145	1.21	1.82
amazon-computers	v_dot_u	256	0.149	0.089	0.249	1.67	2.81
amazon-computers	v_mul_e	32	0.102	0.084	0.124	1.21	1.48
amazon-computers	v_mul_e	64	0.137	0.106	0.225	1.64	2.12
amazon-computers	v_mul_e	128	0.217	0.181	0.415	1.91	2.29
amazon-computers	v_mul_e	256	0.394	0.335	0.779	1.98	2.32
amazon-computers	v_mul_u	32	0.104	0.071	0.118	1.13	1.66
amazon-computers	v_mul_u	64	0.117	0.073	0.208	1.79	2.85
amazon-computers	v_mul_u	128	0.164	0.104	0.383	2.33	3.70
amazon-computers	v_mul_u	256	0.295	0.199	0.718	2.44	3.62
amazon-computers	v_sub_e	32	0.102	0.084	0.163	1.60	1.94

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
amazon-computers	v_sub_e	64	0.132	0.104	0.298	2.25	2.88
amazon-computers	v_sub_e	128	0.216	0.182	0.564	2.61	3.10
amazon-computers	v_sub_e	256	0.396	0.335	1.084	2.74	3.23
amazon-computers	v_sub_u	32	0.104	0.071	0.121	1.16	1.70
amazon-computers	v_sub_u	64	0.116	0.073	0.212	1.83	2.89
amazon-computers	v_sub_u	128	0.165	0.104	0.387	2.34	3.73
amazon-computers	v_sub_u	256	0.295	0.197	0.726	2.46	3.68
amazon-photo	copy_u	32	0.064	0.063	0.056	0.87	0.89
amazon-photo	copy_u	64	0.065	0.064	0.106	1.64	1.66
amazon-photo	copy_u	128	0.081	0.064	0.176	2.17	2.77
amazon-photo	copy_u	256	0.139	0.091	0.315	2.27	3.45
amazon-photo	copy_v	32	0.076	0.062	0.056	0.75	0.91
amazon-photo	copy_v	64	0.065	0.065	0.099	1.54	1.53
amazon-photo	copy_v	128	0.074	0.063	0.169	2.29	2.66
amazon-photo	copy_v	256	0.105	0.096	0.298	2.85	3.10
amazon-photo	e_add_u	32	0.079	0.045	0.066	0.84	1.45
amazon-photo	e_add_u	64	0.085	0.055	0.121	1.43	2.21
amazon-photo	e_add_u	128	0.126	0.092	0.217	1.72	2.36
amazon-photo	e_add_u	256	0.209	0.171	0.401	1.92	2.34
amazon-photo	e_add_v	32	0.057	0.045	0.065	1.14	1.44
amazon-photo	e_add_v	64	0.074	0.055	0.120	1.64	2.19
amazon-photo	e_add_v	128	0.114	0.092	0.216	1.90	2.34
amazon-photo	e_add_v	256	0.195	0.171	0.398	2.04	2.33
amazon-photo	e_div_u	32	0.081	0.048	0.108	1.34	2.25
amazon-photo	e_div_u	64	0.097	0.060	0.130	1.35	2.18
amazon-photo	e_div_u	128	0.134	0.094	0.228	1.70	2.43
amazon-photo	e_div_u	256	0.252	0.174	0.415	1.64	2.39
amazon-photo	e_div_v	32	0.061	0.047	0.111	1.81	2.35
amazon-photo	e_div_v	64	0.079	0.062	0.130	1.66	2.09
amazon-photo	e_div_v	128	0.122	0.095	0.228	1.88	2.41
amazon-photo	e_div_v	256	0.211	0.171	0.413	1.96	2.41
amazon-photo	e_dot_u	32	0.063	0.044	0.066	1.04	1.50
amazon-photo	e_dot_u	64	0.107	0.051	0.066	0.62	1.30
amazon-photo	e_dot_u	128	0.122	0.056	0.101	0.83	1.81
amazon-photo	e_dot_u	256	0.164	0.091	0.163	0.99	1.78
amazon-photo	e_dot_v	32	0.051	0.045	0.071	1.41	1.57
amazon-photo	e_dot_v	64	0.091	0.048	0.066	0.73	1.38
amazon-photo	e_dot_v	128	0.103	0.055	0.099	0.96	1.81
amazon-photo	e_dot_v	256	0.135	0.089	0.163	1.21	1.84
amazon-photo	e_mul_u	32	0.084	0.047	0.065	0.77	1.38
amazon-photo	e_mul_u	64	0.085	0.055	0.121	1.43	2.21
amazon-photo	e_mul_u	128	0.127	0.092	0.218	1.71	2.37
amazon-photo	e_mul_u	256	0.212	0.171	0.400	1.89	2.35
amazon-photo	e_mul_v	32	0.057	0.049	0.066	1.14	1.34
amazon-photo	e_mul_v	64	0.074	0.054	0.122	1.65	2.24
amazon-photo	e_mul_v	128	0.113	0.092	0.216	1.91	2.36
amazon-photo	e_mul_v	256	0.194	0.168	0.398	2.05	2.37
amazon-photo	e_sub_u	32	0.078	0.043	0.083	1.06	1.90
amazon-photo	e_sub_u	64	0.085	0.055	0.126	1.49	2.29
amazon-photo	e_sub_u	128	0.127	0.092	0.223	1.75	2.43
amazon-photo	e_sub_u	256	0.213	0.172	0.408	1.92	2.38
amazon-photo	e_sub_v	32	0.057	0.044	0.085	1.48	1.95
amazon-photo	e_sub_v	64	0.074	0.054	0.125	1.70	2.31
amazon-photo	e_sub_v	128	0.114	0.092	0.222	1.96	2.41
amazon-photo	e_sub_v	256	0.195	0.168	0.405	2.08	2.41
amazon-photo	u_add_e	32	0.077	0.055	0.065	0.84	1.18
amazon-photo	u_add_e	64	0.085	0.054	0.122	1.43	2.23
amazon-photo	u_add_e	128	0.127	0.092	0.218	1.72	2.38
amazon-photo	u_add_e	256	0.207	0.171	0.400	1.93	2.34
amazon-photo	u_add_v	32	0.045	0.044	0.063	1.42	1.43
amazon-photo	u_add_v	64	0.065	0.046	0.111	1.72	2.44
amazon-photo	u_add_v	128	0.084	0.054	0.197	2.34	3.65
amazon-photo	u_add_v	256	0.138	0.091	0.359	2.60	3.96
amazon-photo	u_div_e	32	0.073	0.049	0.108	1.49	2.21
amazon-photo	u_div_e	64	0.091	0.059	0.201	2.22	3.39
amazon-photo	u_div_e	128	0.135	0.093	0.369	2.73	3.96
amazon-photo	u_div_e	256	0.251	0.174	0.707	2.81	4.05
amazon-photo	u_div_v	32	0.045	0.045	0.110	2.47	2.47
amazon-photo	u_div_v	64	0.071	0.049	0.122	1.72	2.52
amazon-photo	u_div_v	128	0.098	0.058	0.216	2.20	3.73
amazon-photo	u_div_v	256	0.162	0.095	0.376	2.32	3.95
amazon-photo	u_dot_e	32	0.064	0.046	0.065	1.03	1.43
amazon-photo	u_dot_e	64	0.112	0.052	0.066	0.59	1.27
amazon-photo	u_dot_e	128	0.120	0.059	0.100	0.83	1.70
amazon-photo	u_dot_e	256	0.158	0.095	0.163	1.03	1.72
amazon-photo	u_dot_v	32	0.062	0.045	0.064	1.03	1.43
amazon-photo	u_dot_v	64	0.063	0.045	0.065	1.03	1.43
amazon-photo	u_dot_v	128	0.068	0.045	0.075	1.11	1.65

... continued

graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
amazon-photo	u_dot_v	256	0.078	0.053	0.112	1.43	2.11
amazon-photo	u_mul_e	32	0.077	0.044	0.065	0.85	1.48
amazon-photo	u_mul_e	64	0.085	0.055	0.122	1.43	2.19
amazon-photo	u_mul_e	128	0.127	0.093	0.218	1.72	2.35
amazon-photo	u_mul_e	256	0.209	0.171	0.400	1.91	2.34
amazon-photo	u_mul_v	32	0.045	0.043	0.064	1.44	1.48
amazon-photo	u_mul_v	64	0.065	0.047	0.111	1.71	2.35
amazon-photo	u_mul_v	128	0.086	0.054	0.199	2.32	3.71
amazon-photo	u_mul_v	256	0.139	0.091	0.362	2.60	3.97
amazon-photo	u_sub_e	32	0.077	0.049	0.086	1.11	1.75
amazon-photo	u_sub_e	64	0.085	0.055	0.161	1.90	2.94
amazon-photo	u_sub_e	128	0.126	0.092	0.290	2.29	3.14
amazon-photo	u_sub_e	256	0.209	0.170	0.545	2.61	3.20
amazon-photo	u_sub_v	32	0.045	0.044	0.082	1.83	1.88
amazon-photo	u_sub_v	64	0.064	0.045	0.116	1.80	2.58
amazon-photo	u_sub_v	128	0.085	0.053	0.203	2.40	3.82
amazon-photo	u_sub_v	256	0.140	0.091	0.370	2.64	4.06
amazon-photo	v_add_e	32	0.058	0.045	0.065	1.13	1.46
amazon-photo	v_add_e	64	0.088	0.055	0.121	1.37	2.19
amazon-photo	v_add_e	128	0.112	0.091	0.218	1.94	2.38
amazon-photo	v_add_e	256	0.190	0.167	0.398	2.10	2.38
amazon-photo	v_add_u	32	0.044	0.044	0.062	1.39	1.40
amazon-photo	v_add_u	64	0.074	0.046	0.112	1.52	2.42
amazon-photo	v_add_u	128	0.083	0.053	0.197	2.37	3.70
amazon-photo	v_add_u	256	0.139	0.091	0.364	2.61	3.99
amazon-photo	v_div_e	32	0.061	0.057	0.106	1.73	1.85
amazon-photo	v_div_e	64	0.081	0.063	0.200	2.46	3.17
amazon-photo	v_div_e	128	0.127	0.094	0.377	2.96	3.99
amazon-photo	v_div_e	256	0.224	0.169	0.699	3.13	4.15
amazon-photo	v_div_u	32	0.045	0.044	0.107	2.39	2.42
amazon-photo	v_div_u	64	0.071	0.049	0.121	1.71	2.48
amazon-photo	v_div_u	128	0.098	0.060	0.207	2.10	3.46
amazon-photo	v_div_u	256	0.164	0.092	0.374	2.27	4.05
amazon-photo	v_dot_e	32	0.051	0.045	0.066	1.29	1.45
amazon-photo	v_dot_e	64	0.090	0.049	0.067	0.74	1.36
amazon-photo	v_dot_e	128	0.103	0.058	0.100	0.97	1.73
amazon-photo	v_dot_e	256	0.134	0.094	0.165	1.23	1.75
amazon-photo	v_dot_u	32	0.061	0.044	0.064	1.04	1.45
amazon-photo	v_dot_u	64	0.063	0.045	0.065	1.04	1.45
amazon-photo	v_dot_u	128	0.068	0.046	0.074	1.10	1.61
amazon-photo	v_dot_u	256	0.078	0.046	0.111	1.42	2.39
amazon-photo	v_mul_e	32	0.057	0.044	0.065	1.15	1.47
amazon-photo	v_mul_e	64	0.074	0.055	0.121	1.63	2.21
amazon-photo	v_mul_e	128	0.113	0.091	0.218	1.92	2.38
amazon-photo	v_mul_e	256	0.193	0.167	0.398	2.06	2.38
amazon-photo	v_mul_u	32	0.045	0.045	0.064	1.41	1.42
amazon-photo	v_mul_u	64	0.065	0.046	0.112	1.72	2.45
amazon-photo	v_mul_u	128	0.085	0.053	0.199	2.35	3.74
amazon-photo	v_mul_u	256	0.139	0.092	0.363	2.62	3.97
amazon-photo	v_sub_e	32	0.057	0.047	0.085	1.50	1.79
amazon-photo	v_sub_e	64	0.074	0.054	0.159	2.16	2.94
amazon-photo	v_sub_e	128	0.113	0.091	0.289	2.55	3.16
amazon-photo	v_sub_e	256	0.194	0.168	0.542	2.80	3.23
amazon-photo	v_sub_u	32	0.045	0.045	0.082	1.81	1.82
amazon-photo	v_sub_u	64	0.064	0.046	0.116	1.80	2.53
amazon-photo	v_sub_u	128	0.085	0.053	0.202	2.39	3.81
amazon-photo	v_sub_u	256	0.138	0.091	0.368	2.65	4.02
artnet-exp	copy_u	32	0.121	0.086	0.132	1.10	1.54
artnet-exp	copy_u	64	0.137	0.090	0.244	1.78	2.72
artnet-exp	copy_u	128	0.179	0.141	0.447	2.49	3.16
artnet-exp	copy_u	256	0.308	0.288	0.810	2.63	2.81
artnet-exp	copy_v	32	0.082	0.068	0.132	1.61	1.93
artnet-exp	copy_v	64	0.096	0.076	0.239	2.48	3.16
artnet-exp	copy_v	128	0.140	0.137	0.446	3.19	3.25
artnet-exp	copy_v	256	0.250	0.263	0.847	3.39	3.22
artnet-exp	e_add_u	32	0.143	0.112	0.154	1.08	1.38
artnet-exp	e_add_u	64	0.176	0.138	0.284	1.61	2.06
artnet-exp	e_add_u	128	0.265	0.246	0.527	1.99	2.15
artnet-exp	e_add_u	256	0.493	0.480	0.992	2.01	2.07
artnet-exp	e_add_v	32	0.126	0.107	0.153	1.21	1.43
artnet-exp	e_add_v	64	0.155	0.135	0.284	1.83	2.10
artnet-exp	e_add_v	128	0.248	0.233	0.530	2.13	2.27
artnet-exp	e_add_v	256	0.448	0.439	1.001	2.23	2.28
artnet-exp	e_div_u	32	0.149	0.120	0.167	1.12	1.40
artnet-exp	e_div_u	64	0.178	0.148	0.302	1.70	2.04
artnet-exp	e_div_u	128	0.295	0.250	0.557	1.89	2.23
artnet-exp	e_div_u	256	0.526	0.481	1.051	2.00	2.19
artnet-exp	e_div_v	32	0.132	0.124	0.166	1.26	1.34

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
artnet-exp	e_div_v	64	0.161	0.151	0.302	1.87	2.00
artnet-exp	e_div_v	128	0.251	0.245	0.560	2.23	2.29
artnet-exp	e_div_v	256	0.469	0.449	1.060	2.26	2.36
artnet-exp	e_dot_u	32	0.160	0.114	0.157	0.98	1.38
artnet-exp	e_dot_u	64	0.178	0.121	0.168	0.94	1.38
artnet-exp	e_dot_u	128	0.200	0.143	0.261	1.31	1.82
artnet-exp	e_dot_u	256	0.298	0.275	0.435	1.46	1.58
artnet-exp	e_dot_v	32	0.147	0.110	0.156	1.06	1.42
artnet-exp	e_dot_v	64	0.153	0.117	0.168	1.10	1.43
artnet-exp	e_dot_v	128	0.177	0.134	0.262	1.48	1.95
artnet-exp	e_dot_v	256	0.257	0.226	0.446	1.74	1.97
artnet-exp	e_mul_u	32	0.143	0.114	0.153	1.07	1.34
artnet-exp	e_mul_u	64	0.167	0.138	0.284	1.70	2.05
artnet-exp	e_mul_u	128	0.270	0.245	0.527	1.95	2.15
artnet-exp	e_mul_u	256	0.498	0.472	0.992	1.99	2.10
artnet-exp	e_mul_v	32	0.127	0.107	0.154	1.21	1.44
artnet-exp	e_mul_v	64	0.155	0.135	0.284	1.82	2.10
artnet-exp	e_mul_v	128	0.248	0.233	0.529	2.13	2.27
artnet-exp	e_mul_v	256	0.447	0.439	1.001	2.24	2.28
artnet-exp	e_sub_u	32	0.143	0.111	0.161	1.13	1.44
artnet-exp	e_sub_u	64	0.168	0.138	0.294	1.75	2.12
artnet-exp	e_sub_u	128	0.270	0.246	0.544	2.01	2.21
artnet-exp	e_sub_u	256	0.499	0.473	1.022	2.05	2.16
artnet-exp	e_sub_v	32	0.136	0.108	0.159	1.17	1.48
artnet-exp	e_sub_v	64	0.156	0.135	0.294	1.89	2.18
artnet-exp	e_sub_v	128	0.247	0.233	0.545	2.20	2.34
artnet-exp	e_sub_v	256	0.448	0.439	1.030	2.30	2.35
artnet-exp	u_add_e	32	0.142	0.112	0.154	1.09	1.38
artnet-exp	u_add_e	64	0.166	0.141	0.284	1.71	2.01
artnet-exp	u_add_e	128	0.267	0.246	0.527	1.98	2.14
artnet-exp	u_add_e	256	0.490	0.469	0.996	2.03	2.12
artnet-exp	u_add_v	32	0.137	0.090	0.151	1.10	1.68
artnet-exp	u_add_v	64	0.153	0.101	0.280	1.82	2.76
artnet-exp	u_add_v	128	0.193	0.157	0.516	2.68	3.28
artnet-exp	u_add_v	256	0.329	0.304	0.966	2.93	3.18
artnet-exp	u_div_e	32	0.140	0.116	0.260	1.85	2.25
artnet-exp	u_div_e	64	0.170	0.148	0.489	2.87	3.32
artnet-exp	u_div_e	128	0.284	0.249	0.923	3.25	3.70
artnet-exp	u_div_e	256	0.524	0.468	1.774	3.39	3.79
artnet-exp	u_div_v	32	0.142	0.099	0.163	1.15	1.65
artnet-exp	u_div_v	64	0.161	0.122	0.299	1.85	2.44
artnet-exp	u_div_v	128	0.204	0.160	0.549	2.70	3.43
artnet-exp	u_div_v	256	0.367	0.304	1.032	2.81	3.40
artnet-exp	u_dot_e	32	0.162	0.113	0.156	0.96	1.38
artnet-exp	u_dot_e	64	0.168	0.126	0.165	0.99	1.32
artnet-exp	u_dot_e	128	0.192	0.149	0.257	1.34	1.72
artnet-exp	u_dot_e	256	0.290	0.275	0.430	1.48	1.57
artnet-exp	u_dot_v	32	0.099	0.094	0.131	1.32	1.40
artnet-exp	u_dot_v	64	0.102	0.095	0.160	1.57	1.69
artnet-exp	u_dot_v	128	0.162	0.106	0.228	1.41	2.16
artnet-exp	u_dot_v	256	0.181	0.122	0.378	2.09	3.10
artnet-exp	u_mul_e	32	0.142	0.111	0.155	1.09	1.39
artnet-exp	u_mul_e	64	0.165	0.140	0.284	1.72	2.04
artnet-exp	u_mul_e	128	0.270	0.247	0.536	1.98	2.17
artnet-exp	u_mul_e	256	0.495	0.469	0.996	2.01	2.12
artnet-exp	u_mul_v	32	0.138	0.090	0.154	1.11	1.70
artnet-exp	u_mul_v	64	0.155	0.103	0.282	1.82	2.75
artnet-exp	u_mul_v	128	0.196	0.158	0.520	2.65	3.30
artnet-exp	u_mul_v	256	0.333	0.303	0.974	2.93	3.21
artnet-exp	u_sub_e	32	0.142	0.112	0.200	1.41	1.79
artnet-exp	u_sub_e	64	0.165	0.138	0.377	2.28	2.72
artnet-exp	u_sub_e	128	0.265	0.246	0.715	2.70	2.91
artnet-exp	u_sub_e	256	0.497	0.469	1.383	2.78	2.95
artnet-exp	u_sub_v	32	0.138	0.090	0.156	1.13	1.73
artnet-exp	u_sub_v	64	0.154	0.102	0.290	1.89	2.86
artnet-exp	u_sub_v	128	0.196	0.158	0.535	2.73	3.40
artnet-exp	u_sub_v	256	0.332	0.304	1.001	3.02	3.29
artnet-exp	v_add_e	32	0.126	0.123	0.154	1.22	1.26
artnet-exp	v_add_e	64	0.154	0.134	0.285	1.85	2.12
artnet-exp	v_add_e	128	0.244	0.233	0.531	2.18	2.28
artnet-exp	v_add_e	256	0.444	0.435	1.007	2.27	2.32
artnet-exp	v_add_u	32	0.137	0.090	0.155	1.13	1.72
artnet-exp	v_add_u	64	0.161	0.102	0.281	1.75	2.76
artnet-exp	v_add_u	128	0.193	0.157	0.519	2.68	3.30
artnet-exp	v_add_u	256	0.330	0.304	0.971	2.95	3.19
artnet-exp	v_div_e	32	0.133	0.126	0.254	1.91	2.02
artnet-exp	v_div_e	64	0.161	0.152	0.481	2.99	3.17
artnet-exp	v_div_e	128	0.261	0.240	0.921	3.53	3.85

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
artnet-exp	v_div_e	256	0.469	0.436	1.789	3.81	4.11
artnet-exp	v_div_u	32	0.143	0.099	0.164	1.15	1.65
artnet-exp	v_div_u	64	0.161	0.124	0.299	1.85	2.42
artnet-exp	v_div_u	128	0.204	0.163	0.550	2.70	3.37
artnet-exp	v_div_u	256	0.362	0.305	1.031	2.85	3.38
artnet-exp	v_dot_e	32	0.147	0.110	0.156	1.06	1.41
artnet-exp	v_dot_e	64	0.153	0.120	0.165	1.08	1.38
artnet-exp	v_dot_e	128	0.174	0.140	0.263	1.51	1.88
artnet-exp	v_dot_e	256	0.254	0.240	0.446	1.76	1.86
artnet-exp	v_dot_u	32	0.101	0.093	0.128	1.27	1.38
artnet-exp	v_dot_u	64	0.110	0.093	0.161	1.46	1.73
artnet-exp	v_dot_u	128	0.162	0.106	0.228	1.41	2.16
artnet-exp	v_dot_u	256	0.181	0.122	0.377	2.08	3.09
artnet-exp	v_mul_e	32	0.126	0.107	0.154	1.22	1.44
artnet-exp	v_mul_e	64	0.154	0.135	0.285	1.84	2.11
artnet-exp	v_mul_e	128	0.244	0.233	0.530	2.17	2.27
artnet-exp	v_mul_e	256	0.446	0.437	1.008	2.26	2.31
artnet-exp	v_mul_u	32	0.138	0.091	0.151	1.10	1.66
artnet-exp	v_mul_u	64	0.154	0.103	0.282	1.83	2.75
artnet-exp	v_mul_u	128	0.196	0.158	0.521	2.66	3.29
artnet-exp	v_mul_u	256	0.331	0.304	0.974	2.94	3.21
artnet-exp	v_sub_e	32	0.126	0.108	0.201	1.59	1.86
artnet-exp	v_sub_e	64	0.154	0.135	0.379	2.46	2.80
artnet-exp	v_sub_e	128	0.244	0.233	0.718	2.95	3.08
artnet-exp	v_sub_e	256	0.447	0.436	1.394	3.12	3.20
artnet-exp	v_sub_u	32	0.138	0.090	0.157	1.14	1.75
artnet-exp	v_sub_u	64	0.155	0.102	0.291	1.88	2.86
artnet-exp	v_sub_u	128	0.196	0.157	0.538	2.74	3.43
artnet-exp	v_sub_u	256	0.332	0.304	1.002	3.02	3.30
artnet-views	copy_u	32	0.120	0.088	0.133	1.11	1.51
artnet-views	copy_u	64	0.136	0.091	0.245	1.81	2.71
artnet-views	copy_u	128	0.188	0.142	0.446	2.37	3.14
artnet-views	copy_u	256	0.310	0.289	0.811	2.62	2.81
artnet-views	copy_v	32	0.083	0.071	0.133	1.60	1.86
artnet-views	copy_v	64	0.104	0.073	0.238	2.29	3.28
artnet-views	copy_v	128	0.139	0.138	0.445	3.20	3.23
artnet-views	copy_v	256	0.249	0.264	0.847	3.40	3.21
artnet-views	e_add_u	32	0.148	0.111	0.154	1.04	1.38
artnet-views	e_add_u	64	0.166	0.138	0.282	1.70	2.04
artnet-views	e_add_u	128	0.266	0.248	0.526	1.98	2.12
artnet-views	e_add_u	256	0.494	0.470	0.989	2.00	2.11
artnet-views	e_add_v	32	0.127	0.107	0.153	1.20	1.43
artnet-views	e_add_v	64	0.159	0.135	0.288	1.81	2.14
artnet-views	e_add_v	128	0.248	0.234	0.528	2.13	2.26
artnet-views	e_add_v	256	0.448	0.438	1.004	2.24	2.29
artnet-views	e_div_u	32	0.149	0.118	0.167	1.12	1.41
artnet-views	e_div_u	64	0.178	0.148	0.302	1.70	2.04
artnet-views	e_div_u	128	0.290	0.250	0.562	1.94	2.25
artnet-views	e_div_u	256	0.525	0.481	1.052	2.00	2.19
artnet-views	e_div_v	32	0.131	0.124	0.167	1.27	1.35
artnet-views	e_div_v	64	0.162	0.151	0.303	1.87	2.00
artnet-views	e_div_v	128	0.252	0.240	0.558	2.22	2.32
artnet-views	e_div_v	256	0.468	0.448	1.065	2.28	2.38
artnet-views	e_dot_u	32	0.160	0.114	0.157	0.98	1.37
artnet-views	e_dot_u	64	0.172	0.121	0.167	0.97	1.38
artnet-views	e_dot_u	128	0.201	0.144	0.259	1.29	1.80
artnet-views	e_dot_u	256	0.298	0.274	0.430	1.44	1.57
artnet-views	e_dot_v	32	0.147	0.110	0.156	1.06	1.42
artnet-views	e_dot_v	64	0.154	0.117	0.176	1.14	1.51
artnet-views	e_dot_v	128	0.177	0.133	0.259	1.46	1.94
artnet-views	e_dot_v	256	0.256	0.232	0.446	1.74	1.92
artnet-views	e_mul_u	32	0.142	0.112	0.153	1.08	1.37
artnet-views	e_mul_u	64	0.167	0.140	0.283	1.69	2.02
artnet-views	e_mul_u	128	0.270	0.247	0.525	1.95	2.13
artnet-views	e_mul_u	256	0.497	0.472	0.985	1.98	2.09
artnet-views	e_mul_v	32	0.126	0.108	0.153	1.21	1.42
artnet-views	e_mul_v	64	0.156	0.134	0.285	1.82	2.12
artnet-views	e_mul_v	128	0.248	0.234	0.528	2.13	2.26
artnet-views	e_mul_v	256	0.446	0.437	1.004	2.25	2.30
artnet-views	e_sub_u	32	0.142	0.111	0.161	1.13	1.44
artnet-views	e_sub_u	64	0.167	0.139	0.292	1.74	2.10
artnet-views	e_sub_u	128	0.272	0.246	0.542	1.99	2.20
artnet-views	e_sub_u	256	0.509	0.468	1.021	2.00	2.18
artnet-views	e_sub_v	32	0.126	0.108	0.160	1.27	1.48
artnet-views	e_sub_v	64	0.156	0.135	0.293	1.88	2.17
artnet-views	e_sub_v	128	0.247	0.234	0.545	2.20	2.33
artnet-views	e_sub_v	256	0.446	0.436	1.033	2.32	2.37
artnet-views	u_add_e	32	0.142	0.112	0.154	1.08	1.38

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
artnet-views	u_add_e	64	0.166	0.138	0.285	1.72	2.06
artnet-views	u_add_e	128	0.265	0.247	0.526	1.98	2.13
artnet-views	u_add_e	256	0.491	0.470	0.995	2.02	2.12
artnet-views	u_add_v	32	0.138	0.091	0.151	1.09	1.66
artnet-views	u_add_v	64	0.154	0.102	0.283	1.83	2.77
artnet-views	u_add_v	128	0.201	0.158	0.515	2.56	3.26
artnet-views	u_add_v	256	0.330	0.305	0.964	2.92	3.16
artnet-views	u_div_e	32	0.141	0.116	0.261	1.85	2.25
artnet-views	u_div_e	64	0.171	0.145	0.481	2.81	3.32
artnet-views	u_div_e	128	0.284	0.249	0.919	3.23	3.69
artnet-views	u_div_e	256	0.523	0.469	1.777	3.40	3.79
artnet-views	u_div_v	32	0.143	0.099	0.163	1.14	1.64
artnet-views	u_div_v	64	0.161	0.123	0.298	1.85	2.42
artnet-views	u_div_v	128	0.205	0.167	0.548	2.68	3.28
artnet-views	u_div_v	256	0.367	0.304	1.028	2.80	3.39
artnet-views	u_dot_e	32	0.163	0.114	0.156	0.96	1.36
artnet-views	u_dot_e	64	0.168	0.124	0.165	0.98	1.33
artnet-views	u_dot_e	128	0.192	0.149	0.254	1.32	1.70
artnet-views	u_dot_e	256	0.291	0.275	0.430	1.48	1.57
artnet-views	u_dot_v	32	0.111	0.095	0.130	1.18	1.38
artnet-views	u_dot_v	64	0.108	0.093	0.159	1.48	1.71
artnet-views	u_dot_v	128	0.163	0.107	0.228	1.40	2.14
artnet-views	u_dot_v	256	0.188	0.122	0.377	2.01	3.10
artnet-views	u_mul_e	32	0.143	0.112	0.156	1.09	1.40
artnet-views	u_mul_e	64	0.166	0.138	0.284	1.71	2.06
artnet-views	u_mul_e	128	0.266	0.247	0.527	1.98	2.14
artnet-views	u_mul_e	256	0.497	0.470	0.994	2.00	2.12
artnet-views	u_mul_v	32	0.139	0.091	0.151	1.09	1.66
artnet-views	u_mul_v	64	0.155	0.102	0.281	1.81	2.75
artnet-views	u_mul_v	128	0.196	0.158	0.516	2.63	3.26
artnet-views	u_mul_v	256	0.346	0.305	0.970	2.80	3.18
artnet-views	u_sub_e	32	0.142	0.112	0.201	1.41	1.80
artnet-views	u_sub_e	64	0.166	0.140	0.377	2.27	2.69
artnet-views	u_sub_e	128	0.265	0.246	0.714	2.69	2.90
artnet-views	u_sub_e	256	0.496	0.470	1.381	2.78	2.94
artnet-views	u_sub_v	32	0.139	0.092	0.156	1.13	1.70
artnet-views	u_sub_v	64	0.154	0.102	0.289	1.87	2.83
artnet-views	u_sub_v	128	0.196	0.158	0.533	2.71	3.36
artnet-views	u_sub_v	256	0.332	0.305	0.999	3.01	3.28
artnet-views	v_add_e	32	0.126	0.107	0.154	1.22	1.44
artnet-views	v_add_e	64	0.154	0.140	0.285	1.84	2.03
artnet-views	v_add_e	128	0.244	0.234	0.531	2.18	2.27
artnet-views	v_add_e	256	0.442	0.435	1.010	2.29	2.32
artnet-views	v_add_u	32	0.139	0.092	0.151	1.09	1.64
artnet-views	v_add_u	64	0.154	0.102	0.279	1.81	2.74
artnet-views	v_add_u	128	0.194	0.158	0.517	2.67	3.27
artnet-views	v_add_u	256	0.329	0.305	0.968	2.94	3.17
artnet-views	v_div_e	32	0.134	0.126	0.254	1.89	2.02
artnet-views	v_div_e	64	0.161	0.152	0.483	2.99	3.18
artnet-views	v_div_e	128	0.268	0.241	0.921	3.44	3.83
artnet-views	v_div_e	256	0.476	0.445	1.785	3.75	4.01
artnet-views	v_div_u	32	0.143	0.101	0.163	1.14	1.60
artnet-views	v_div_u	64	0.162	0.125	0.297	1.84	2.38
artnet-views	v_div_u	128	0.205	0.164	0.549	2.68	3.36
artnet-views	v_div_u	256	0.361	0.306	1.031	2.85	3.37
artnet-views	v_dot_e	32	0.146	0.112	0.156	1.07	1.40
artnet-views	v_dot_e	64	0.154	0.120	0.166	1.08	1.38
artnet-views	v_dot_e	128	0.175	0.142	0.260	1.49	1.84
artnet-views	v_dot_e	256	0.254	0.241	0.447	1.76	1.85
artnet-views	v_dot_u	32	0.100	0.095	0.131	1.31	1.38
artnet-views	v_dot_u	64	0.108	0.093	0.159	1.47	1.71
artnet-views	v_dot_u	128	0.163	0.106	0.228	1.39	2.14
artnet-views	v_dot_u	256	0.181	0.124	0.378	2.08	3.06
artnet-views	v_mul_e	32	0.128	0.109	0.155	1.21	1.42
artnet-views	v_mul_e	64	0.155	0.135	0.285	1.84	2.12
artnet-views	v_mul_e	128	0.243	0.234	0.529	2.17	2.27
artnet-views	v_mul_e	256	0.444	0.435	1.004	2.26	2.31
artnet-views	v_mul_u	32	0.139	0.092	0.151	1.09	1.64
artnet-views	v_mul_u	64	0.154	0.103	0.279	1.81	2.73
artnet-views	v_mul_u	128	0.197	0.158	0.519	2.64	3.28
artnet-views	v_mul_u	256	0.331	0.305	0.974	2.94	3.20
artnet-views	v_sub_e	32	0.126	0.107	0.201	1.59	1.87
artnet-views	v_sub_e	64	0.154	0.135	0.384	2.49	2.85
artnet-views	v_sub_e	128	0.244	0.233	0.720	2.95	3.09
artnet-views	v_sub_e	256	0.447	0.433	1.394	3.12	3.22
artnet-views	v_sub_u	32	0.139	0.091	0.156	1.13	1.72
artnet-views	v_sub_u	64	0.154	0.103	0.289	1.87	2.80
artnet-views	v_sub_u	128	0.196	0.159	0.536	2.73	3.36

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
artnet-views	v_sub_u	256	0.332	0.304	0.999	3.01	3.29
avazu-ctr	copy_u	32	2.010	2.526	3.110	1.55	1.23
avazu-ctr	copy_u	64	2.753	2.687	5.751	2.09	2.14
avazu-ctr	copy_u	128	4.750	4.109	12.621	2.66	3.07
avazu-ctr	copy_u	256	9.351	8.217	25.250	2.70	3.07
avazu-ctr	copy_v	32	0.919	1.964	3.520	3.83	1.79
avazu-ctr	copy_v	64	1.769	2.230	6.737	3.81	3.02
avazu-ctr	copy_v	128	3.431	4.096	13.358	3.89	3.26
avazu-ctr	copy_v	256	6.744	7.937	26.607	3.95	3.35
avazu-ctr	e_add_u	32	2.900	3.427	4.312	1.49	1.26
avazu-ctr	e_add_u	64	4.278	4.310	8.196	1.92	1.90
avazu-ctr	e_add_u	128	7.743	7.716	15.815	2.04	2.05
avazu-ctr	e_add_u	256	15.214	14.781	30.650	2.01	2.07
avazu-ctr	e_add_v	32	2.327	3.204	4.360	1.87	1.36
avazu-ctr	e_add_v	64	3.938	4.211	8.347	2.12	1.98
avazu-ctr	e_add_v	128	7.128	7.435	16.184	2.27	2.18
avazu-ctr	e_add_v	256	13.921	13.929	31.708	2.28	2.28
avazu-ctr	e_div_u	32	3.011	3.647	4.327	1.44	1.19
avazu-ctr	e_div_u	64	4.431	4.640	8.217	1.85	1.77
avazu-ctr	e_div_u	128	7.784	7.844	15.872	2.04	2.02
avazu-ctr	e_div_u	256	15.826	15.107	30.665	1.94	2.03
avazu-ctr	e_div_v	32	2.395	3.730	4.376	1.83	1.17
avazu-ctr	e_div_v	64	3.999	4.713	8.379	2.10	1.78
avazu-ctr	e_div_v	128	7.218	7.627	16.217	2.25	2.13
avazu-ctr	e_div_v	256	13.906	14.277	31.804	2.29	2.23
avazu-ctr	e_dot_u	32	3.708	3.502	4.983	1.34	1.42
avazu-ctr	e_dot_u	64	4.033	3.766	5.256	1.30	1.40
avazu-ctr	e_dot_u	128	5.007	4.510	8.090	1.62	1.79
avazu-ctr	e_dot_u	256	8.564	7.988	13.259	1.55	1.66
avazu-ctr	e_dot_v	32	2.922	3.319	4.949	1.69	1.49
avazu-ctr	e_dot_v	64	3.243	3.585	5.231	1.61	1.46
avazu-ctr	e_dot_v	128	4.211	4.273	8.327	1.98	1.95
avazu-ctr	e_dot_v	256	7.437	7.235	13.910	1.87	1.92
avazu-ctr	e_mul_u	32	2.934	3.427	4.310	1.47	1.26
avazu-ctr	e_mul_u	64	4.329	4.335	8.195	1.89	1.89
avazu-ctr	e_mul_u	128	7.741	7.723	15.811	2.04	2.05
avazu-ctr	e_mul_u	256	15.193	14.779	30.574	2.01	2.07
avazu-ctr	e_mul_v	32	2.327	3.204	4.360	1.87	1.36
avazu-ctr	e_mul_v	64	3.938	4.210	8.345	2.12	1.98
avazu-ctr	e_mul_v	128	7.138	7.451	16.180	2.27	2.17
avazu-ctr	e_mul_v	256	13.926	13.952	31.699	2.28	2.27
avazu-ctr	e_sub_u	32	2.937	3.437	4.320	1.47	1.26
avazu-ctr	e_sub_u	64	4.324	4.336	8.208	1.90	1.89
avazu-ctr	e_sub_u	128	7.747	7.711	15.838	2.04	2.05
avazu-ctr	e_sub_u	256	15.213	14.794	30.636	2.01	2.07
avazu-ctr	e_sub_v	32	2.327	3.205	4.368	1.88	1.36
avazu-ctr	e_sub_v	64	3.937	4.210	8.359	2.12	1.99
avazu-ctr	e_sub_v	128	7.142	7.438	16.208	2.27	2.18
avazu-ctr	e_sub_v	256	13.928	13.949	31.768	2.28	2.28
avazu-ctr	u_add_e	32	2.965	3.447	4.323	1.46	1.25
avazu-ctr	u_add_e	64	4.306	4.297	8.215	1.91	1.91
avazu-ctr	u_add_e	128	7.748	7.715	15.850	2.05	2.05
avazu-ctr	u_add_e	256	15.198	14.794	30.653	2.02	2.07
avazu-ctr	u_add_v	32	2.037	2.653	3.998	1.96	1.51
avazu-ctr	u_add_v	64	2.806	2.785	7.580	2.70	2.72
avazu-ctr	u_add_v	128	4.789	4.305	14.667	3.06	3.41
avazu-ctr	u_add_v	256	9.376	8.117	29.013	3.09	3.57
avazu-ctr	u_div_e	32	2.797	3.569	7.592	2.71	2.13
avazu-ctr	u_div_e	64	4.358	4.556	14.867	3.41	3.26
avazu-ctr	u_div_e	128	7.763	7.854	29.273	3.77	3.73
avazu-ctr	u_div_e	256	15.806	14.762	57.512	3.64	3.90
avazu-ctr	u_div_v	32	2.122	2.920	4.030	1.90	1.38
avazu-ctr	u_div_v	64	2.829	3.483	7.625	2.70	2.19
avazu-ctr	u_div_v	128	4.853	4.498	14.760	3.04	3.28
avazu-ctr	u_div_v	256	9.117	8.229	29.242	3.21	3.55
avazu-ctr	u_dot_e	32	3.730	3.525	4.935	1.32	1.40
avazu-ctr	u_dot_e	64	3.887	3.842	5.190	1.34	1.35
avazu-ctr	u_dot_e	128	5.012	4.512	8.116	1.62	1.80
avazu-ctr	u_dot_e	256	8.564	7.993	13.317	1.56	1.67
avazu-ctr	u_dot_v	32	2.774	2.803	4.920	1.77	1.76
avazu-ctr	u_dot_v	64	2.899	2.873	5.051	1.74	1.76
avazu-ctr	u_dot_v	128	3.151	3.106	6.755	2.14	2.17
avazu-ctr	u_dot_v	256	3.648	3.514	10.277	2.82	2.92
avazu-ctr	u_mul_e	32	2.959	3.444	4.323	1.46	1.26
avazu-ctr	u_mul_e	64	4.326	4.316	8.218	1.90	1.90
avazu-ctr	u_mul_e	128	7.744	7.718	15.877	2.05	2.06
avazu-ctr	u_mul_e	256	15.186	14.779	30.677	2.02	2.08
avazu-ctr	u_mul_v	32	2.046	2.652	4.020	1.96	1.52

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
avazu-ctr	u_mul_v	64	2.799	2.795	7.623	2.72	2.73
avazu-ctr	u_mul_v	128	4.825	4.291	14.749	3.06	3.44
avazu-ctr	u_mul_v	256	9.384	8.112	29.196	3.11	3.60
avazu-ctr	u_sub_e	32	2.960	3.447	5.936	2.01	1.72
avazu-ctr	u_sub_e	64	4.325	4.323	11.502	2.66	2.66
avazu-ctr	u_sub_e	128	7.730	7.720	22.472	2.91	2.91
avazu-ctr	u_sub_e	256	15.185	14.790	43.893	2.89	2.97
avazu-ctr	u_sub_v	32	2.024	2.652	4.020	1.99	1.52
avazu-ctr	u_sub_v	64	2.800	2.786	7.616	2.72	2.73
avazu-ctr	u_sub_v	128	4.841	4.305	14.745	3.05	3.43
avazu-ctr	u_sub_v	256	9.403	8.111	29.231	3.11	3.60
avazu-ctr	v_add_e	32	2.295	3.203	4.370	1.90	1.36
avazu-ctr	v_add_e	64	3.872	4.172	8.359	2.16	2.00
avazu-ctr	v_add_e	128	7.110	7.441	16.206	2.28	2.18
avazu-ctr	v_add_e	256	13.938	13.957	31.747	2.28	2.27
avazu-ctr	v_add_u	32	2.020	2.646	4.006	1.98	1.51
avazu-ctr	v_add_u	64	2.804	2.808	7.609	2.71	2.71
avazu-ctr	v_add_u	128	4.828	4.310	14.737	3.05	3.42
avazu-ctr	v_add_u	256	9.388	8.111	29.243	3.11	3.61
avazu-ctr	v_div_e	32	2.368	3.840	7.642	3.23	1.99
avazu-ctr	v_div_e	64	4.004	4.745	15.017	3.75	3.16
avazu-ctr	v_div_e	128	7.278	7.617	29.632	4.07	3.89
avazu-ctr	v_div_e	256	14.147	13.957	58.588	4.14	4.20
avazu-ctr	v_div_u	32	2.150	2.941	4.023	1.87	1.37
avazu-ctr	v_div_u	64	2.849	3.544	7.629	2.68	2.15
avazu-ctr	v_div_u	128	4.898	4.660	14.773	3.02	3.17
avazu-ctr	v_div_u	256	9.122	8.191	29.251	3.21	3.57
avazu-ctr	v_dot_e	32	2.880	3.341	4.936	1.71	1.48
avazu-ctr	v_dot_e	64	3.134	3.679	5.232	1.67	1.42
avazu-ctr	v_dot_e	128	4.218	4.271	8.388	1.99	1.96
avazu-ctr	v_dot_e	256	7.454	7.237	13.941	1.87	1.93
avazu-ctr	v_dot_u	32	2.778	2.807	4.922	1.77	1.75
avazu-ctr	v_dot_u	64	2.897	2.871	5.040	1.74	1.76
avazu-ctr	v_dot_u	128	3.156	3.114	6.734	2.13	2.16
avazu-ctr	v_dot_u	256	3.647	3.513	10.261	2.81	2.92
avazu-ctr	v_mul_e	32	2.295	3.203	4.377	1.91	1.37
avazu-ctr	v_mul_e	64	3.935	4.203	8.360	2.12	1.99
avazu-ctr	v_mul_e	128	7.144	7.436	16.220	2.27	2.18
avazu-ctr	v_mul_e	256	13.887	13.940	31.780	2.29	2.28
avazu-ctr	v_mul_u	32	2.027	2.648	4.016	1.98	1.52
avazu-ctr	v_mul_u	64	2.807	2.798	7.625	2.72	2.72
avazu-ctr	v_mul_u	128	4.831	4.291	14.754	3.05	3.44
avazu-ctr	v_mul_u	256	9.391	8.118	29.226	3.11	3.60
avazu-ctr	v_sub_e	32	2.295	3.201	5.989	2.61	1.87
avazu-ctr	v_sub_e	64	3.936	4.198	11.651	2.96	2.78
avazu-ctr	v_sub_e	128	7.133	7.449	22.831	3.20	3.06
avazu-ctr	v_sub_e	256	13.879	13.953	44.985	3.24	3.22
avazu-ctr	v_sub_u	32	2.027	2.649	4.014	1.98	1.52
avazu-ctr	v_sub_u	64	2.802	2.808	7.620	2.72	2.71
avazu-ctr	v_sub_u	128	4.831	4.291	14.753	3.05	3.44
avazu-ctr	v_sub_u	256	9.414	8.122	29.192	3.10	3.59
citeseer	copy_u	32	0.067	0.068	0.058	0.87	0.85
citeseer	copy_u	64	0.063	0.063	0.055	0.87	0.86
citeseer	copy_u	128	0.120	0.102	0.056	0.47	0.55
citeseer	copy_u	256	0.064	0.063	0.056	0.88	0.89
citeseer	copy_v	32	0.068	0.077	0.056	0.82	0.72
citeseer	copy_v	64	0.064	0.063	0.055	0.87	0.87
citeseer	copy_v	128	0.096	0.096	0.056	0.59	0.59
citeseer	copy_v	256	0.064	0.063	0.055	0.86	0.87
citeseer	e_add_u	32	0.047	0.045	0.063	1.34	1.39
citeseer	e_add_u	64	0.045	0.045	0.063	1.40	1.39
citeseer	e_add_u	128	0.045	0.045	0.063	1.40	1.37
citeseer	e_add_u	256	0.045	0.046	0.062	1.39	1.34
citeseer	e_add_v	32	0.049	0.046	0.064	1.31	1.37
citeseer	e_add_v	64	0.044	0.044	0.065	1.48	1.48
citeseer	e_add_v	128	0.043	0.044	0.065	1.51	1.49
citeseer	e_add_v	256	0.046	0.045	0.064	1.40	1.44
citeseer	e_div_u	32	0.048	0.047	0.107	2.22	2.28
citeseer	e_div_u	64	0.046	0.048	0.107	2.33	2.22
citeseer	e_div_u	128	0.044	0.044	0.108	2.45	2.45
citeseer	e_div_u	256	0.043	0.045	0.113	2.60	2.49
citeseer	e_div_v	32	0.047	0.047	0.107	2.26	2.26
citeseer	e_div_v	64	0.047	0.047	0.113	2.42	2.37
citeseer	e_div_v	128	0.044	0.044	0.107	2.43	2.42
citeseer	e_div_v	256	0.045	0.045	0.111	2.45	2.47
citeseer	e_dot_u	32	0.048	0.047	0.063	1.33	1.34
citeseer	e_dot_u	64	0.044	0.046	0.065	1.46	1.40
citeseer	e_dot_u	128	0.045	0.046	0.066	1.49	1.43

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
citeseer	e_dot_u	256	0.045	0.047	0.066	1.47	1.38
citeseer	e_dot_v	32	0.048	0.048	0.063	1.33	1.32
citeseer	e_dot_v	64	0.045	0.045	0.065	1.44	1.44
citeseer	e_dot_v	128	0.045	0.045	0.065	1.44	1.43
citeseer	e_dot_v	256	0.045	0.046	0.066	1.48	1.43
citeseer	e_mul_u	32	0.046	0.047	0.062	1.36	1.32
citeseer	e_mul_u	64	0.048	0.047	0.063	1.31	1.32
citeseer	e_mul_u	128	0.044	0.045	0.062	1.40	1.37
citeseer	e_mul_u	256	0.045	0.045	0.063	1.41	1.39
citeseer	e_mul_v	32	0.046	0.047	0.068	1.47	1.45
citeseer	e_mul_v	64	0.046	0.046	0.063	1.37	1.37
citeseer	e_mul_v	128	0.044	0.045	0.063	1.42	1.40
citeseer	e_mul_v	256	0.052	0.046	0.082	1.56	1.79
citeseer	e_sub_u	32	0.047	0.047	0.082	1.73	1.75
citeseer	e_sub_u	64	0.044	0.046	0.083	1.89	1.82
citeseer	e_sub_u	128	0.044	0.047	0.085	1.90	1.82
citeseer	e_sub_u	256	0.045	0.047	0.084	1.87	1.80
citeseer	e_sub_v	32	0.046	0.047	0.084	1.82	1.78
citeseer	e_sub_v	64	0.045	0.056	0.084	1.87	1.51
citeseer	e_sub_v	128	0.044	0.045	0.082	1.85	1.82
citeseer	e_sub_v	256	0.045	0.046	0.085	1.89	1.83
citeseer	u_add_e	32	0.047	0.047	0.066	1.41	1.39
citeseer	u_add_e	64	0.044	0.046	0.063	1.44	1.38
citeseer	u_add_e	128	0.068	0.048	0.063	0.93	1.30
citeseer	u_add_e	256	0.044	0.045	0.063	1.43	1.38
citeseer	u_add_v	32	0.048	0.048	0.066	1.39	1.38
citeseer	u_add_v	64	0.044	0.045	0.064	1.46	1.41
citeseer	u_add_v	128	0.062	0.064	0.061	0.99	0.96
citeseer	u_add_v	256	0.044	0.045	0.063	1.44	1.42
citeseer	u_div_e	32	0.047	0.047	0.115	2.45	2.44
citeseer	u_div_e	64	0.044	0.046	0.107	2.42	2.32
citeseer	u_div_e	128	0.044	0.045	0.119	2.72	2.68
citeseer	u_div_e	256	0.044	0.046	0.108	2.45	2.37
citeseer	u_div_v	32	0.047	0.047	0.111	2.33	2.33
citeseer	u_div_v	64	0.044	0.045	0.107	2.41	2.37
citeseer	u_div_v	128	0.046	0.046	0.108	2.33	2.38
citeseer	u_div_v	256	0.044	0.051	0.108	2.43	2.12
citeseer	u_dot_e	32	0.055	0.047	0.065	1.18	1.39
citeseer	u_dot_e	64	0.045	0.046	0.065	1.46	1.41
citeseer	u_dot_e	128	0.045	0.047	0.063	1.42	1.35
citeseer	u_dot_e	256	0.045	0.046	0.065	1.45	1.43
citeseer	u_dot_v	32	0.046	0.047	0.065	1.40	1.38
citeseer	u_dot_v	64	0.045	0.045	0.065	1.46	1.44
citeseer	u_dot_v	128	0.045	0.046	0.064	1.42	1.38
citeseer	u_dot_v	256	0.045	0.046	0.063	1.41	1.37
citeseer	u_mul_e	32	0.048	0.047	0.065	1.35	1.36
citeseer	u_mul_e	64	0.043	0.046	0.063	1.45	1.37
citeseer	u_mul_e	128	0.044	0.047	0.064	1.47	1.36
citeseer	u_mul_e	256	0.044	0.046	0.064	1.47	1.39
citeseer	u_mul_v	32	0.047	0.048	0.065	1.39	1.35
citeseer	u_mul_v	64	0.044	0.044	0.064	1.47	1.44
citeseer	u_mul_v	128	0.057	0.070	0.062	1.09	0.90
citeseer	u_mul_v	256	0.045	0.045	0.063	1.40	1.41
citeseer	u_sub_e	32	0.045	0.047	0.086	1.90	1.82
citeseer	u_sub_e	64	0.044	0.045	0.083	1.87	1.84
citeseer	u_sub_e	128	0.046	0.049	0.084	1.81	1.73
citeseer	u_sub_e	256	0.044	0.045	0.085	1.92	1.88
citeseer	u_sub_v	32	0.048	0.047	0.085	1.78	1.80
citeseer	u_sub_v	64	0.044	0.045	0.083	1.89	1.87
citeseer	u_sub_v	128	0.046	0.063	0.084	1.82	1.33
citeseer	u_sub_v	256	0.045	0.044	0.084	1.89	1.91
citeseer	v_add_e	32	0.046	0.047	0.065	1.41	1.39
citeseer	v_add_e	64	0.044	0.045	0.064	1.47	1.44
citeseer	v_add_e	128	0.043	0.043	0.064	1.50	1.47
citeseer	v_add_e	256	0.044	0.044	0.063	1.43	1.44
citeseer	v_add_u	32	0.047	0.048	0.064	1.37	1.35
citeseer	v_add_u	64	0.043	0.044	0.062	1.42	1.41
citeseer	v_add_u	128	0.052	0.044	0.062	1.19	1.40
citeseer	v_add_u	256	0.044	0.045	0.073	1.65	1.63
citeseer	v_div_e	32	0.047	0.047	0.108	2.31	2.30
citeseer	v_div_e	64	0.043	0.044	0.106	2.46	2.39
citeseer	v_div_e	128	0.045	0.045	0.106	2.38	2.35
citeseer	v_div_e	256	0.044	0.045	0.107	2.45	2.39
citeseer	v_div_u	32	0.047	0.046	0.106	2.27	2.30
citeseer	v_div_u	64	0.044	0.045	0.115	2.61	2.59
citeseer	v_div_u	128	0.043	0.045	0.108	2.48	2.41
citeseer	v_div_u	256	0.045	0.045	0.108	2.41	2.38
citeseer	v_dot_e	32	0.047	0.047	0.064	1.36	1.35

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
citeseer	v_dot_e	64	0.044	0.045	0.063	1.43	1.41
citeseer	v_dot_e	128	0.044	0.045	0.064	1.46	1.40
citeseer	v_dot_e	256	0.045	0.045	0.064	1.41	1.40
citeseer	v_dot_u	32	0.047	0.046	0.064	1.35	1.39
citeseer	v_dot_u	64	0.046	0.047	0.063	1.39	1.35
citeseer	v_dot_u	128	0.044	0.045	0.065	1.46	1.42
citeseer	v_dot_u	256	0.045	0.046	0.063	1.39	1.38
citeseer	v_mul_e	32	0.047	0.047	0.065	1.38	1.38
citeseer	v_mul_e	64	0.044	0.045	0.071	1.58	1.56
citeseer	v_mul_e	128	0.044	0.045	0.063	1.42	1.39
citeseer	v_mul_e	256	0.043	0.044	0.063	1.46	1.42
citeseer	v_mul_u	32	0.048	0.048	0.065	1.36	1.36
citeseer	v_mul_u	64	0.045	0.045	0.062	1.40	1.40
citeseer	v_mul_u	128	0.044	0.045	0.063	1.45	1.42
citeseer	v_mul_u	256	0.045	0.046	0.065	1.44	1.40
citeseer	v_sub_e	32	0.048	0.047	0.083	1.74	1.78
citeseer	v_sub_e	64	0.045	0.045	0.083	1.86	1.86
citeseer	v_sub_e	128	0.044	0.045	0.083	1.87	1.86
citeseer	v_sub_e	256	0.044	0.044	0.084	1.89	1.91
citeseer	v_sub_u	32	0.047	0.047	0.086	1.85	1.84
citeseer	v_sub_u	64	0.045	0.045	0.084	1.88	1.87
citeseer	v_sub_u	128	0.045	0.045	0.084	1.87	1.88
citeseer	v_sub_u	256	0.044	0.045	0.082	1.87	1.84
city-reviews	copy_u	32	0.612	0.466	0.478	0.78	1.03
city-reviews	copy_u	64	0.531	0.390	0.871	1.64	2.24
city-reviews	copy_u	128	0.728	0.601	1.587	2.18	2.64
city-reviews	copy_u	256	1.393	1.284	2.917	2.09	2.27
city-reviews	copy_v	32	0.340	0.338	0.485	1.43	1.44
city-reviews	copy_v	64	0.274	0.282	0.907	3.30	3.22
city-reviews	copy_v	128	0.490	0.523	1.755	3.58	3.36
city-reviews	copy_v	256	0.963	1.010	3.448	3.58	3.42
city-reviews	e_add_u	32	0.556	0.440	0.548	0.99	1.25
city-reviews	e_add_u	64	0.664	0.553	1.033	1.55	1.87
city-reviews	e_add_u	128	1.142	1.032	1.977	1.73	1.91
city-reviews	e_add_u	256	2.157	2.008	3.812	1.77	1.90
city-reviews	e_add_v	32	0.443	0.405	0.558	1.26	1.38
city-reviews	e_add_v	64	0.553	0.513	1.054	1.91	2.05
city-reviews	e_add_v	128	0.956	0.907	2.042	2.14	2.25
city-reviews	e_add_v	256	1.760	1.699	3.934	2.23	2.32
city-reviews	e_div_u	32	0.576	0.454	0.572	0.99	1.26
city-reviews	e_div_u	64	0.707	0.600	1.076	1.52	1.79
city-reviews	e_div_u	128	1.175	1.057	2.064	1.76	1.95
city-reviews	e_div_u	256	2.356	2.073	3.977	1.69	1.92
city-reviews	e_div_v	32	0.463	0.467	0.583	1.26	1.25
city-reviews	e_div_v	64	0.584	0.581	1.098	1.88	1.89
city-reviews	e_div_v	128	0.987	0.931	2.131	2.16	2.29
city-reviews	e_div_v	256	1.811	1.746	4.105	2.27	2.35
city-reviews	e_dot_u	32	0.685	0.434	0.616	0.90	1.42
city-reviews	e_dot_u	64	0.743	0.469	0.652	0.88	1.39
city-reviews	e_dot_u	128	0.882	0.580	1.021	1.16	1.76
city-reviews	e_dot_u	256	1.435	1.242	1.661	1.16	1.34
city-reviews	e_dot_v	32	0.560	0.417	0.623	1.11	1.49
city-reviews	e_dot_v	64	0.602	0.439	0.662	1.10	1.51
city-reviews	e_dot_v	128	0.687	0.502	1.072	1.56	2.14
city-reviews	e_dot_v	256	1.018	0.861	1.821	1.79	2.12
city-reviews	e_mul_u	32	0.553	0.429	0.547	0.99	1.27
city-reviews	e_mul_u	64	0.663	0.560	1.032	1.56	1.84
city-reviews	e_mul_u	128	1.156	1.034	1.976	1.71	1.91
city-reviews	e_mul_u	256	2.173	2.028	3.804	1.75	1.88
city-reviews	e_mul_v	32	0.438	0.401	0.556	1.27	1.39
city-reviews	e_mul_v	64	0.565	0.513	1.054	1.87	2.06
city-reviews	e_mul_v	128	0.958	0.910	2.042	2.13	2.24
city-reviews	e_mul_v	256	1.763	1.700	3.933	2.23	2.31
city-reviews	e_sub_u	32	0.556	0.429	0.562	1.01	1.31
city-reviews	e_sub_u	64	0.675	0.560	1.056	1.56	1.88
city-reviews	e_sub_u	128	1.156	1.034	2.019	1.75	1.95
city-reviews	e_sub_u	256	2.172	2.015	3.888	1.79	1.93
city-reviews	e_sub_v	32	0.438	0.401	0.569	1.30	1.42
city-reviews	e_sub_v	64	0.565	0.514	1.076	1.90	2.09
city-reviews	e_sub_v	128	0.956	0.909	2.086	2.18	2.29
city-reviews	e_sub_v	256	1.757	1.700	4.019	2.29	2.36
city-reviews	u_add_e	32	0.759	0.613	0.553	0.73	0.90
city-reviews	u_add_e	64	0.666	0.558	1.033	1.55	1.85
city-reviews	u_add_e	128	1.140	1.034	1.983	1.74	1.92
city-reviews	u_add_e	256	2.146	2.009	3.803	1.77	1.89
city-reviews	u_add_v	32	0.730	0.546	0.552	0.76	1.01
city-reviews	u_add_v	64	0.585	0.417	1.032	1.76	2.47
city-reviews	u_add_v	128	0.792	0.676	1.953	2.46	2.89

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
city-reviews	u_add_v	256	1.459	1.334	3.742	2.57	2.80
city-reviews	u_div_e	32	0.803	0.770	0.946	1.18	1.23
city-reviews	u_div_e	64	0.681	0.589	1.810	2.66	3.07
city-reviews	u_div_e	128	1.164	1.048	3.535	3.04	3.37
city-reviews	u_div_e	256	2.347	1.999	6.891	2.94	3.45
city-reviews	u_div_v	32	0.759	0.588	0.576	0.76	0.98
city-reviews	u_div_v	64	0.607	0.496	1.075	1.77	2.17
city-reviews	u_div_v	128	0.818	0.674	2.044	2.50	3.03
city-reviews	u_div_v	256	1.493	1.347	3.930	2.63	2.92
city-reviews	u_dot_e	32	0.828	0.467	0.617	0.74	1.32
city-reviews	u_dot_e	64	0.723	0.483	0.639	0.88	1.32
city-reviews	u_dot_e	128	0.842	0.627	1.018	1.21	1.62
city-reviews	u_dot_e	256	1.428	1.244	1.666	1.17	1.34
city-reviews	u_dot_v	32	0.659	0.401	0.618	0.94	1.54
city-reviews	u_dot_v	64	0.641	0.381	0.633	0.99	1.66
city-reviews	u_dot_v	128	0.692	0.422	0.941	1.36	2.23
city-reviews	u_dot_v	256	0.784	0.498	1.525	1.95	3.06
city-reviews	u_mul_e	32	0.741	0.602	0.552	0.75	0.92
city-reviews	u_mul_e	64	0.666	0.560	1.034	1.55	1.85
city-reviews	u_mul_e	128	1.150	1.031	1.983	1.72	1.92
city-reviews	u_mul_e	256	2.166	2.012	3.804	1.76	1.89
city-reviews	u_mul_v	32	0.755	0.548	0.552	0.73	1.01
city-reviews	u_mul_v	64	0.594	0.420	1.032	1.74	2.46
city-reviews	u_mul_v	128	0.779	0.676	1.966	2.52	2.91
city-reviews	u_mul_v	256	1.458	1.333	3.768	2.59	2.83
city-reviews	u_sub_e	32	0.807	0.590	0.743	0.92	1.26
city-reviews	u_sub_e	64	0.665	0.562	1.420	2.14	2.53
city-reviews	u_sub_e	128	1.147	1.037	2.744	2.39	2.65
city-reviews	u_sub_e	256	2.167	2.010	5.329	2.46	2.65
city-reviews	u_sub_v	32	0.735	0.551	0.564	0.77	1.02
city-reviews	u_sub_v	64	0.591	0.416	1.053	1.78	2.53
city-reviews	u_sub_v	128	0.784	0.676	2.000	2.55	2.96
city-reviews	u_sub_v	256	1.460	1.334	3.842	2.63	2.88
city-reviews	v_add_e	32	0.462	0.480	0.561	1.22	1.17
city-reviews	v_add_e	64	0.555	0.511	1.061	1.91	2.07
city-reviews	v_add_e	128	0.945	0.905	2.044	2.16	2.26
city-reviews	v_add_e	256	1.750	1.689	3.961	2.26	2.34
city-reviews	v_add_u	32	0.563	0.398	0.552	0.98	1.39
city-reviews	v_add_u	64	0.584	0.418	1.029	1.76	2.46
city-reviews	v_add_u	128	0.782	0.672	1.959	2.51	2.92
city-reviews	v_add_u	256	1.456	1.333	3.759	2.58	2.82
city-reviews	v_div_e	32	0.481	0.479	0.958	1.99	2.00
city-reviews	v_div_e	64	0.587	0.591	1.839	3.13	3.11
city-reviews	v_div_e	128	1.008	0.925	3.593	3.56	3.88
city-reviews	v_div_e	256	1.874	1.711	7.068	3.77	4.13
city-reviews	v_div_u	32	0.632	0.422	0.581	0.92	1.37
city-reviews	v_div_u	64	0.616	0.504	1.072	1.74	2.13
city-reviews	v_div_u	128	0.818	0.686	2.047	2.50	2.98
city-reviews	v_div_u	256	1.525	1.342	3.931	2.58	2.93
city-reviews	v_dot_e	32	0.583	0.422	0.624	1.07	1.48
city-reviews	v_dot_e	64	0.589	0.451	0.660	1.12	1.46
city-reviews	v_dot_e	128	0.673	0.528	1.079	1.60	2.04
city-reviews	v_dot_e	256	1.019	0.911	1.842	1.81	2.02
city-reviews	v_dot_u	32	0.614	0.381	0.618	1.01	1.62
city-reviews	v_dot_u	64	0.642	0.381	0.645	1.01	1.69
city-reviews	v_dot_u	128	0.689	0.421	0.940	1.36	2.23
city-reviews	v_dot_u	256	0.798	0.498	1.525	1.91	3.06
city-reviews	v_mul_e	32	0.698	0.427	0.561	0.80	1.31
city-reviews	v_mul_e	64	0.554	0.514	1.060	1.91	2.06
city-reviews	v_mul_e	128	0.957	0.903	2.044	2.14	2.26
city-reviews	v_mul_e	256	1.761	1.701	3.972	2.26	2.33
city-reviews	v_mul_u	32	0.922	0.399	0.551	0.60	1.38
city-reviews	v_mul_u	64	0.590	0.425	1.033	1.75	2.43
city-reviews	v_mul_u	128	0.782	0.677	1.970	2.52	2.91
city-reviews	v_mul_u	256	1.452	1.334	3.770	2.60	2.83
city-reviews	v_sub_e	32	0.518	0.426	0.754	1.46	1.77
city-reviews	v_sub_e	64	0.562	0.507	1.447	2.58	2.86
city-reviews	v_sub_e	128	0.958	0.902	2.808	2.93	3.11
city-reviews	v_sub_e	256	1.762	1.701	5.482	3.11	3.22
city-reviews	v_sub_u	32	0.557	0.398	0.566	1.02	1.42
city-reviews	v_sub_u	64	0.591	0.418	1.053	1.78	2.52
city-reviews	v_sub_u	128	0.785	0.677	2.003	2.55	2.96
city-reviews	v_sub_u	256	1.453	1.333	3.843	2.64	2.88
city-roads-L	copy_u	32	0.246	0.071	0.123	0.50	1.74
city-roads-L	copy_u	64	0.264	0.080	0.235	0.89	2.93
city-roads-L	copy_u	128	0.286	0.139	0.419	1.46	3.02
city-roads-L	copy_u	256	0.328	0.262	0.807	2.46	3.08
city-roads-L	copy_v	32	0.209	0.067	0.124	0.59	1.85

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
city-roads-L	copy_v	64	0.222	0.074	0.234	1.05	3.17
city-roads-L	copy_v	128	0.240	0.135	0.418	1.74	3.11
city-roads-L	copy_v	256	0.285	0.258	0.807	2.83	3.13
city-roads-L	e_add_u	32	0.258	0.098	0.139	0.54	1.42
city-roads-L	e_add_u	64	0.275	0.130	0.256	0.93	1.97
city-roads-L	e_add_u	128	0.310	0.226	0.473	1.52	2.09
city-roads-L	e_add_u	256	0.461	0.404	0.892	1.94	2.21
city-roads-L	e_add_v	32	0.270	0.098	0.138	0.51	1.40
city-roads-L	e_add_v	64	0.287	0.122	0.254	0.89	2.09
city-roads-L	e_add_v	128	0.323	0.214	0.472	1.46	2.21
city-roads-L	e_add_v	256	0.464	0.397	0.893	1.92	2.25
city-roads-L	e_div_u	32	0.275	0.104	0.161	0.58	1.54
city-roads-L	e_div_u	64	0.299	0.136	0.295	0.99	2.17
city-roads-L	e_div_u	128	0.444	0.223	0.558	1.26	2.50
city-roads-L	e_div_u	256	0.500	0.415	1.060	2.12	2.56
city-roads-L	e_div_v	32	0.278	0.105	0.162	0.58	1.54
city-roads-L	e_div_v	64	0.294	0.131	0.294	1.00	2.24
city-roads-L	e_div_v	128	0.333	0.225	0.553	1.66	2.46
city-roads-L	e_div_v	256	0.600	0.407	1.056	1.76	2.59
city-roads-L	e_dot_u	32	0.252	0.100	0.135	0.54	1.36
city-roads-L	e_dot_u	64	0.259	0.110	0.153	0.59	1.39
city-roads-L	e_dot_u	128	0.277	0.129	0.245	0.89	1.89
city-roads-L	e_dot_u	256	0.333	0.242	0.410	1.23	1.70
city-roads-L	e_dot_v	32	0.257	0.098	0.135	0.52	1.37
city-roads-L	e_dot_v	64	0.264	0.104	0.153	0.58	1.47
city-roads-L	e_dot_v	128	0.276	0.123	0.238	0.86	1.94
city-roads-L	e_dot_v	256	0.317	0.223	0.412	1.30	1.84
city-roads-L	e_mul_u	32	0.259	0.099	0.138	0.53	1.40
city-roads-L	e_mul_u	64	0.276	0.130	0.254	0.92	1.95
city-roads-L	e_mul_u	128	0.312	0.220	0.473	1.51	2.15
city-roads-L	e_mul_u	256	0.467	0.404	0.892	1.91	2.21
city-roads-L	e_mul_v	32	0.269	0.098	0.140	0.52	1.43
city-roads-L	e_mul_v	64	0.287	0.122	0.253	0.88	2.08
city-roads-L	e_mul_v	128	0.323	0.214	0.473	1.47	2.21
city-roads-L	e_mul_v	256	0.464	0.397	0.891	1.92	2.24
city-roads-L	e_sub_u	32	0.258	0.099	0.149	0.58	1.51
city-roads-L	e_sub_u	64	0.276	0.130	0.274	1.00	2.11
city-roads-L	e_sub_u	128	0.313	0.221	0.513	1.64	2.32
city-roads-L	e_sub_u	256	0.465	0.404	0.975	2.10	2.41
city-roads-L	e_sub_v	32	0.268	0.097	0.149	0.56	1.54
city-roads-L	e_sub_v	64	0.294	0.128	0.275	0.93	2.14
city-roads-L	e_sub_v	128	0.322	0.215	0.512	1.59	2.39
city-roads-L	e_sub_v	256	0.464	0.399	0.970	2.09	2.43
city-roads-L	u_add_e	32	0.258	0.098	0.139	0.54	1.42
city-roads-L	u_add_e	64	0.276	0.129	0.255	0.93	1.98
city-roads-L	u_add_e	128	0.311	0.218	0.474	1.52	2.17
city-roads-L	u_add_e	256	0.470	0.402	0.907	1.93	2.25
city-roads-L	u_add_v	32	0.301	0.082	0.145	0.48	1.75
city-roads-L	u_add_v	64	0.321	0.093	0.260	0.81	2.79
city-roads-L	u_add_v	128	0.345	0.163	0.479	1.39	2.93
city-roads-L	u_add_v	256	0.396	0.294	0.910	2.30	3.09
city-roads-L	u_div_e	32	0.260	0.102	0.227	0.87	2.23
city-roads-L	u_div_e	64	0.282	0.136	0.422	1.50	3.11
city-roads-L	u_div_e	128	0.420	0.222	0.805	1.92	3.63
city-roads-L	u_div_e	256	0.498	0.401	1.561	3.14	3.90
city-roads-L	u_div_v	32	0.306	0.109	0.167	0.54	1.53
city-roads-L	u_div_v	64	0.328	0.108	0.301	0.92	2.79
city-roads-L	u_div_v	128	0.359	0.157	0.563	1.57	3.59
city-roads-L	u_div_v	256	0.598	0.295	1.076	1.80	3.65
city-roads-L	u_dot_e	32	0.252	0.099	0.135	0.53	1.35
city-roads-L	u_dot_e	64	0.259	0.113	0.152	0.59	1.35
city-roads-L	u_dot_e	128	0.271	0.137	0.235	0.87	1.72
city-roads-L	u_dot_e	256	0.327	0.241	0.410	1.25	1.70
city-roads-L	u_dot_v	32	0.230	0.082	0.133	0.58	1.62
city-roads-L	u_dot_v	64	0.291	0.086	0.155	0.53	1.80
city-roads-L	u_dot_v	128	0.308	0.092	0.240	0.78	2.60
city-roads-L	u_dot_v	256	0.324	0.115	0.398	1.23	3.47
city-roads-L	u_mul_e	32	0.258	0.098	0.139	0.54	1.42
city-roads-L	u_mul_e	64	0.277	0.130	0.255	0.92	1.96
city-roads-L	u_mul_e	128	0.311	0.219	0.473	1.52	2.17
city-roads-L	u_mul_e	256	0.463	0.402	0.906	1.96	2.25
city-roads-L	u_mul_v	32	0.301	0.083	0.143	0.47	1.73
city-roads-L	u_mul_v	64	0.322	0.095	0.260	0.81	2.73
city-roads-L	u_mul_v	128	0.346	0.156	0.482	1.39	3.09
city-roads-L	u_mul_v	256	0.399	0.295	0.916	2.30	3.10
city-roads-L	u_sub_e	32	0.258	0.098	0.179	0.69	1.83
city-roads-L	u_sub_e	64	0.276	0.129	0.332	1.20	2.58
city-roads-L	u_sub_e	128	0.311	0.218	0.634	2.04	2.91

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
city-roads-L	u_sub_e	256	0.464	0.411	1.224	2.63	2.97
city-roads-L	u_sub_v	32	0.301	0.082	0.155	0.51	1.87
city-roads-L	u_sub_v	64	0.321	0.093	0.281	0.88	3.04
city-roads-L	u_sub_v	128	0.346	0.156	0.522	1.51	3.34
city-roads-L	u_sub_v	256	0.408	0.295	0.995	2.44	3.37
city-roads-L	v_add_e	32	0.269	0.097	0.140	0.52	1.45
city-roads-L	v_add_e	64	0.287	0.123	0.255	0.89	2.08
city-roads-L	v_add_e	128	0.321	0.213	0.472	1.47	2.21
city-roads-L	v_add_e	256	0.459	0.394	0.897	1.95	2.27
city-roads-L	v_add_u	32	0.302	0.082	0.143	0.47	1.74
city-roads-L	v_add_u	64	0.320	0.093	0.260	0.81	2.80
city-roads-L	v_add_u	128	0.345	0.156	0.482	1.40	3.08
city-roads-L	v_add_u	256	0.397	0.294	0.917	2.31	3.12
city-roads-L	v_div_e	32	0.277	0.106	0.225	0.81	2.13
city-roads-L	v_div_e	64	0.295	0.131	0.422	1.43	3.23
city-roads-L	v_div_e	128	0.392	0.217	0.805	2.06	3.72
city-roads-L	v_div_e	256	0.572	0.395	1.562	2.73	3.95
city-roads-L	v_div_u	32	0.307	0.089	0.167	0.54	1.88
city-roads-L	v_div_u	64	0.334	0.108	0.300	0.90	2.77
city-roads-L	v_div_u	128	0.359	0.158	0.570	1.59	3.60
city-roads-L	v_div_u	256	0.549	0.296	1.082	1.97	3.66
city-roads-L	v_dot_e	32	0.257	0.099	0.135	0.53	1.37
city-roads-L	v_dot_e	64	0.264	0.106	0.153	0.58	1.44
city-roads-L	v_dot_e	128	0.276	0.131	0.238	0.86	1.81
city-roads-L	v_dot_e	256	0.318	0.236	0.412	1.29	1.75
city-roads-L	v_dot_u	32	0.232	0.081	0.132	0.57	1.62
city-roads-L	v_dot_u	64	0.291	0.086	0.155	0.53	1.80
city-roads-L	v_dot_u	128	0.308	0.093	0.241	0.78	2.60
city-roads-L	v_dot_u	256	0.327	0.115	0.399	1.22	3.49
city-roads-L	v_mul_e	32	0.269	0.097	0.139	0.52	1.43
city-roads-L	v_mul_e	64	0.286	0.121	0.255	0.89	2.10
city-roads-L	v_mul_e	128	0.321	0.213	0.472	1.47	2.21
city-roads-L	v_mul_e	256	0.458	0.397	0.896	1.96	2.26
city-roads-L	v_mul_u	32	0.302	0.082	0.143	0.47	1.73
city-roads-L	v_mul_u	64	0.320	0.092	0.261	0.81	2.82
city-roads-L	v_mul_u	128	0.346	0.156	0.482	1.40	3.09
city-roads-L	v_mul_u	256	0.401	0.297	0.920	2.29	3.10
city-roads-L	v_sub_e	32	0.269	0.097	0.180	0.67	1.85
city-roads-L	v_sub_e	64	0.287	0.121	0.332	1.16	2.74
city-roads-L	v_sub_e	128	0.321	0.212	0.633	1.97	2.98
city-roads-L	v_sub_e	256	0.454	0.394	1.224	2.69	3.10
city-roads-L	v_sub_u	32	0.302	0.083	0.155	0.51	1.88
city-roads-L	v_sub_u	64	0.320	0.093	0.281	0.88	3.03
city-roads-L	v_sub_u	128	0.346	0.156	0.522	1.51	3.35
city-roads-L	v_sub_u	256	0.399	0.294	0.995	2.49	3.38
city-roads-M	copy_u	32	0.081	0.064	0.057	0.71	0.90
city-roads-M	copy_u	64	0.132	0.068	0.105	0.80	1.54
city-roads-M	copy_u	128	0.152	0.070	0.199	1.31	2.82
city-roads-M	copy_u	256	0.165	0.117	0.360	2.18	3.07
city-roads-M	copy_v	32	0.073	0.063	0.056	0.76	0.88
city-roads-M	copy_v	64	0.121	0.063	0.106	0.87	1.67
city-roads-M	copy_v	128	0.122	0.067	0.198	1.62	2.97
city-roads-M	copy_v	256	0.142	0.114	0.358	2.52	3.13
city-roads-M	e_add_u	32	0.129	0.059	0.064	0.50	1.08
city-roads-M	e_add_u	64	0.140	0.060	0.121	0.86	2.01
city-roads-M	e_add_u	128	0.159	0.099	0.220	1.39	2.22
city-roads-M	e_add_u	256	0.220	0.180	0.408	1.85	2.26
city-roads-M	e_add_v	32	0.136	0.047	0.064	0.47	1.37
city-roads-M	e_add_v	64	0.147	0.056	0.121	0.82	2.16
city-roads-M	e_add_v	128	0.163	0.096	0.221	1.35	2.30
city-roads-M	e_add_v	256	0.223	0.176	0.406	1.82	2.30
city-roads-M	e_div_u	32	0.137	0.049	0.111	0.81	2.24
city-roads-M	e_div_u	64	0.150	0.063	0.148	0.99	2.33
city-roads-M	e_div_u	128	0.234	0.100	0.253	1.08	2.53
city-roads-M	e_div_u	256	0.242	0.184	0.475	1.97	2.58
city-roads-M	e_div_v	32	0.140	0.048	0.109	0.78	2.26
city-roads-M	e_div_v	64	0.149	0.061	0.141	0.94	2.30
city-roads-M	e_div_v	128	0.168	0.099	0.253	1.51	2.56
city-roads-M	e_div_v	256	0.302	0.181	0.475	1.57	2.62
city-roads-M	e_dot_u	32	0.089	0.046	0.065	0.73	1.42
city-roads-M	e_dot_u	64	0.134	0.053	0.066	0.49	1.25
city-roads-M	e_dot_u	128	0.142	0.061	0.107	0.75	1.75
city-roads-M	e_dot_u	256	0.169	0.103	0.182	1.08	1.76
city-roads-M	e_dot_v	32	0.087	0.046	0.067	0.77	1.47
city-roads-M	e_dot_v	64	0.143	0.051	0.074	0.52	1.47
city-roads-M	e_dot_v	128	0.144	0.058	0.105	0.73	1.82
city-roads-M	e_dot_v	256	0.160	0.101	0.175	1.09	1.72
city-roads-M	e_mul_u	32	0.129	0.046	0.067	0.52	1.46

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
city-roads-M	e_mul_u	64	0.140	0.059	0.122	0.87	2.04
city-roads-M	e_mul_u	128	0.158	0.099	0.219	1.39	2.22
city-roads-M	e_mul_u	256	0.223	0.180	0.408	1.83	2.27
city-roads-M	e_mul_v	32	0.136	0.046	0.065	0.48	1.42
city-roads-M	e_mul_v	64	0.147	0.057	0.120	0.82	2.13
city-roads-M	e_mul_v	128	0.163	0.095	0.220	1.35	2.31
city-roads-M	e_mul_v	256	0.223	0.177	0.408	1.83	2.31
city-roads-M	e_sub_u	32	0.129	0.046	0.085	0.66	1.83
city-roads-M	e_sub_u	64	0.140	0.060	0.131	0.93	2.18
city-roads-M	e_sub_u	128	0.158	0.099	0.238	1.51	2.41
city-roads-M	e_sub_u	256	0.223	0.180	0.441	1.98	2.45
city-roads-M	e_sub_v	32	0.136	0.046	0.086	0.63	1.87
city-roads-M	e_sub_v	64	0.147	0.056	0.131	0.89	2.35
city-roads-M	e_sub_v	128	0.163	0.096	0.238	1.46	2.48
city-roads-M	e_sub_v	256	0.222	0.177	0.443	1.99	2.51
city-roads-M	u_add_e	32	0.129	0.046	0.064	0.50	1.38
city-roads-M	u_add_e	64	0.140	0.059	0.122	0.87	2.05
city-roads-M	u_add_e	128	0.158	0.099	0.222	1.40	2.25
city-roads-M	u_add_e	256	0.223	0.179	0.408	1.83	2.27
city-roads-M	u_add_v	32	0.116	0.046	0.066	0.57	1.45
city-roads-M	u_add_v	64	0.167	0.047	0.121	0.72	2.59
city-roads-M	u_add_v	128	0.175	0.069	0.221	1.27	3.19
city-roads-M	u_add_v	256	0.197	0.131	0.411	2.08	3.14
city-roads-M	u_div_e	32	0.130	0.048	0.107	0.83	2.26
city-roads-M	u_div_e	64	0.143	0.063	0.199	1.40	3.14
city-roads-M	u_div_e	128	0.224	0.100	0.368	1.65	3.68
city-roads-M	u_div_e	256	0.239	0.178	0.702	2.93	3.94
city-roads-M	u_div_v	32	0.119	0.043	0.111	0.93	2.55
city-roads-M	u_div_v	64	0.164	0.051	0.143	0.87	2.81
city-roads-M	u_div_v	128	0.180	0.071	0.255	1.41	3.59
city-roads-M	u_div_v	256	0.309	0.130	0.480	1.55	3.69
city-roads-M	u_dot_e	32	0.087	0.047	0.065	0.74	1.38
city-roads-M	u_dot_e	64	0.133	0.053	0.066	0.50	1.24
city-roads-M	u_dot_e	128	0.141	0.064	0.105	0.74	1.63
city-roads-M	u_dot_e	256	0.164	0.109	0.171	1.05	1.57
city-roads-M	u_dot_v	32	0.093	0.045	0.066	0.72	1.47
city-roads-M	u_dot_v	64	0.096	0.046	0.064	0.66	1.38
city-roads-M	u_dot_v	128	0.155	0.046	0.102	0.66	2.21
city-roads-M	u_dot_v	256	0.166	0.054	0.174	1.05	3.24
city-roads-M	u_mul_e	32	0.129	0.046	0.065	0.50	1.39
city-roads-M	u_mul_e	64	0.140	0.060	0.121	0.87	2.02
city-roads-M	u_mul_e	128	0.158	0.099	0.221	1.39	2.22
city-roads-M	u_mul_e	256	0.221	0.179	0.407	1.84	2.27
city-roads-M	u_mul_v	32	0.116	0.046	0.063	0.54	1.36
city-roads-M	u_mul_v	64	0.160	0.048	0.121	0.76	2.53
city-roads-M	u_mul_v	128	0.174	0.070	0.221	1.27	3.16
city-roads-M	u_mul_v	256	0.198	0.132	0.413	2.08	3.14
city-roads-M	u_sub_e	32	0.129	0.047	0.085	0.66	1.81
city-roads-M	u_sub_e	64	0.139	0.060	0.157	1.13	2.63
city-roads-M	u_sub_e	128	0.159	0.099	0.290	1.82	2.92
city-roads-M	u_sub_e	256	0.220	0.179	0.547	2.49	3.06
city-roads-M	u_sub_v	32	0.116	0.045	0.083	0.72	1.85
city-roads-M	u_sub_v	64	0.160	0.046	0.133	0.83	2.86
city-roads-M	u_sub_v	128	0.173	0.070	0.240	1.39	3.45
city-roads-M	u_sub_v	256	0.206	0.128	0.445	2.16	3.47
city-roads-M	v_add_e	32	0.136	0.045	0.065	0.48	1.45
city-roads-M	v_add_e	64	0.147	0.056	0.121	0.82	2.18
city-roads-M	v_add_e	128	0.163	0.095	0.223	1.37	2.34
city-roads-M	v_add_e	256	0.234	0.176	0.407	1.74	2.32
city-roads-M	v_add_u	32	0.117	0.045	0.063	0.54	1.38
city-roads-M	v_add_u	64	0.160	0.047	0.122	0.76	2.62
city-roads-M	v_add_u	128	0.173	0.069	0.223	1.29	3.21
city-roads-M	v_add_u	256	0.197	0.133	0.412	2.09	3.09
city-roads-M	v_div_e	32	0.141	0.050	0.107	0.76	2.14
city-roads-M	v_div_e	64	0.151	0.061	0.199	1.31	3.26
city-roads-M	v_div_e	128	0.191	0.098	0.368	1.93	3.76
city-roads-M	v_div_e	256	0.294	0.175	0.698	2.37	3.99
city-roads-M	v_div_u	32	0.120	0.063	0.108	0.90	1.70
city-roads-M	v_div_u	64	0.164	0.051	0.142	0.87	2.81
city-roads-M	v_div_u	128	0.180	0.071	0.255	1.42	3.59
city-roads-M	v_div_u	256	0.290	0.130	0.480	1.65	3.71
city-roads-M	v_dot_e	32	0.085	0.045	0.066	0.77	1.45
city-roads-M	v_dot_e	64	0.137	0.050	0.067	0.49	1.34
city-roads-M	v_dot_e	128	0.144	0.062	0.105	0.73	1.69
city-roads-M	v_dot_e	256	0.159	0.107	0.173	1.08	1.61
city-roads-M	v_dot_u	32	0.092	0.045	0.064	0.69	1.41
city-roads-M	v_dot_u	64	0.095	0.045	0.064	0.67	1.40
city-roads-M	v_dot_u	128	0.150	0.046	0.102	0.68	2.20

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
city-roads-M	v_dot_u	256	0.166	0.054	0.176	1.06	3.26
city-roads-M	v_mul_e	32	0.145	0.045	0.065	0.45	1.44
city-roads-M	v_mul_e	64	0.161	0.056	0.121	0.75	2.18
city-roads-M	v_mul_e	128	0.164	0.095	0.221	1.34	2.32
city-roads-M	v_mul_e	256	0.222	0.175	0.407	1.84	2.33
city-roads-M	v_mul_u	32	0.117	0.045	0.062	0.53	1.38
city-roads-M	v_mul_u	64	0.168	0.045	0.121	0.72	2.71
city-roads-M	v_mul_u	128	0.180	0.069	0.228	1.26	3.28
city-roads-M	v_mul_u	256	0.198	0.130	0.413	2.09	3.17
city-roads-M	v_sub_e	32	0.143	0.046	0.085	0.60	1.83
city-roads-M	v_sub_e	64	0.147	0.056	0.158	1.07	2.81
city-roads-M	v_sub_e	128	0.163	0.096	0.291	1.78	3.04
city-roads-M	v_sub_e	256	0.221	0.175	0.547	2.48	3.12
city-roads-M	v_sub_u	32	0.117	0.044	0.084	0.72	1.88
city-roads-M	v_sub_u	64	0.160	0.046	0.133	0.83	2.88
city-roads-M	v_sub_u	128	0.173	0.070	0.241	1.39	3.47
city-roads-M	v_sub_u	256	0.198	0.131	0.444	2.25	3.40
coauthor-cs	copy_u	32	0.063	0.064	0.057	0.91	0.89
coauthor-cs	copy_u	64	0.063	0.064	0.078	1.24	1.23
coauthor-cs	copy_u	128	0.064	0.064	0.148	2.32	2.31
coauthor-cs	copy_u	256	0.095	0.082	0.283	2.97	3.47
coauthor-cs	copy_v	32	0.064	0.062	0.056	0.87	0.91
coauthor-cs	copy_v	64	0.064	0.062	0.078	1.21	1.25
coauthor-cs	copy_v	128	0.063	0.062	0.145	2.31	2.34
coauthor-cs	copy_v	256	0.085	0.080	0.268	3.16	3.36
coauthor-cs	e_add_u	32	0.047	0.044	0.066	1.40	1.49
coauthor-cs	e_add_u	64	0.057	0.048	0.097	1.71	2.04
coauthor-cs	e_add_u	128	0.086	0.077	0.178	2.06	2.32
coauthor-cs	e_add_u	256	0.155	0.146	0.329	2.12	2.25
coauthor-cs	e_add_v	32	0.044	0.048	0.063	1.42	1.31
coauthor-cs	e_add_v	64	0.057	0.046	0.104	1.82	2.26
coauthor-cs	e_add_v	128	0.083	0.076	0.178	2.14	2.35
coauthor-cs	e_add_v	256	0.145	0.136	0.328	2.26	2.40
coauthor-cs	e_div_u	32	0.049	0.044	0.108	2.20	2.43
coauthor-cs	e_div_u	64	0.062	0.050	0.111	1.78	2.21
coauthor-cs	e_div_u	128	0.093	0.078	0.194	2.08	2.49
coauthor-cs	e_div_u	256	0.168	0.149	0.353	2.11	2.37
coauthor-cs	e_div_v	32	0.048	0.046	0.110	2.31	2.41
coauthor-cs	e_div_v	64	0.059	0.051	0.113	1.91	2.19
coauthor-cs	e_div_v	128	0.084	0.079	0.194	2.30	2.45
coauthor-cs	e_div_v	256	0.152	0.150	0.353	2.32	2.35
coauthor-cs	e_dot_u	32	0.045	0.045	0.063	1.39	1.39
coauthor-cs	e_dot_u	64	0.058	0.047	0.068	1.17	1.44
coauthor-cs	e_dot_u	128	0.070	0.047	0.082	1.17	1.75
coauthor-cs	e_dot_u	256	0.096	0.082	0.134	1.40	1.63
coauthor-cs	e_dot_v	32	0.046	0.044	0.064	1.40	1.46
coauthor-cs	e_dot_v	64	0.051	0.046	0.067	1.32	1.47
coauthor-cs	e_dot_v	128	0.065	0.050	0.081	1.25	1.61
coauthor-cs	e_dot_v	256	0.085	0.075	0.129	1.52	1.71
coauthor-cs	e_mul_u	32	0.048	0.045	0.072	1.48	1.59
coauthor-cs	e_mul_u	64	0.058	0.047	0.097	1.68	2.05
coauthor-cs	e_mul_u	128	0.087	0.077	0.178	2.06	2.30
coauthor-cs	e_mul_u	256	0.158	0.146	0.328	2.08	2.25
coauthor-cs	e_mul_v	32	0.046	0.045	0.062	1.36	1.38
coauthor-cs	e_mul_v	64	0.056	0.047	0.097	1.73	2.05
coauthor-cs	e_mul_v	128	0.082	0.076	0.178	2.16	2.34
coauthor-cs	e_mul_v	256	0.144	0.137	0.328	2.27	2.39
coauthor-cs	e_sub_u	32	0.048	0.046	0.084	1.76	1.82
coauthor-cs	e_sub_u	64	0.057	0.047	0.103	1.81	2.17
coauthor-cs	e_sub_u	128	0.086	0.077	0.186	2.15	2.42
coauthor-cs	e_sub_u	256	0.157	0.149	0.346	2.20	2.33
coauthor-cs	e_sub_v	32	0.045	0.044	0.093	2.04	2.09
coauthor-cs	e_sub_v	64	0.056	0.056	0.103	1.84	1.83
coauthor-cs	e_sub_v	128	0.082	0.085	0.185	2.25	2.19
coauthor-cs	e_sub_v	256	0.144	0.138	0.340	2.36	2.47
coauthor-cs	u_add_e	32	0.048	0.045	0.064	1.36	1.42
coauthor-cs	u_add_e	64	0.057	0.047	0.098	1.72	2.09
coauthor-cs	u_add_e	128	0.086	0.077	0.179	2.07	2.32
coauthor-cs	u_add_e	256	0.155	0.146	0.330	2.14	2.27
coauthor-cs	u_add_v	32	0.046	0.048	0.065	1.42	1.35
coauthor-cs	u_add_v	64	0.055	0.046	0.091	1.66	1.99
coauthor-cs	u_add_v	128	0.064	0.047	0.168	2.60	3.57
coauthor-cs	u_add_v	256	0.101	0.092	0.318	3.16	3.47
coauthor-cs	u_div_e	32	0.047	0.048	0.109	2.30	2.26
coauthor-cs	u_div_e	64	0.060	0.048	0.162	2.70	3.33
coauthor-cs	u_div_e	128	0.093	0.078	0.299	3.22	3.86
coauthor-cs	u_div_e	256	0.166	0.146	0.567	3.42	3.89
coauthor-cs	u_div_v	32	0.045	0.046	0.108	2.40	2.36

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
coauthor-cs	u_div_v	64	0.057	0.049	0.109	1.90	2.24
coauthor-cs	u_div_v	128	0.070	0.049	0.186	2.66	3.77
coauthor-cs	u_div_v	256	0.118	0.091	0.343	2.90	3.78
coauthor-cs	u_dot_e	32	0.046	0.044	0.065	1.40	1.47
coauthor-cs	u_dot_e	64	0.057	0.046	0.063	1.10	1.37
coauthor-cs	u_dot_e	128	0.068	0.050	0.081	1.19	1.62
coauthor-cs	u_dot_e	256	0.092	0.085	0.132	1.44	1.55
coauthor-cs	u_dot_v	32	0.046	0.044	0.065	1.42	1.47
coauthor-cs	u_dot_v	64	0.045	0.045	0.063	1.40	1.40
coauthor-cs	u_dot_v	128	0.046	0.053	0.065	1.41	1.22
coauthor-cs	u_dot_v	256	0.052	0.046	0.102	1.96	2.22
coauthor-cs	u_mul_e	32	0.047	0.045	0.064	1.35	1.41
coauthor-cs	u_mul_e	64	0.057	0.048	0.098	1.72	2.05
coauthor-cs	u_mul_e	128	0.086	0.077	0.184	2.13	2.39
coauthor-cs	u_mul_e	256	0.156	0.146	0.330	2.12	2.27
coauthor-cs	u_mul_v	32	0.047	0.045	0.063	1.32	1.39
coauthor-cs	u_mul_v	64	0.054	0.047	0.092	1.70	1.94
coauthor-cs	u_mul_v	128	0.065	0.047	0.169	2.61	3.62
coauthor-cs	u_mul_v	256	0.103	0.093	0.318	3.10	3.42
coauthor-cs	u_sub_e	32	0.048	0.044	0.083	1.72	1.87
coauthor-cs	u_sub_e	64	0.057	0.049	0.129	2.26	2.65
coauthor-cs	u_sub_e	128	0.087	0.077	0.237	2.73	3.07
coauthor-cs	u_sub_e	256	0.155	0.146	0.460	2.96	3.16
coauthor-cs	u_sub_v	32	0.046	0.047	0.082	1.78	1.76
coauthor-cs	u_sub_v	64	0.054	0.045	0.097	1.80	2.18
coauthor-cs	u_sub_v	128	0.065	0.048	0.177	2.74	3.73
coauthor-cs	u_sub_v	256	0.103	0.092	0.331	3.22	3.59
coauthor-cs	v_add_e	32	0.046	0.045	0.064	1.41	1.44
coauthor-cs	v_add_e	64	0.057	0.048	0.098	1.72	2.04
coauthor-cs	v_add_e	128	0.083	0.076	0.179	2.16	2.36
coauthor-cs	v_add_e	256	0.142	0.138	0.329	2.31	2.39
coauthor-cs	v_add_u	32	0.045	0.044	0.063	1.41	1.43
coauthor-cs	v_add_u	64	0.054	0.046	0.092	1.70	2.01
coauthor-cs	v_add_u	128	0.064	0.048	0.171	2.66	3.56
coauthor-cs	v_add_u	256	0.101	0.092	0.318	3.15	3.46
coauthor-cs	v_div_e	32	0.046	0.043	0.109	2.34	2.50
coauthor-cs	v_div_e	64	0.060	0.052	0.161	2.71	3.12
coauthor-cs	v_div_e	128	0.088	0.077	0.300	3.40	3.88
coauthor-cs	v_div_e	256	0.153	0.138	0.567	3.70	4.10
coauthor-cs	v_div_u	32	0.044	0.043	0.108	2.46	2.48
coauthor-cs	v_div_u	64	0.057	0.045	0.109	1.91	2.40
coauthor-cs	v_div_u	128	0.070	0.051	0.183	2.61	3.59
coauthor-cs	v_div_u	256	0.116	0.092	0.343	2.97	3.73
coauthor-cs	v_dot_e	32	0.045	0.044	0.063	1.39	1.41
coauthor-cs	v_dot_e	64	0.052	0.044	0.064	1.23	1.44
coauthor-cs	v_dot_e	128	0.065	0.049	0.088	1.36	1.80
coauthor-cs	v_dot_e	256	0.084	0.080	0.132	1.57	1.66
coauthor-cs	v_dot_u	32	0.046	0.048	0.064	1.39	1.31
coauthor-cs	v_dot_u	64	0.046	0.046	0.065	1.41	1.42
coauthor-cs	v_dot_u	128	0.049	0.046	0.064	1.32	1.39
coauthor-cs	v_dot_u	256	0.054	0.046	0.102	1.90	2.20
coauthor-cs	v_mul_e	32	0.045	0.044	0.063	1.40	1.42
coauthor-cs	v_mul_e	64	0.056	0.049	0.099	1.76	2.02
coauthor-cs	v_mul_e	128	0.082	0.076	0.179	2.17	2.35
coauthor-cs	v_mul_e	256	0.143	0.138	0.330	2.30	2.40
coauthor-cs	v_mul_u	32	0.044	0.045	0.063	1.41	1.40
coauthor-cs	v_mul_u	64	0.054	0.046	0.092	1.71	2.02
coauthor-cs	v_mul_u	128	0.065	0.048	0.169	2.61	3.53
coauthor-cs	v_mul_u	256	0.103	0.093	0.319	3.08	3.44
coauthor-cs	v_sub_e	32	0.046	0.044	0.085	1.86	1.91
coauthor-cs	v_sub_e	64	0.056	0.049	0.130	2.32	2.64
coauthor-cs	v_sub_e	128	0.083	0.076	0.236	2.85	3.11
coauthor-cs	v_sub_e	256	0.143	0.145	0.442	3.09	3.06
coauthor-cs	v_sub_u	32	0.043	0.043	0.082	1.89	1.89
coauthor-cs	v_sub_u	64	0.055	0.045	0.098	1.77	2.18
coauthor-cs	v_sub_u	128	0.064	0.048	0.175	2.72	3.65
coauthor-cs	v_sub_u	256	0.103	0.092	0.332	3.22	3.60
coauthor-physics	copy_u	32	0.092	0.075	0.116	1.26	1.54
coauthor-physics	copy_u	64	0.103	0.078	0.209	2.03	2.66
coauthor-physics	copy_u	128	0.135	0.115	0.389	2.88	3.38
coauthor-physics	copy_u	256	0.274	0.256	0.730	2.67	2.86
coauthor-physics	copy_v	32	0.065	0.064	0.112	1.72	1.74
coauthor-physics	copy_v	64	0.070	0.064	0.205	2.94	3.21
coauthor-physics	copy_v	128	0.114	0.112	0.381	3.35	3.39
coauthor-physics	copy_v	256	0.214	0.224	0.734	3.43	3.28
coauthor-physics	e_add_u	32	0.114	0.095	0.134	1.18	1.41
coauthor-physics	e_add_u	64	0.132	0.117	0.244	1.85	2.08
coauthor-physics	e_add_u	128	0.229	0.213	0.453	1.97	2.13

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
coauthor-physics	e_add_u	256	0.436	0.420	0.848	1.94	2.02
coauthor-physics	e_add_v	32	0.099	0.093	0.133	1.35	1.44
coauthor-physics	e_add_v	64	0.122	0.115	0.245	2.01	2.13
coauthor-physics	e_add_v	128	0.208	0.199	0.457	2.20	2.30
coauthor-physics	e_add_v	256	0.378	0.373	0.866	2.29	2.32
coauthor-physics	e_div_u	32	0.118	0.101	0.146	1.23	1.44
coauthor-physics	e_div_u	64	0.142	0.126	0.261	1.84	2.07
coauthor-physics	e_div_u	128	0.242	0.217	0.476	1.97	2.20
coauthor-physics	e_div_u	256	0.471	0.432	0.886	1.88	2.05
coauthor-physics	e_div_v	32	0.112	0.107	0.146	1.30	1.36
coauthor-physics	e_div_v	64	0.129	0.131	0.269	2.10	2.06
coauthor-physics	e_div_v	128	0.211	0.204	0.481	2.28	2.36
coauthor-physics	e_div_v	256	0.394	0.382	0.906	2.30	2.37
coauthor-physics	e_dot_u	32	0.133	0.097	0.134	1.01	1.38
coauthor-physics	e_dot_u	64	0.143	0.104	0.143	1.00	1.38
coauthor-physics	e_dot_u	128	0.166	0.124	0.223	1.34	1.80
coauthor-physics	e_dot_u	256	0.269	0.248	0.365	1.36	1.47
coauthor-physics	e_dot_v	32	0.120	0.095	0.133	1.11	1.40
coauthor-physics	e_dot_v	64	0.126	0.101	0.141	1.12	1.40
coauthor-physics	e_dot_v	128	0.146	0.114	0.222	1.52	1.94
coauthor-physics	e_dot_v	256	0.217	0.190	0.388	1.79	2.04
coauthor-physics	e_mul_u	32	0.114	0.095	0.138	1.22	1.45
coauthor-physics	e_mul_u	64	0.133	0.117	0.244	1.84	2.08
coauthor-physics	e_mul_u	128	0.234	0.213	0.453	1.93	2.13
coauthor-physics	e_mul_u	256	0.442	0.420	0.848	1.92	2.02
coauthor-physics	e_mul_v	32	0.099	0.093	0.133	1.35	1.43
coauthor-physics	e_mul_v	64	0.122	0.115	0.244	2.00	2.13
coauthor-physics	e_mul_v	128	0.217	0.199	0.457	2.11	2.30
coauthor-physics	e_mul_v	256	0.377	0.372	0.866	2.30	2.33
coauthor-physics	e_sub_u	32	0.114	0.096	0.140	1.23	1.46
coauthor-physics	e_sub_u	64	0.133	0.116	0.253	1.90	2.17
coauthor-physics	e_sub_u	128	0.233	0.214	0.465	1.99	2.17
coauthor-physics	e_sub_u	256	0.442	0.420	0.868	1.96	2.07
coauthor-physics	e_sub_v	32	0.099	0.093	0.139	1.40	1.50
coauthor-physics	e_sub_v	64	0.122	0.115	0.252	2.06	2.19
coauthor-physics	e_sub_v	128	0.207	0.199	0.479	2.31	2.41
coauthor-physics	e_sub_v	256	0.378	0.373	0.887	2.35	2.38
coauthor-physics	u_add_e	32	0.113	0.095	0.135	1.20	1.42
coauthor-physics	u_add_e	64	0.132	0.117	0.245	1.86	2.10
coauthor-physics	u_add_e	128	0.228	0.221	0.455	2.00	2.05
coauthor-physics	u_add_e	256	0.435	0.419	0.855	1.96	2.04
coauthor-physics	u_add_v	32	0.104	0.078	0.130	1.25	1.66
coauthor-physics	u_add_v	64	0.116	0.084	0.235	2.02	2.81
coauthor-physics	u_add_v	128	0.149	0.131	0.443	2.98	3.38
coauthor-physics	u_add_v	256	0.287	0.270	0.831	2.90	3.07
coauthor-physics	u_div_e	32	0.110	0.106	0.221	2.00	2.09
coauthor-physics	u_div_e	64	0.137	0.124	0.413	3.02	3.32
coauthor-physics	u_div_e	128	0.240	0.218	0.788	3.28	3.62
coauthor-physics	u_div_e	256	0.466	0.417	1.520	3.26	3.64
coauthor-physics	u_div_v	32	0.109	0.086	0.141	1.29	1.63
coauthor-physics	u_div_v	64	0.124	0.102	0.252	2.04	2.47
coauthor-physics	u_div_v	128	0.161	0.135	0.467	2.90	3.47
coauthor-physics	u_div_v	256	0.296	0.266	0.875	2.95	3.29
coauthor-physics	u_dot_e	32	0.135	0.098	0.134	0.99	1.37
coauthor-physics	u_dot_e	64	0.139	0.107	0.142	1.02	1.33
coauthor-physics	u_dot_e	128	0.159	0.128	0.218	1.38	1.71
coauthor-physics	u_dot_e	256	0.262	0.248	0.363	1.38	1.46
coauthor-physics	u_dot_v	32	0.084	0.077	0.110	1.32	1.43
coauthor-physics	u_dot_v	64	0.085	0.082	0.122	1.44	1.49
coauthor-physics	u_dot_v	128	0.115	0.089	0.187	1.63	2.11
coauthor-physics	u_dot_v	256	0.144	0.104	0.315	2.19	3.04
coauthor-physics	u_mul_e	32	0.113	0.096	0.138	1.22	1.43
coauthor-physics	u_mul_e	64	0.132	0.117	0.245	1.86	2.09
coauthor-physics	u_mul_e	128	0.230	0.213	0.455	1.97	2.13
coauthor-physics	u_mul_e	256	0.439	0.419	0.855	1.95	2.04
coauthor-physics	u_mul_v	32	0.105	0.078	0.129	1.24	1.65
coauthor-physics	u_mul_v	64	0.117	0.085	0.237	2.02	2.80
coauthor-physics	u_mul_v	128	0.149	0.132	0.446	2.99	3.38
coauthor-physics	u_mul_v	256	0.290	0.268	0.838	2.89	3.13
coauthor-physics	u_sub_e	32	0.112	0.095	0.176	1.56	1.85
coauthor-physics	u_sub_e	64	0.133	0.117	0.324	2.43	2.77
coauthor-physics	u_sub_e	128	0.229	0.213	0.614	2.68	2.89
coauthor-physics	u_sub_e	256	0.438	0.419	1.180	2.69	2.82
coauthor-physics	u_sub_v	32	0.104	0.078	0.134	1.28	1.71
coauthor-physics	u_sub_v	64	0.118	0.084	0.244	2.07	2.91
coauthor-physics	u_sub_v	128	0.149	0.132	0.456	3.06	3.45
coauthor-physics	u_sub_v	256	0.289	0.268	0.857	2.96	3.20
coauthor-physics	v_add_e	32	0.099	0.093	0.134	1.35	1.45

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
coauthor-physics	v_add_e	64	0.122	0.115	0.248	2.04	2.15
coauthor-physics	v_add_e	128	0.203	0.206	0.458	2.25	2.22
coauthor-physics	v_add_e	256	0.373	0.369	0.873	2.34	2.37
coauthor-physics	v_add_u	32	0.104	0.078	0.129	1.23	1.64
coauthor-physics	v_add_u	64	0.116	0.084	0.236	2.03	2.82
coauthor-physics	v_add_u	128	0.149	0.132	0.445	2.98	3.38
coauthor-physics	v_add_u	256	0.287	0.276	0.836	2.92	3.03
coauthor-physics	v_div_e	32	0.106	0.109	0.221	2.08	2.02
coauthor-physics	v_div_e	64	0.128	0.132	0.414	3.24	3.15
coauthor-physics	v_div_e	128	0.219	0.204	0.793	3.62	3.88
coauthor-physics	v_div_e	256	0.400	0.371	1.534	3.84	4.13
coauthor-physics	v_div_u	32	0.110	0.087	0.141	1.28	1.62
coauthor-physics	v_div_u	64	0.125	0.104	0.262	2.10	2.53
coauthor-physics	v_div_u	128	0.160	0.138	0.468	2.92	3.38
coauthor-physics	v_div_u	256	0.298	0.269	0.874	2.93	3.25
coauthor-physics	v_dot_e	32	0.120	0.095	0.133	1.11	1.40
coauthor-physics	v_dot_e	64	0.126	0.103	0.142	1.13	1.38
coauthor-physics	v_dot_e	128	0.143	0.120	0.222	1.55	1.85
coauthor-physics	v_dot_e	256	0.216	0.204	0.383	1.78	1.88
coauthor-physics	v_dot_u	32	0.083	0.077	0.110	1.33	1.43
coauthor-physics	v_dot_u	64	0.085	0.082	0.122	1.44	1.48
coauthor-physics	v_dot_u	128	0.118	0.089	0.187	1.59	2.11
coauthor-physics	v_dot_u	256	0.144	0.104	0.315	2.19	3.03
coauthor-physics	v_mul_e	32	0.099	0.093	0.135	1.36	1.45
coauthor-physics	v_mul_e	64	0.122	0.115	0.246	2.02	2.15
coauthor-physics	v_mul_e	128	0.205	0.199	0.459	2.24	2.31
coauthor-physics	v_mul_e	256	0.378	0.371	0.873	2.31	2.36
coauthor-physics	v_mul_u	32	0.112	0.078	0.130	1.16	1.65
coauthor-physics	v_mul_u	64	0.117	0.084	0.238	2.03	2.83
coauthor-physics	v_mul_u	128	0.149	0.132	0.444	2.97	3.36
coauthor-physics	v_mul_u	256	0.291	0.269	0.838	2.88	3.11
coauthor-physics	v_sub_e	32	0.099	0.093	0.175	1.77	1.89
coauthor-physics	v_sub_e	64	0.121	0.115	0.327	2.69	2.84
coauthor-physics	v_sub_e	128	0.203	0.199	0.620	3.05	3.12
coauthor-physics	v_sub_e	256	0.377	0.368	1.199	3.18	3.25
coauthor-physics	v_sub_u	32	0.105	0.078	0.135	1.29	1.73
coauthor-physics	v_sub_u	64	0.117	0.084	0.245	2.08	2.91
coauthor-physics	v_sub_u	128	0.149	0.132	0.457	3.07	3.46
coauthor-physics	v_sub_u	256	0.289	0.268	0.858	2.96	3.20
cora	copy_u	32	0.069	0.065	0.063	0.91	0.97
cora	copy_u	64	0.065	0.063	0.092	1.41	1.45
cora	copy_u	128	0.063	0.063	0.055	0.87	0.87
cora	copy_u	256	0.063	0.063	0.059	0.93	0.94
cora	copy_v	32	0.065	0.064	0.060	0.92	0.93
cora	copy_v	64	0.065	0.062	0.056	0.87	0.91
cora	copy_v	128	0.064	0.062	0.055	0.87	0.89
cora	copy_v	256	0.064	0.062	0.059	0.92	0.95
cora	e_add_u	32	0.048	0.048	0.064	1.32	1.32
cora	e_add_u	64	0.045	0.045	0.062	1.39	1.39
cora	e_add_u	128	0.045	0.045	0.066	1.45	1.45
cora	e_add_u	256	0.045	0.046	0.065	1.44	1.41
cora	e_add_v	32	0.047	0.045	0.065	1.38	1.44
cora	e_add_v	64	0.044	0.045	0.063	1.43	1.39
cora	e_add_v	128	0.045	0.044	0.064	1.43	1.45
cora	e_add_v	256	0.045	0.046	0.064	1.40	1.38
cora	e_div_u	32	0.045	0.044	0.110	2.44	2.51
cora	e_div_u	64	0.044	0.045	0.109	2.48	2.40
cora	e_div_u	128	0.047	0.048	0.113	2.43	2.37
cora	e_div_u	256	0.048	0.049	0.108	2.26	2.21
cora	e_div_v	32	0.046	0.045	0.109	2.37	2.39
cora	e_div_v	64	0.044	0.045	0.106	2.40	2.37
cora	e_div_v	128	0.048	0.046	0.113	2.36	2.44
cora	e_div_v	256	0.048	0.048	0.110	2.29	2.28
cora	e_dot_u	32	0.045	0.045	0.064	1.41	1.42
cora	e_dot_u	64	0.044	0.047	0.072	1.64	1.54
cora	e_dot_u	128	0.045	0.046	0.069	1.54	1.49
cora	e_dot_u	256	0.048	0.050	0.065	1.35	1.30
cora	e_dot_v	32	0.046	0.045	0.064	1.40	1.43
cora	e_dot_v	64	0.046	0.046	0.065	1.43	1.43
cora	e_dot_v	128	0.045	0.046	0.068	1.52	1.49
cora	e_dot_v	256	0.049	0.048	0.066	1.35	1.37
cora	e_mul_u	32	0.047	0.046	0.064	1.35	1.38
cora	e_mul_u	64	0.044	0.046	0.063	1.43	1.38
cora	e_mul_u	128	0.055	0.048	0.071	1.29	1.48
cora	e_mul_u	256	0.046	0.046	0.064	1.41	1.39
cora	e_mul_v	32	0.045	0.045	0.066	1.47	1.47
cora	e_mul_v	64	0.044	0.044	0.062	1.41	1.41
cora	e_mul_v	128	0.048	0.047	0.082	1.72	1.74

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
cora	e_mul_v	256	0.046	0.059	0.066	1.45	1.12
cora	e_sub_u	32	0.046	0.054	0.083	1.81	1.54
cora	e_sub_u	64	0.044	0.045	0.084	1.89	1.86
cora	e_sub_u	128	0.045	0.048	0.085	1.89	1.76
cora	e_sub_u	256	0.045	0.047	0.084	1.86	1.81
cora	e_sub_v	32	0.046	0.045	0.087	1.90	1.93
cora	e_sub_v	64	0.045	0.044	0.084	1.89	1.91
cora	e_sub_v	128	0.044	0.046	0.084	1.90	1.85
cora	e_sub_v	256	0.045	0.045	0.085	1.89	1.89
cora	u_add_e	32	0.047	0.047	0.066	1.39	1.40
cora	u_add_e	64	0.045	0.045	0.063	1.40	1.40
cora	u_add_e	128	0.043	0.046	0.062	1.44	1.35
cora	u_add_e	256	0.045	0.047	0.068	1.52	1.45
cora	u_add_v	32	0.049	0.048	0.065	1.33	1.36
cora	u_add_v	64	0.046	0.045	0.066	1.45	1.47
cora	u_add_v	128	0.043	0.043	0.063	1.47	1.45
cora	u_add_v	256	0.045	0.045	0.067	1.50	1.50
cora	u_div_e	32	0.046	0.048	0.108	2.34	2.27
cora	u_div_e	64	0.044	0.046	0.110	2.47	2.40
cora	u_div_e	128	0.045	0.045	0.106	2.37	2.34
cora	u_div_e	256	0.045	0.046	0.110	2.45	2.40
cora	u_div_v	32	0.049	0.046	0.109	2.22	2.38
cora	u_div_v	64	0.045	0.046	0.110	2.44	2.41
cora	u_div_v	128	0.045	0.046	0.109	2.44	2.38
cora	u_div_v	256	0.045	0.044	0.109	2.42	2.44
cora	u_dot_e	32	0.051	0.049	0.065	1.28	1.33
cora	u_dot_e	64	0.045	0.047	0.067	1.47	1.43
cora	u_dot_e	128	0.052	0.052	0.064	1.23	1.24
cora	u_dot_e	256	0.045	0.047	0.064	1.43	1.37
cora	u_dot_v	32	0.052	0.049	0.064	1.23	1.32
cora	u_dot_v	64	0.046	0.046	0.067	1.45	1.46
cora	u_dot_v	128	0.045	0.046	0.064	1.42	1.41
cora	u_dot_v	256	0.045	0.044	0.066	1.45	1.48
cora	u_mul_e	32	0.047	0.047	0.063	1.34	1.35
cora	u_mul_e	64	0.046	0.046	0.065	1.39	1.42
cora	u_mul_e	128	0.045	0.045	0.063	1.40	1.39
cora	u_mul_e	256	0.045	0.047	0.066	1.48	1.40
cora	u_mul_v	32	0.049	0.048	0.062	1.25	1.29
cora	u_mul_v	64	0.047	0.047	0.076	1.61	1.62
cora	u_mul_v	128	0.044	0.044	0.062	1.40	1.40
cora	u_mul_v	256	0.046	0.045	0.064	1.38	1.41
cora	u_sub_e	32	0.047	0.047	0.095	2.00	2.02
cora	u_sub_e	64	0.057	0.048	0.086	1.49	1.80
cora	u_sub_e	128	0.043	0.045	0.084	1.94	1.85
cora	u_sub_e	256	0.045	0.046	0.087	1.94	1.87
cora	u_sub_v	32	0.049	0.048	0.100	2.03	2.07
cora	u_sub_v	64	0.045	0.046	0.085	1.89	1.84
cora	u_sub_v	128	0.044	0.045	0.084	1.90	1.87
cora	u_sub_v	256	0.044	0.045	0.086	1.96	1.89
cora	v_add_e	32	0.048	0.049	0.064	1.32	1.31
cora	v_add_e	64	0.045	0.045	0.065	1.43	1.45
cora	v_add_e	128	0.047	0.047	0.062	1.33	1.31
cora	v_add_e	256	0.044	0.045	0.064	1.44	1.44
cora	v_add_u	32	0.049	0.065	0.064	1.30	0.99
cora	v_add_u	64	0.044	0.044	0.063	1.44	1.42
cora	v_add_u	128	0.047	0.046	0.063	1.34	1.36
cora	v_add_u	256	0.046	0.044	0.067	1.46	1.53
cora	v_div_e	32	0.048	0.049	0.107	2.22	2.20
cora	v_div_e	64	0.045	0.044	0.108	2.39	2.43
cora	v_div_e	128	0.045	0.045	0.106	2.33	2.35
cora	v_div_e	256	0.046	0.045	0.110	2.39	2.44
cora	v_div_u	32	0.049	0.048	0.109	2.22	2.28
cora	v_div_u	64	0.047	0.048	0.107	2.25	2.22
cora	v_div_u	128	0.044	0.045	0.108	2.47	2.40
cora	v_div_u	256	0.046	0.046	0.108	2.37	2.35
cora	v_dot_e	32	0.048	0.049	0.065	1.35	1.35
cora	v_dot_e	64	0.045	0.045	0.063	1.40	1.39
cora	v_dot_e	128	0.045	0.046	0.064	1.42	1.41
cora	v_dot_e	256	0.044	0.046	0.066	1.48	1.43
cora	v_dot_u	32	0.048	0.048	0.064	1.33	1.35
cora	v_dot_u	64	0.045	0.046	0.063	1.40	1.39
cora	v_dot_u	128	0.045	0.054	0.064	1.41	1.20
cora	v_dot_u	256	0.048	0.046	0.065	1.34	1.41
cora	v_mul_e	32	0.049	0.049	0.065	1.33	1.33
cora	v_mul_e	64	0.047	0.047	0.063	1.36	1.35
cora	v_mul_e	128	0.045	0.046	0.063	1.40	1.37
cora	v_mul_e	256	0.045	0.046	0.065	1.45	1.43
cora	v_mul_u	32	0.049	0.048	0.063	1.30	1.32

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
cora	v_mul_u	64	0.047	0.047	0.064	1.37	1.37
cora	v_mul_u	128	0.044	0.046	0.062	1.40	1.36
cora	v_mul_u	256	0.045	0.045	0.065	1.44	1.44
cora	v_sub_e	32	0.048	0.050	0.082	1.70	1.66
cora	v_sub_e	64	0.045	0.046	0.087	1.91	1.89
cora	v_sub_e	128	0.045	0.045	0.084	1.89	1.89
cora	v_sub_e	256	0.045	0.045	0.087	1.93	1.91
cora	v_sub_u	32	0.049	0.047	0.086	1.76	1.84
cora	v_sub_u	64	0.044	0.043	3.866	87.60	89.15
cora	v_sub_u	128	0.047	0.045	0.100	2.12	2.24
cora	v_sub_u	256	0.046	0.045	0.086	1.88	1.91
CoraFull	copy_u	32	0.063	0.062	0.057	0.91	0.91
CoraFull	copy_u	64	0.064	0.063	0.062	0.97	0.98
CoraFull	copy_u	128	0.065	0.065	0.126	1.94	1.94
CoraFull	copy_u	256	0.083	0.070	0.239	2.87	3.43
CoraFull	copy_v	32	0.063	0.061	0.055	0.87	0.90
CoraFull	copy_v	64	0.064	0.063	0.060	0.94	0.95
CoraFull	copy_v	128	0.065	0.064	0.126	1.96	1.98
CoraFull	copy_v	256	0.074	0.068	0.231	3.11	3.38
CoraFull	e_add_u	32	0.045	0.044	0.064	1.40	1.43
CoraFull	e_add_u	64	0.056	0.047	0.083	1.48	1.78
CoraFull	e_add_u	128	0.078	0.065	0.153	1.96	2.34
CoraFull	e_add_u	256	0.133	0.121	0.281	2.12	2.32
CoraFull	e_add_v	32	0.046	0.045	0.063	1.38	1.39
CoraFull	e_add_v	64	0.056	0.046	0.082	1.45	1.77
CoraFull	e_add_v	128	0.073	0.065	0.153	2.09	2.37
CoraFull	e_add_v	256	0.126	0.116	0.278	2.21	2.40
CoraFull	e_div_u	32	0.047	0.045	0.108	2.32	2.40
CoraFull	e_div_u	64	0.061	0.047	0.112	1.81	2.38
CoraFull	e_div_u	128	0.088	0.067	0.169	1.92	2.53
CoraFull	e_div_u	256	0.147	0.123	0.305	2.07	2.47
CoraFull	e_div_v	32	0.045	0.045	0.108	2.41	2.39
CoraFull	e_div_v	64	0.058	0.046	0.114	1.95	2.44
CoraFull	e_div_v	128	0.076	0.066	0.175	2.31	2.66
CoraFull	e_div_v	256	0.136	0.119	0.304	2.24	2.55
CoraFull	e_dot_u	32	0.045	0.045	0.064	1.42	1.43
CoraFull	e_dot_u	64	0.047	0.048	0.064	1.36	1.34
CoraFull	e_dot_u	128	0.069	0.046	0.069	1.01	1.50
CoraFull	e_dot_u	256	0.091	0.069	0.107	1.17	1.55
CoraFull	e_dot_v	32	0.044	0.044	0.065	1.46	1.47
CoraFull	e_dot_v	64	0.046	0.047	0.065	1.42	1.39
CoraFull	e_dot_v	128	0.065	0.046	0.069	1.06	1.49
CoraFull	e_dot_v	256	0.078	0.065	0.110	1.40	1.68
CoraFull	e_mul_u	32	0.046	0.045	0.064	1.39	1.43
CoraFull	e_mul_u	64	0.057	0.049	0.082	1.45	1.68
CoraFull	e_mul_u	128	0.077	0.065	0.152	1.97	2.34
CoraFull	e_mul_u	256	0.135	0.121	0.280	2.07	2.31
CoraFull	e_mul_v	32	0.045	0.045	0.063	1.39	1.41
CoraFull	e_mul_v	64	0.055	0.046	0.082	1.49	1.78
CoraFull	e_mul_v	128	0.073	0.064	0.152	2.07	2.37
CoraFull	e_mul_v	256	0.126	0.116	0.279	2.21	2.40
CoraFull	e_sub_u	32	0.047	0.045	0.086	1.84	1.92
CoraFull	e_sub_u	64	0.057	0.049	0.088	1.55	1.79
CoraFull	e_sub_u	128	0.077	0.066	0.161	2.08	2.43
CoraFull	e_sub_u	256	0.135	0.121	0.293	2.17	2.42
CoraFull	e_sub_v	32	0.046	0.046	0.084	1.84	1.83
CoraFull	e_sub_v	64	0.055	0.057	0.088	1.59	1.55
CoraFull	e_sub_v	128	0.074	0.065	0.160	2.18	2.47
CoraFull	e_sub_v	256	0.126	0.116	0.291	2.32	2.51
CoraFull	u_add_e	32	0.045	0.044	0.062	1.38	1.41
CoraFull	u_add_e	64	0.056	0.047	0.082	1.46	1.75
CoraFull	u_add_e	128	0.077	0.065	0.154	1.99	2.36
CoraFull	u_add_e	256	0.133	0.121	0.280	2.11	2.31
CoraFull	u_add_v	32	0.045	0.043	0.063	1.42	1.48
CoraFull	u_add_v	64	0.051	0.044	0.074	1.45	1.68
CoraFull	u_add_v	128	0.066	0.047	0.144	2.20	3.07
CoraFull	u_add_v	256	0.088	0.079	0.272	3.07	3.44
CoraFull	u_div_e	32	0.044	0.045	0.109	2.45	2.44
CoraFull	u_div_e	64	0.059	0.047	0.136	2.30	2.87
CoraFull	u_div_e	128	0.088	0.066	0.254	2.89	3.83
CoraFull	u_div_e	256	0.146	0.122	0.479	3.28	3.94
CoraFull	u_div_v	32	0.045	0.044	0.108	2.40	2.44
CoraFull	u_div_v	64	0.053	0.045	0.110	2.06	2.43
CoraFull	u_div_v	128	0.071	0.045	0.161	2.27	3.62
CoraFull	u_div_v	256	0.116	0.078	0.298	2.58	3.80
CoraFull	u_dot_e	32	0.046	0.045	0.066	1.44	1.45
CoraFull	u_dot_e	64	0.050	0.047	0.064	1.27	1.35
CoraFull	u_dot_e	128	0.068	0.048	0.071	1.04	1.48

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
CoraFull	u_dot_e	256	0.087	0.073	0.110	1.27	1.50
CoraFull	u_dot_v	32	0.046	0.044	0.065	1.42	1.46
CoraFull	u_dot_v	64	0.044	0.045	0.063	1.45	1.40
CoraFull	u_dot_v	128	0.046	0.045	0.066	1.42	1.48
CoraFull	u_dot_v	256	0.055	0.045	0.087	1.59	1.92
CoraFull	u_mul_e	32	0.045	0.045	0.065	1.44	1.45
CoraFull	u_mul_e	64	0.056	0.046	0.083	1.46	1.81
CoraFull	u_mul_e	128	0.077	0.067	0.153	1.99	2.31
CoraFull	u_mul_e	256	0.134	0.121	0.280	2.09	2.31
CoraFull	u_mul_v	32	0.045	0.043	0.066	1.48	1.55
CoraFull	u_mul_v	64	0.051	0.046	0.075	1.47	1.64
CoraFull	u_mul_v	128	0.065	0.046	0.146	2.23	3.18
CoraFull	u_mul_v	256	0.091	0.079	0.274	3.03	3.46
CoraFull	u_sub_e	32	0.045	0.045	0.087	1.93	1.91
CoraFull	u_sub_e	64	0.056	0.047	0.109	1.93	2.33
CoraFull	u_sub_e	128	0.077	0.065	0.201	2.59	3.07
CoraFull	u_sub_e	256	0.134	0.121	0.374	2.79	3.09
CoraFull	u_sub_v	32	0.046	0.045	0.086	1.89	1.92
CoraFull	u_sub_v	64	0.051	0.045	0.085	1.66	1.90
CoraFull	u_sub_v	128	0.066	0.046	0.153	2.33	3.36
CoraFull	u_sub_v	256	0.090	0.079	0.286	3.17	3.61
CoraFull	v_add_e	32	0.044	0.045	0.064	1.43	1.42
CoraFull	v_add_e	64	0.056	0.046	0.082	1.48	1.79
CoraFull	v_add_e	128	0.073	0.071	0.153	2.09	2.16
CoraFull	v_add_e	256	0.124	0.116	0.280	2.25	2.42
CoraFull	v_add_u	32	0.045	0.044	0.064	1.42	1.46
CoraFull	v_add_u	64	0.051	0.045	0.075	1.48	1.67
CoraFull	v_add_u	128	0.065	0.046	0.145	2.22	3.19
CoraFull	v_add_u	256	0.088	0.079	0.272	3.08	3.43
CoraFull	v_div_e	32	0.046	0.044	0.120	2.62	2.70
CoraFull	v_div_e	64	0.059	0.046	0.136	2.32	2.94
CoraFull	v_div_e	128	0.087	0.066	0.253	2.92	3.84
CoraFull	v_div_e	256	0.138	0.117	0.477	3.47	4.08
CoraFull	v_div_u	32	0.044	0.044	0.108	2.43	2.45
CoraFull	v_div_u	64	0.054	0.046	0.110	2.04	2.37
CoraFull	v_div_u	128	0.071	0.046	0.162	2.26	3.54
CoraFull	v_div_u	256	0.114	0.080	0.298	2.61	3.73
CoraFull	v_dot_e	32	0.045	0.045	0.064	1.41	1.41
CoraFull	v_dot_e	64	0.046	0.046	0.064	1.37	1.37
CoraFull	v_dot_e	128	0.063	0.046	0.069	1.09	1.52
CoraFull	v_dot_e	256	0.078	0.070	0.112	1.43	1.61
CoraFull	v_dot_u	32	0.045	0.044	0.067	1.47	1.50
CoraFull	v_dot_u	64	0.047	0.047	0.073	1.54	1.57
CoraFull	v_dot_u	128	0.046	0.045	0.064	1.38	1.43
CoraFull	v_dot_u	256	0.055	0.045	0.087	1.60	1.94
CoraFull	v_mul_e	32	0.045	0.045	0.072	1.58	1.60
CoraFull	v_mul_e	64	0.055	0.046	0.082	1.49	1.78
CoraFull	v_mul_e	128	0.074	0.072	0.153	2.08	2.12
CoraFull	v_mul_e	256	0.125	0.116	0.280	2.23	2.41
CoraFull	v_mul_u	32	0.045	0.044	0.063	1.42	1.44
CoraFull	v_mul_u	64	0.051	0.045	0.075	1.48	1.69
CoraFull	v_mul_u	128	0.065	0.046	0.146	2.24	3.19
CoraFull	v_mul_u	256	0.090	0.079	0.274	3.04	3.46
CoraFull	v_sub_e	32	0.046	0.044	0.085	1.84	1.95
CoraFull	v_sub_e	64	0.055	0.047	0.109	1.98	2.30
CoraFull	v_sub_e	128	0.074	0.064	0.201	2.74	3.15
CoraFull	v_sub_e	256	0.124	0.116	0.373	3.01	3.21
CoraFull	v_sub_u	32	0.051	0.044	0.083	1.62	1.86
CoraFull	v_sub_u	64	0.051	0.046	0.086	1.70	1.90
CoraFull	v_sub_u	128	0.066	0.046	0.155	2.35	3.40
CoraFull	v_sub_u	256	0.090	0.080	0.286	3.17	3.58
Flickr	copy_u	32	0.234	0.137	0.211	0.90	1.54
Flickr	copy_u	64	0.274	0.158	0.389	1.42	2.45
Flickr	copy_u	128	0.350	0.262	0.720	2.06	2.75
Flickr	copy_u	256	0.615	0.545	1.354	2.20	2.49
Flickr	copy_v	32	0.137	0.106	0.207	1.51	1.94
Flickr	copy_v	64	0.157	0.118	0.393	2.51	3.32
Flickr	copy_v	128	0.225	0.223	0.747	3.32	3.35
Flickr	copy_v	256	0.436	0.428	1.447	3.32	3.38
Flickr	e_add_u	32	0.280	0.179	0.238	0.85	1.33
Flickr	e_add_u	64	0.320	0.235	0.445	1.39	1.90
Flickr	e_add_u	128	0.517	0.436	0.837	1.62	1.92
Flickr	e_add_u	256	0.931	0.840	1.618	1.74	1.92
Flickr	e_add_v	32	0.235	0.171	0.238	1.01	1.39
Flickr	e_add_v	64	0.272	0.217	0.455	1.67	2.09
Flickr	e_add_v	128	0.432	0.374	0.860	1.99	2.30
Flickr	e_add_v	256	0.764	0.711	1.658	2.17	2.33
Flickr	e_div_u	32	0.293	0.189	0.257	0.87	1.36

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
Flickr	e_div_u	64	0.345	0.250	0.471	1.37	1.89
Flickr	e_div_u	128	0.540	0.442	0.892	1.65	2.02
Flickr	e_div_u	256	1.072	0.860	1.718	1.60	2.00
Flickr	e_div_v	32	0.250	0.197	0.256	1.02	1.29
Flickr	e_div_v	64	0.294	0.244	0.481	1.63	1.97
Flickr	e_div_v	128	0.452	0.389	0.914	2.02	2.35
Flickr	e_div_v	256	0.816	0.730	1.762	2.16	2.41
Flickr	e_dot_u	32	0.358	0.180	0.253	0.71	1.40
Flickr	e_dot_u	64	0.395	0.196	0.272	0.69	1.39
Flickr	e_dot_u	128	0.454	0.255	0.427	0.94	1.67
Flickr	e_dot_u	256	0.672	0.517	0.699	1.04	1.35
Flickr	e_dot_v	32	0.300	0.175	0.249	0.83	1.43
Flickr	e_dot_v	64	0.313	0.187	0.274	0.88	1.47
Flickr	e_dot_v	128	0.351	0.213	0.442	1.26	2.08
Flickr	e_dot_v	256	0.475	0.363	0.775	1.63	2.13
Flickr	e_mul_u	32	0.280	0.179	0.238	0.85	1.33
Flickr	e_mul_u	64	0.322	0.235	0.444	1.38	1.89
Flickr	e_mul_u	128	0.523	0.436	0.838	1.60	1.92
Flickr	e_mul_u	256	0.940	0.839	1.617	1.72	1.93
Flickr	e_mul_v	32	0.239	0.172	0.238	1.00	1.39
Flickr	e_mul_v	64	0.272	0.217	0.462	1.70	2.13
Flickr	e_mul_v	128	0.433	0.373	0.862	1.99	2.31
Flickr	e_mul_v	256	0.764	0.710	1.658	2.17	2.33
Flickr	e_sub_u	32	0.281	0.179	0.247	0.88	1.38
Flickr	e_sub_u	64	0.322	0.239	0.458	1.42	1.92
Flickr	e_sub_u	128	0.524	0.436	0.864	1.65	1.98
Flickr	e_sub_u	256	0.940	0.841	1.664	1.77	1.98
Flickr	e_sub_v	32	0.235	0.171	0.247	1.05	1.45
Flickr	e_sub_v	64	0.272	0.217	0.468	1.72	2.15
Flickr	e_sub_v	128	0.433	0.378	0.886	2.05	2.34
Flickr	e_sub_v	256	0.764	0.710	1.709	2.24	2.41
Flickr	u_add_e	32	0.278	0.179	0.240	0.86	1.34
Flickr	u_add_e	64	0.328	0.235	0.453	1.38	1.93
Flickr	u_add_e	128	0.516	0.435	0.840	1.63	1.93
Flickr	u_add_e	256	0.929	0.833	1.605	1.73	1.93
Flickr	u_add_v	32	0.267	0.167	0.241	0.90	1.44
Flickr	u_add_v	64	0.305	0.178	0.450	1.48	2.52
Flickr	u_add_v	128	0.384	0.294	0.843	2.20	2.87
Flickr	u_add_v	256	0.652	0.572	1.600	2.45	2.80
Flickr	u_div_e	32	0.278	0.186	0.400	1.44	2.15
Flickr	u_div_e	64	0.334	0.247	0.763	2.28	3.09
Flickr	u_div_e	128	0.533	0.442	1.475	2.77	3.34
Flickr	u_div_e	256	1.042	0.836	2.870	2.76	3.43
Flickr	u_div_v	32	0.277	0.169	0.256	0.92	1.52
Flickr	u_div_v	64	0.323	0.213	0.477	1.48	2.24
Flickr	u_div_v	128	0.419	0.293	0.903	2.15	3.08
Flickr	u_div_v	256	0.725	0.584	1.711	2.36	2.93
Flickr	u_dot_e	32	0.370	0.181	0.252	0.68	1.39
Flickr	u_dot_e	64	0.387	0.202	0.267	0.69	1.32
Flickr	u_dot_e	128	0.435	0.269	0.421	0.97	1.56
Flickr	u_dot_e	256	0.631	0.531	0.663	1.05	1.25
Flickr	u_dot_v	32	0.248	0.152	0.251	1.01	1.66
Flickr	u_dot_v	64	0.346	0.156	0.271	0.78	1.73
Flickr	u_dot_v	128	0.380	0.174	0.402	1.06	2.32
Flickr	u_dot_v	256	0.434	0.214	0.657	1.51	3.07
Flickr	u_mul_e	32	0.278	0.179	0.240	0.86	1.34
Flickr	u_mul_e	64	0.321	0.235	0.446	1.39	1.90
Flickr	u_mul_e	128	0.517	0.435	0.840	1.62	1.93
Flickr	u_mul_e	256	0.931	0.839	1.605	1.72	1.91
Flickr	u_mul_v	32	0.267	0.151	0.239	0.89	1.58
Flickr	u_mul_v	64	0.306	0.175	0.453	1.48	2.58
Flickr	u_mul_v	128	0.388	0.294	0.848	2.18	2.89
Flickr	u_mul_v	256	0.644	0.570	1.612	2.50	2.83
Flickr	u_sub_e	32	0.278	0.179	0.315	1.14	1.76
Flickr	u_sub_e	64	0.321	0.235	0.598	1.86	2.54
Flickr	u_sub_e	128	0.514	0.434	1.151	2.24	2.65
Flickr	u_sub_e	256	0.942	0.840	2.243	2.38	2.67
Flickr	u_sub_v	32	0.267	0.151	0.246	0.92	1.63
Flickr	u_sub_v	64	0.306	0.175	0.468	1.53	2.67
Flickr	u_sub_v	128	0.389	0.294	0.873	2.24	2.97
Flickr	u_sub_v	256	0.653	0.573	1.665	2.55	2.91
Flickr	v_add_e	32	0.235	0.171	0.240	1.02	1.41
Flickr	v_add_e	64	0.270	0.217	0.460	1.70	2.12
Flickr	v_add_e	128	0.426	0.378	0.862	2.02	2.28
Flickr	v_add_e	256	0.757	0.703	1.667	2.20	2.37
Flickr	v_add_u	32	0.265	0.155	0.238	0.90	1.54
Flickr	v_add_u	64	0.304	0.175	0.451	1.48	2.57
Flickr	v_add_u	128	0.383	0.298	0.847	2.21	2.85

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
Flickr	v_add_u	256	0.646	0.572	1.606	2.49	2.81
Flickr	v_div_e	32	0.252	0.206	0.401	1.59	1.95
Flickr	v_div_e	64	0.297	0.247	0.781	2.63	3.16
Flickr	v_div_e	128	0.462	0.388	1.499	3.24	3.86
Flickr	v_div_e	256	0.834	0.706	2.942	3.53	4.17
Flickr	v_div_u	32	0.278	0.170	0.257	0.93	1.51
Flickr	v_div_u	64	0.326	0.210	0.478	1.47	2.28
Flickr	v_div_u	128	0.418	0.295	0.903	2.16	3.06
Flickr	v_div_u	256	0.743	0.579	1.711	2.30	2.96
Flickr	v_dot_e	32	0.300	0.176	0.250	0.83	1.42
Flickr	v_dot_e	64	0.313	0.191	0.274	0.87	1.44
Flickr	v_dot_e	128	0.347	0.224	0.443	1.28	1.97
Flickr	v_dot_e	256	0.469	0.388	0.775	1.65	2.00
Flickr	v_dot_u	32	0.249	0.152	0.250	1.00	1.65
Flickr	v_dot_u	64	0.340	0.157	0.265	0.78	1.68
Flickr	v_dot_u	128	0.381	0.180	0.402	1.05	2.24
Flickr	v_dot_u	256	0.434	0.215	0.657	1.51	3.06
Flickr	v_mul_e	32	0.234	0.171	0.240	1.02	1.40
Flickr	v_mul_e	64	0.270	0.217	0.456	1.68	2.10
Flickr	v_mul_e	128	0.434	0.378	0.865	1.99	2.29
Flickr	v_mul_e	256	0.762	0.704	1.667	2.19	2.37
Flickr	v_mul_u	32	0.266	0.152	0.239	0.90	1.58
Flickr	v_mul_u	64	0.306	0.175	0.452	1.48	2.58
Flickr	v_mul_u	128	0.389	0.294	0.850	2.19	2.89
Flickr	v_mul_u	256	0.654	0.574	1.612	2.47	2.81
Flickr	v_sub_e	32	0.235	0.171	0.316	1.35	1.85
Flickr	v_sub_e	64	0.270	0.217	0.610	2.26	2.81
Flickr	v_sub_e	128	0.426	0.377	1.176	2.76	3.12
Flickr	v_sub_e	256	0.762	0.704	2.305	3.02	3.28
Flickr	v_sub_u	32	0.265	0.151	0.248	0.93	1.64
Flickr	v_sub_u	64	0.306	0.176	0.467	1.53	2.65
Flickr	v_sub_u	128	0.382	0.294	0.875	2.29	2.97
Flickr	v_sub_u	256	0.656	0.574	1.657	2.53	2.89
hm-categories	copy_u	32	1.782	2.514	2.940	1.65	1.17
hm-categories	copy_u	64	2.534	2.682	5.483	2.16	2.04
hm-categories	copy_u	128	4.552	3.920	12.408	2.73	3.17
hm-categories	copy_u	256	9.260	8.035	24.677	2.66	3.07
hm-categories	copy_v	32	0.864	1.914	3.277	3.79	1.71
hm-categories	copy_v	64	1.703	2.163	6.279	3.69	2.90
hm-categories	copy_v	128	3.305	3.985	12.379	3.75	3.11
hm-categories	copy_v	256	6.454	7.720	24.190	3.75	3.13
hm-categories	e_add_u	32	2.743	3.344	4.203	1.53	1.26
hm-categories	e_add_u	64	4.087	4.198	7.980	1.95	1.90
hm-categories	e_add_u	128	7.538	7.555	15.419	2.05	2.04
hm-categories	e_add_u	256	14.959	14.593	29.863	2.00	2.05
hm-categories	e_add_v	32	2.267	3.129	4.220	1.86	1.35
hm-categories	e_add_v	64	3.829	4.100	8.068	2.11	1.97
hm-categories	e_add_v	128	6.903	7.243	15.577	2.26	2.15
hm-categories	e_add_v	256	13.675	13.580	30.405	2.22	2.24
hm-categories	e_div_u	32	2.839	3.559	4.214	1.48	1.18
hm-categories	e_div_u	64	4.258	4.522	7.997	1.88	1.77
hm-categories	e_div_u	128	7.747	7.679	15.432	1.99	2.01
hm-categories	e_div_u	256	15.433	14.909	29.843	1.93	2.00
hm-categories	e_div_v	32	2.315	3.596	4.231	1.83	1.18
hm-categories	e_div_v	64	3.871	4.556	8.088	2.09	1.78
hm-categories	e_div_v	128	6.975	7.412	15.604	2.24	2.11
hm-categories	e_div_v	256	13.602	13.875	30.451	2.24	2.19
hm-categories	e_dot_u	32	3.369	3.419	4.851	1.44	1.42
hm-categories	e_dot_u	64	3.698	3.694	5.097	1.38	1.38
hm-categories	e_dot_u	128	4.677	4.404	7.826	1.67	1.78
hm-categories	e_dot_u	256	8.256	7.882	12.891	1.56	1.64
hm-categories	e_dot_v	32	2.786	3.233	4.831	1.73	1.49
hm-categories	e_dot_v	64	3.094	3.487	5.132	1.66	1.47
hm-categories	e_dot_v	128	4.038	4.158	8.211	2.03	1.97
hm-categories	e_dot_v	256	7.167	7.034	13.661	1.91	1.94
hm-categories	e_mul_u	32	2.773	3.345	4.202	1.52	1.26
hm-categories	e_mul_u	64	4.132	4.230	7.981	1.93	1.89
hm-categories	e_mul_u	128	7.534	7.555	15.403	2.04	2.04
hm-categories	e_mul_u	256	14.960	14.597	29.778	1.99	2.04
hm-categories	e_mul_v	32	2.273	3.118	4.216	1.86	1.35
hm-categories	e_mul_v	64	3.832	4.101	8.066	2.10	1.97
hm-categories	e_mul_v	128	6.909	7.245	15.577	2.25	2.15
hm-categories	e_mul_v	256	13.665	13.579	30.399	2.22	2.24
hm-categories	e_sub_u	32	2.774	3.345	4.218	1.52	1.26
hm-categories	e_sub_u	64	4.142	4.229	7.989	1.93	1.89
hm-categories	e_sub_u	128	7.548	7.559	15.421	2.04	2.04
hm-categories	e_sub_u	256	14.948	14.591	29.818	1.99	2.04
hm-categories	e_sub_v	32	2.272	3.120	4.223	1.86	1.35

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
hm-categories	e_sub_v	64	3.830	4.100	8.075	2.11	1.97
hm-categories	e_sub_v	128	6.907	7.250	15.592	2.26	2.15
hm-categories	e_sub_v	256	13.649	13.561	30.418	2.23	2.24
hm-categories	u_add_e	32	2.755	3.346	4.214	1.53	1.26
hm-categories	u_add_e	64	4.121	4.186	8.005	1.94	1.91
hm-categories	u_add_e	128	7.531	7.550	15.449	2.05	2.05
hm-categories	u_add_e	256	14.953	14.586	29.846	2.00	2.05
hm-categories	u_add_v	32	1.804	2.622	3.758	2.08	1.43
hm-categories	u_add_v	64	2.589	2.763	7.166	2.77	2.59
hm-categories	u_add_v	128	4.599	4.182	13.900	3.02	3.32
hm-categories	u_add_v	256	9.263	7.934	27.661	2.99	3.49
hm-categories	u_div_e	32	2.645	3.489	7.399	2.80	2.12
hm-categories	u_div_e	64	4.186	4.439	14.491	3.46	3.26
hm-categories	u_div_e	128	7.741	7.671	28.529	3.69	3.72
hm-categories	u_div_e	256	15.428	14.553	56.045	3.63	3.85
hm-categories	u_div_v	32	1.893	2.884	3.780	2.00	1.31
hm-categories	u_div_v	64	2.626	3.439	7.205	2.74	2.10
hm-categories	u_div_v	128	4.706	4.365	13.989	2.97	3.21
hm-categories	u_div_v	256	9.320	8.024	27.861	2.99	3.47
hm-categories	u_dot_e	32	3.381	3.438	4.803	1.42	1.40
hm-categories	u_dot_e	64	3.598	3.757	5.031	1.40	1.34
hm-categories	u_dot_e	128	4.671	4.403	7.856	1.68	1.78
hm-categories	u_dot_e	256	8.252	7.882	12.925	1.57	1.64
hm-categories	u_dot_v	32	2.370	2.786	4.814	2.03	1.73
hm-categories	u_dot_v	64	2.484	2.846	4.915	1.98	1.73
hm-categories	u_dot_v	128	2.735	3.055	6.583	2.41	2.15
hm-categories	u_dot_v	256	3.223	3.458	10.032	3.11	2.90
hm-categories	u_mul_e	32	2.759	3.353	4.208	1.53	1.26
hm-categories	u_mul_e	64	4.132	4.213	8.008	1.94	1.90
hm-categories	u_mul_e	128	7.534	7.550	15.463	2.05	2.05
hm-categories	u_mul_e	256	14.956	14.593	29.900	2.00	2.05
hm-categories	u_mul_v	32	1.799	2.625	3.776	2.10	1.44
hm-categories	u_mul_v	64	2.581	2.772	7.202	2.79	2.60
hm-categories	u_mul_v	128	4.622	4.152	13.976	3.02	3.37
hm-categories	u_mul_v	256	9.275	7.936	27.853	3.00	3.51
hm-categories	u_sub_e	32	2.759	3.346	5.787	2.10	1.73
hm-categories	u_sub_e	64	4.135	4.221	11.207	2.71	2.66
hm-categories	u_sub_e	128	7.515	7.552	21.890	2.91	2.90
hm-categories	u_sub_e	256	14.951	14.584	42.772	2.86	2.93
hm-categories	u_sub_v	32	1.797	2.628	3.775	2.10	1.44
hm-categories	u_sub_v	64	2.593	2.762	7.199	2.78	2.61
hm-categories	u_sub_v	128	4.628	4.180	13.979	3.02	3.34
hm-categories	u_sub_v	256	9.277	7.930	27.818	3.00	3.51
hm-categories	v_add_e	32	2.231	3.118	4.235	1.90	1.36
hm-categories	v_add_e	64	3.771	4.065	8.072	2.14	1.99
hm-categories	v_add_e	128	6.895	7.243	15.605	2.26	2.15
hm-categories	v_add_e	256	13.647	13.567	30.439	2.23	2.24
hm-categories	v_add_u	32	1.795	2.624	3.764	2.10	1.43
hm-categories	v_add_u	64	2.579	2.784	7.190	2.79	2.58
hm-categories	v_add_u	128	4.618	4.188	13.965	3.02	3.33
hm-categories	v_add_u	256	9.282	7.930	27.845	3.00	3.51
hm-categories	v_div_e	32	2.285	3.701	7.416	3.25	2.00
hm-categories	v_div_e	64	3.867	4.585	14.568	3.77	3.18
hm-categories	v_div_e	128	7.007	7.413	28.690	4.09	3.87
hm-categories	v_div_e	256	13.855	13.601	56.599	4.09	4.16
hm-categories	v_div_u	32	1.937	2.905	3.776	1.95	1.30
hm-categories	v_div_u	64	2.649	3.502	7.203	2.72	2.06
hm-categories	v_div_u	128	4.691	4.550	13.972	2.98	3.07
hm-categories	v_div_u	256	9.355	7.946	27.841	2.98	3.50
hm-categories	v_dot_e	32	2.742	3.249	4.829	1.76	1.49
hm-categories	v_dot_e	64	2.991	3.591	5.126	1.71	1.43
hm-categories	v_dot_e	128	4.037	4.159	8.240	2.04	1.98
hm-categories	v_dot_e	256	7.160	7.038	13.677	1.91	1.94
hm-categories	v_dot_u	32	2.372	2.787	4.811	2.03	1.73
hm-categories	v_dot_u	64	2.480	2.849	4.924	1.99	1.73
hm-categories	v_dot_u	128	2.756	3.069	6.571	2.38	2.14
hm-categories	v_dot_u	256	3.236	3.466	10.000	3.09	2.88
hm-categories	v_mul_e	32	2.230	3.121	4.237	1.90	1.36
hm-categories	v_mul_e	64	3.807	4.052	8.096	2.13	2.00
hm-categories	v_mul_e	128	6.912	7.244	15.632	2.26	2.16
hm-categories	v_mul_e	256	13.665	13.553	30.450	2.23	2.25
hm-categories	v_mul_u	32	1.799	2.627	3.773	2.10	1.44
hm-categories	v_mul_u	64	2.594	2.775	7.206	2.78	2.60
hm-categories	v_mul_u	128	4.619	4.185	13.967	3.02	3.34
hm-categories	v_mul_u	256	9.252	7.935	27.835	3.01	3.51
hm-categories	v_sub_e	32	2.223	3.117	5.809	2.61	1.86
hm-categories	v_sub_e	64	3.829	4.083	11.271	2.94	2.76
hm-categories	v_sub_e	128	6.891	7.246	22.060	3.20	3.04

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
hm-categories	v_sub_e	256	13.657	13.556	43.322	3.17	3.20
hm-categories	v_sub_u	32	1.803	2.628	3.770	2.09	1.43
hm-categories	v_sub_u	64	2.580	2.784	7.199	2.79	2.59
hm-categories	v_sub_u	128	4.628	4.180	13.961	3.02	3.34
hm-categories	v_sub_u	256	9.265	7.929	27.829	3.00	3.51
hm-prices	copy_u	32	1.798	2.521	2.939	1.63	1.17
hm-prices	copy_u	64	2.536	2.681	5.480	2.16	2.04
hm-prices	copy_u	128	4.551	3.922	12.362	2.72	3.15
hm-prices	copy_u	256	9.262	8.038	24.674	2.66	3.07
hm-prices	copy_v	32	0.883	1.915	3.276	3.71	1.71
hm-prices	copy_v	64	1.704	2.164	6.277	3.68	2.90
hm-prices	copy_v	128	3.308	3.986	12.372	3.74	3.10
hm-prices	copy_v	256	6.516	7.687	24.191	3.71	3.15
hm-prices	e_add_u	32	2.737	3.344	4.199	1.53	1.26
hm-prices	e_add_u	64	4.087	4.199	7.979	1.95	1.90
hm-prices	e_add_u	128	10.489	7.562	15.417	1.47	2.04
hm-prices	e_add_u	256	14.952	14.599	29.853	2.00	2.04
hm-prices	e_add_v	32	2.267	3.119	4.218	1.86	1.35
hm-prices	e_add_v	64	3.834	4.099	8.068	2.10	1.97
hm-prices	e_add_v	128	6.919	7.244	15.577	2.25	2.15
hm-prices	e_add_v	256	13.667	13.578	30.383	2.22	2.24
hm-prices	e_div_u	32	2.839	3.560	4.216	1.49	1.18
hm-prices	e_div_u	64	4.257	4.517	7.996	1.88	1.77
hm-prices	e_div_u	128	7.745	7.678	15.433	1.99	2.01
hm-prices	e_div_u	256	15.412	14.919	29.852	1.94	2.00
hm-prices	e_div_v	32	2.313	3.596	4.228	1.83	1.18
hm-prices	e_div_v	64	3.870	4.556	8.095	2.09	1.78
hm-prices	e_div_v	128	6.976	7.409	15.604	2.24	2.11
hm-prices	e_div_v	256	13.600	13.883	30.442	2.24	2.19
hm-prices	e_dot_u	32	3.365	3.417	4.851	1.44	1.42
hm-prices	e_dot_u	64	3.695	3.692	5.095	1.38	1.38
hm-prices	e_dot_u	128	4.674	4.403	7.824	1.67	1.78
hm-prices	e_dot_u	256	8.250	7.878	12.873	1.56	1.63
hm-prices	e_dot_v	32	2.786	3.232	4.829	1.73	1.49
hm-prices	e_dot_v	64	3.097	3.487	5.127	1.66	1.47
hm-prices	e_dot_v	128	4.043	4.157	8.211	2.03	1.98
hm-prices	e_dot_v	256	7.169	7.040	13.642	1.90	1.94
hm-prices	e_mul_u	32	2.774	3.342	4.201	1.51	1.26
hm-prices	e_mul_u	64	4.130	4.216	7.977	1.93	1.89
hm-prices	e_mul_u	128	7.538	7.549	15.404	2.04	2.04
hm-prices	e_mul_u	256	14.958	14.595	29.779	1.99	2.04
hm-prices	e_mul_v	32	2.267	3.119	4.217	1.86	1.35
hm-prices	e_mul_v	64	3.833	4.100	8.066	2.10	1.97
hm-prices	e_mul_v	128	6.907	7.243	15.572	2.25	2.15
hm-prices	e_mul_v	256	13.652	13.576	30.382	2.23	2.24
hm-prices	e_sub_u	32	2.773	3.344	4.209	1.52	1.26
hm-prices	e_sub_u	64	4.133	4.229	7.990	1.93	1.89
hm-prices	e_sub_u	128	7.535	7.544	15.421	2.05	2.04
hm-prices	e_sub_u	256	14.964	14.601	29.821	1.99	2.04
hm-prices	e_sub_v	32	2.266	3.119	4.224	1.86	1.35
hm-prices	e_sub_v	64	3.831	4.096	8.077	2.11	1.97
hm-prices	e_sub_v	128	6.915	7.251	15.590	2.25	2.15
hm-prices	e_sub_v	256	13.639	13.562	30.413	2.23	2.24
hm-prices	u_add_e	32	2.799	3.365	4.213	1.51	1.25
hm-prices	u_add_e	64	4.114	4.188	8.001	1.94	1.91
hm-prices	u_add_e	128	7.531	7.545	15.443	2.05	2.05
hm-prices	u_add_e	256	14.949	14.601	29.850	2.00	2.04
hm-prices	u_add_v	32	1.813	2.630	3.757	2.07	1.43
hm-prices	u_add_v	64	2.587	2.762	7.161	2.77	2.59
hm-prices	u_add_v	128	4.588	4.180	13.890	3.03	3.32
hm-prices	u_add_v	256	9.271	7.937	27.656	2.98	3.48
hm-prices	u_div_e	32	2.675	3.498	7.399	2.77	2.12
hm-prices	u_div_e	64	4.177	4.439	14.495	3.47	3.27
hm-prices	u_div_e	128	7.737	7.670	28.527	3.69	3.72
hm-prices	u_div_e	256	15.408	14.550	56.022	3.64	3.85
hm-prices	u_div_v	32	1.903	2.890	3.790	1.99	1.31
hm-prices	u_div_v	64	2.625	3.438	7.202	2.74	2.10
hm-prices	u_div_v	128	4.684	4.371	13.966	2.98	3.19
hm-prices	u_div_v	256	9.324	8.027	27.838	2.99	3.47
hm-prices	u_dot_e	32	3.387	3.438	4.810	1.42	1.40
hm-prices	u_dot_e	64	3.592	3.756	5.029	1.40	1.34
hm-prices	u_dot_e	128	4.670	4.403	7.851	1.68	1.78
hm-prices	u_dot_e	256	8.252	7.889	12.922	1.57	1.64
hm-prices	u_dot_v	32	2.369	2.814	4.809	2.03	1.71
hm-prices	u_dot_v	64	2.478	2.842	4.925	1.99	1.73
hm-prices	u_dot_v	128	2.732	3.064	6.584	2.41	2.15
hm-prices	u_dot_v	256	3.228	3.477	10.033	3.11	2.89
hm-prices	u_mul_e	32	2.792	3.366	4.208	1.51	1.25

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
hm-prices	u_mul_e	64	4.139	4.205	8.006	1.93	1.90
hm-prices	u_mul_e	128	7.541	7.550	15.458	2.05	2.05
hm-prices	u_mul_e	256	14.939	14.600	29.879	2.00	2.05
hm-prices	u_mul_v	32	1.796	2.628	3.777	2.10	1.44
hm-prices	u_mul_v	64	2.578	2.771	7.200	2.79	2.60
hm-prices	u_mul_v	128	4.607	4.150	13.959	3.03	3.36
hm-prices	u_mul_v	256	9.292	7.933	27.858	3.00	3.51
hm-prices	u_sub_e	32	2.796	3.361	5.780	2.07	1.72
hm-prices	u_sub_e	64	4.133	4.222	11.205	2.71	2.65
hm-prices	u_sub_e	128	7.520	7.551	21.891	2.91	2.90
hm-prices	u_sub_e	256	14.945	14.597	42.766	2.86	2.93
hm-prices	u_sub_v	32	1.813	2.631	3.783	2.09	1.44
hm-prices	u_sub_v	64	2.582	2.765	7.198	2.79	2.60
hm-prices	u_sub_v	128	4.620	4.178	13.956	3.02	3.34
hm-prices	u_sub_v	256	9.248	7.938	27.802	3.01	3.50
hm-prices	v_add_e	32	2.231	3.117	4.234	1.90	1.36
hm-prices	v_add_e	64	3.767	4.071	8.084	2.15	1.99
hm-prices	v_add_e	128	6.901	7.245	15.581	2.26	2.15
hm-prices	v_add_e	256	13.628	13.573	30.426	2.23	2.24
hm-prices	v_add_u	32	1.792	2.622	3.764	2.10	1.44
hm-prices	v_add_u	64	2.581	2.789	7.187	2.78	2.58
hm-prices	v_add_u	128	4.628	4.180	13.947	3.01	3.34
hm-prices	v_add_u	256	9.277	7.930	27.830	3.00	3.51
hm-prices	v_div_e	32	2.287	3.701	7.415	3.24	2.00
hm-prices	v_div_e	64	3.869	4.585	14.564	3.76	3.18
hm-prices	v_div_e	128	6.997	7.406	28.669	4.10	3.87
hm-prices	v_div_e	256	13.849	13.596	56.584	4.09	4.16
hm-prices	v_div_u	32	1.924	2.905	3.776	1.96	1.30
hm-prices	v_div_u	64	2.633	3.502	7.202	2.74	2.06
hm-prices	v_div_u	128	4.710	4.550	13.975	2.97	3.07
hm-prices	v_div_u	256	9.354	7.947	27.843	2.98	3.50
hm-prices	v_dot_e	32	2.742	3.251	4.816	1.76	1.48
hm-prices	v_dot_e	64	2.985	3.584	5.128	1.72	1.43
hm-prices	v_dot_e	128	4.041	4.160	8.231	2.04	1.98
hm-prices	v_dot_e	256	7.156	7.039	13.676	1.91	1.94
hm-prices	v_dot_u	32	2.369	2.786	4.806	2.03	1.73
hm-prices	v_dot_u	64	2.479	2.841	4.916	1.98	1.73
hm-prices	v_dot_u	128	2.752	3.065	6.564	2.39	2.14
hm-prices	v_dot_u	256	3.231	3.458	9.995	3.09	2.89
hm-prices	v_mul_e	32	2.230	3.120	4.235	1.90	1.36
hm-prices	v_mul_e	64	3.829	4.100	8.078	2.11	1.97
hm-prices	v_mul_e	128	6.886	7.244	15.614	2.27	2.16
hm-prices	v_mul_e	256	13.663	13.556	30.443	2.23	2.25
hm-prices	v_mul_u	32	1.798	2.627	3.773	2.10	1.44
hm-prices	v_mul_u	64	2.586	2.774	7.200	2.78	2.60
hm-prices	v_mul_u	128	4.621	7.286	13.972	3.02	1.92
hm-prices	v_mul_u	256	9.289	7.928	27.830	3.00	3.51
hm-prices	v_sub_e	32	2.238	3.117	5.806	2.59	1.86
hm-prices	v_sub_e	64	3.830	4.083	11.276	2.94	2.76
hm-prices	v_sub_e	128	6.887	7.249	22.047	3.20	3.04
hm-prices	v_sub_e	256	13.658	13.580	43.321	3.17	3.19
hm-prices	v_sub_u	32	1.800	2.627	3.769	2.09	1.43
hm-prices	v_sub_u	64	2.577	2.789	7.196	2.79	2.58
hm-prices	v_sub_u	128	4.618	4.179	13.963	3.02	3.34
hm-prices	v_sub_u	256	9.283	7.929	27.817	3.00	3.51
ogbn-arxiv	copy_u	32	0.455	0.199	0.297	0.65	1.50
ogbn-arxiv	copy_u	64	0.513	0.218	0.546	1.06	2.50
ogbn-arxiv	copy_u	128	0.629	0.356	1.024	1.63	2.87
ogbn-arxiv	copy_u	256	0.988	0.658	1.949	1.97	2.96
ogbn-arxiv	copy_v	32	0.248	0.150	0.282	1.14	1.88
ogbn-arxiv	copy_v	64	0.285	0.171	0.512	1.79	2.99
ogbn-arxiv	copy_v	128	0.377	0.319	0.998	2.64	3.13
ogbn-arxiv	copy_v	256	0.659	0.615	1.968	2.98	3.20
ogbn-arxiv	e_add_u	32	0.534	0.253	0.326	0.61	1.29
ogbn-arxiv	e_add_u	64	0.585	0.360	0.615	1.05	1.71
ogbn-arxiv	e_add_u	128	0.835	0.562	1.163	1.39	2.07
ogbn-arxiv	e_add_u	256	1.456	1.031	2.255	1.55	2.19
ogbn-arxiv	e_add_v	32	0.443	0.238	0.328	0.74	1.38
ogbn-arxiv	e_add_v	64	0.497	0.302	0.623	1.25	2.06
ogbn-arxiv	e_add_v	128	0.687	0.531	1.177	1.71	2.22
ogbn-arxiv	e_add_v	256	1.159	1.006	2.280	1.97	2.27
ogbn-arxiv	e_div_u	32	0.566	0.267	0.353	0.62	1.32
ogbn-arxiv	e_div_u	64	0.636	0.378	0.666	1.05	1.76
ogbn-arxiv	e_div_u	128	0.915	0.567	1.261	1.38	2.22
ogbn-arxiv	e_div_u	256	1.733	1.051	2.443	1.41	2.33
ogbn-arxiv	e_div_v	32	0.466	0.271	0.354	0.76	1.31
ogbn-arxiv	e_div_v	64	0.534	0.336	0.673	1.26	2.00
ogbn-arxiv	e_div_v	128	0.728	0.544	1.276	1.75	2.35

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
ogbn-arxiv	e_div_v	256	1.287	1.022	2.475	1.92	2.42
ogbn-arxiv	e_dot_u	32	0.682	0.253	0.353	0.52	1.40
ogbn-arxiv	e_dot_u	64	0.730	0.289	0.386	0.53	1.33
ogbn-arxiv	e_dot_u	128	0.829	0.349	0.606	0.73	1.74
ogbn-arxiv	e_dot_u	256	1.150	0.606	0.996	0.87	1.64
ogbn-arxiv	e_dot_v	32	0.563	0.242	0.349	0.62	1.44
ogbn-arxiv	e_dot_v	64	0.586	0.258	0.382	0.65	1.48
ogbn-arxiv	e_dot_v	128	0.639	0.297	0.613	0.96	2.07
ogbn-arxiv	e_dot_v	256	0.800	0.517	1.039	1.30	2.01
ogbn-arxiv	e_mul_u	32	0.533	0.253	0.327	0.61	1.29
ogbn-arxiv	e_mul_u	64	0.588	0.361	0.615	1.05	1.71
ogbn-arxiv	e_mul_u	128	0.842	0.561	1.163	1.38	2.07
ogbn-arxiv	e_mul_u	256	1.463	1.031	2.245	1.53	2.18
ogbn-arxiv	e_mul_v	32	0.443	0.238	0.328	0.74	1.38
ogbn-arxiv	e_mul_v	64	0.500	0.302	0.623	1.25	2.06
ogbn-arxiv	e_mul_v	128	0.682	0.531	1.177	1.73	2.21
ogbn-arxiv	e_mul_v	256	1.153	0.998	2.280	1.98	2.29
ogbn-arxiv	e_sub_u	32	0.534	0.253	0.340	0.64	1.35
ogbn-arxiv	e_sub_u	64	0.588	0.360	0.640	1.09	1.78
ogbn-arxiv	e_sub_u	128	0.842	0.561	1.210	1.44	2.16
ogbn-arxiv	e_sub_u	256	1.464	1.031	2.342	1.60	2.27
ogbn-arxiv	e_sub_v	32	0.443	0.238	0.341	0.77	1.44
ogbn-arxiv	e_sub_v	64	0.497	0.303	0.652	1.31	2.15
ogbn-arxiv	e_sub_v	128	0.682	0.532	1.226	1.80	2.30
ogbn-arxiv	e_sub_v	256	1.155	0.998	2.371	2.05	2.38
ogbn-arxiv	u_add_e	32	0.528	0.254	0.329	0.62	1.30
ogbn-arxiv	u_add_e	64	0.587	0.359	0.615	1.05	1.71
ogbn-arxiv	u_add_e	128	0.836	0.560	1.166	1.39	2.08
ogbn-arxiv	u_add_e	256	1.448	1.032	2.244	1.55	2.17
ogbn-arxiv	u_add_v	32	0.512	0.219	0.333	0.65	1.52
ogbn-arxiv	u_add_v	64	0.575	0.261	0.618	1.07	2.37
ogbn-arxiv	u_add_v	128	0.693	0.455	1.160	1.67	2.55
ogbn-arxiv	u_add_v	256	1.073	0.863	2.214	2.06	2.56
ogbn-arxiv	u_div_e	32	0.532	0.262	0.552	1.04	2.11
ogbn-arxiv	u_div_e	64	0.614	0.379	1.067	1.74	2.81
ogbn-arxiv	u_div_e	128	0.897	0.568	2.054	2.29	3.61
ogbn-arxiv	u_div_e	256	1.697	1.022	4.028	2.37	3.94
ogbn-arxiv	u_div_v	32	0.528	0.246	0.360	0.68	1.46
ogbn-arxiv	u_div_v	64	0.601	0.301	0.673	1.12	2.23
ogbn-arxiv	u_div_v	128	0.757	0.453	1.264	1.67	2.79
ogbn-arxiv	u_div_v	256	1.285	0.894	2.412	1.88	2.70
ogbn-arxiv	u_dot_e	32	0.707	0.253	0.352	0.50	1.39
ogbn-arxiv	u_dot_e	64	0.735	0.298	0.378	0.51	1.27
ogbn-arxiv	u_dot_e	128	0.803	0.364	0.600	0.75	1.65
ogbn-arxiv	u_dot_e	256	1.110	0.614	0.998	0.90	1.62
ogbn-arxiv	u_dot_v	32	0.618	0.217	0.354	0.57	1.63
ogbn-arxiv	u_dot_v	64	0.658	0.227	0.380	0.58	1.67
ogbn-arxiv	u_dot_v	128	0.722	0.249	0.564	0.78	2.27
ogbn-arxiv	u_dot_v	256	0.818	0.340	0.911	1.11	2.68
ogbn-arxiv	u_mul_e	32	0.527	0.253	0.331	0.63	1.31
ogbn-arxiv	u_mul_e	64	0.587	0.359	0.615	1.05	1.71
ogbn-arxiv	u_mul_e	128	0.837	0.572	1.165	1.39	2.04
ogbn-arxiv	u_mul_e	256	1.453	1.029	2.241	1.54	2.18
ogbn-arxiv	u_mul_v	32	0.513	0.220	0.334	0.65	1.52
ogbn-arxiv	u_mul_v	64	0.583	0.262	0.618	1.06	2.36
ogbn-arxiv	u_mul_v	128	0.691	0.454	1.167	1.69	2.57
ogbn-arxiv	u_mul_v	256	1.073	0.866	2.223	2.07	2.57
ogbn-arxiv	u_sub_e	32	0.528	0.253	0.435	0.82	1.72
ogbn-arxiv	u_sub_e	64	0.587	0.359	0.831	1.41	2.31
ogbn-arxiv	u_sub_e	128	0.835	0.561	1.598	1.91	2.85
ogbn-arxiv	u_sub_e	256	1.451	1.029	3.121	2.15	3.03
ogbn-arxiv	u_sub_v	32	0.513	0.220	0.346	0.67	1.57
ogbn-arxiv	u_sub_v	64	0.579	0.260	0.645	1.11	2.47
ogbn-arxiv	u_sub_v	128	0.700	0.455	1.213	1.73	2.67
ogbn-arxiv	u_sub_v	256	1.071	0.865	2.311	2.16	2.67
ogbn-arxiv	v_add_e	32	0.455	0.238	0.331	0.73	1.39
ogbn-arxiv	v_add_e	64	0.495	0.302	0.622	1.26	2.06
ogbn-arxiv	v_add_e	128	0.673	0.530	1.189	1.77	2.25
ogbn-arxiv	v_add_e	256	1.146	0.989	2.294	2.00	2.32
ogbn-arxiv	v_add_u	32	0.513	0.220	0.333	0.65	1.51
ogbn-arxiv	v_add_u	64	0.573	0.260	0.619	1.08	2.38
ogbn-arxiv	v_add_u	128	0.696	0.455	1.165	1.67	2.56
ogbn-arxiv	v_add_u	256	1.072	0.863	2.224	2.07	2.58
ogbn-arxiv	v_div_e	32	0.470	0.275	0.555	1.18	2.02
ogbn-arxiv	v_div_e	64	0.541	0.339	1.076	1.99	3.18
ogbn-arxiv	v_div_e	128	0.785	0.542	2.073	2.64	3.82
ogbn-arxiv	v_div_e	256	1.328	0.991	4.060	3.06	4.10
ogbn-arxiv	v_div_u	32	0.532	0.248	0.359	0.67	1.45

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
ogbn-arxiv	v_div_u	64	0.609	0.303	0.674	1.11	2.22
ogbn-arxiv	v_div_u	128	0.759	0.455	1.265	1.67	2.78
ogbn-arxiv	v_div_u	256	1.292	0.878	2.414	1.87	2.75
ogbn-arxiv	v_dot_e	32	0.565	0.244	0.350	0.62	1.44
ogbn-arxiv	v_dot_e	64	0.585	0.270	0.379	0.65	1.40
ogbn-arxiv	v_dot_e	128	0.633	0.313	0.612	0.97	1.96
ogbn-arxiv	v_dot_e	256	0.790	0.552	1.042	1.32	1.89
ogbn-arxiv	v_dot_u	32	0.618	0.217	0.353	0.57	1.63
ogbn-arxiv	v_dot_u	64	0.657	0.226	0.380	0.58	1.68
ogbn-arxiv	v_dot_u	128	0.722	0.249	0.565	0.78	2.27
ogbn-arxiv	v_dot_u	256	0.818	0.341	0.911	1.11	2.67
ogbn-arxiv	v_mul_e	32	0.443	0.241	0.330	0.75	1.37
ogbn-arxiv	v_mul_e	64	0.494	0.308	0.622	1.26	2.02
ogbn-arxiv	v_mul_e	128	0.675	0.531	1.181	1.75	2.22
ogbn-arxiv	v_mul_e	256	1.153	0.990	2.301	2.00	2.33
ogbn-arxiv	v_mul_u	32	0.513	0.220	0.333	0.65	1.52
ogbn-arxiv	v_mul_u	64	0.578	0.261	0.621	1.07	2.38
ogbn-arxiv	v_mul_u	128	0.702	0.455	1.169	1.67	2.57
ogbn-arxiv	v_mul_u	256	1.073	0.866	2.233	2.08	2.58
ogbn-arxiv	v_sub_e	32	0.442	0.238	0.440	1.00	1.85
ogbn-arxiv	v_sub_e	64	0.495	0.302	0.839	1.69	2.77
ogbn-arxiv	v_sub_e	128	0.674	0.536	1.625	2.41	3.03
ogbn-arxiv	v_sub_e	256	1.148	0.989	3.171	2.76	3.21
ogbn-arxiv	v_sub_u	32	0.513	0.220	0.348	0.68	1.58
ogbn-arxiv	v_sub_u	64	0.577	0.260	0.646	1.12	2.48
ogbn-arxiv	v_sub_u	128	0.699	0.454	1.214	1.74	2.67
ogbn-arxiv	v_sub_u	256	1.080	0.865	2.313	2.14	2.67
ogbn-products	copy_u	32	17.182	20.394	21.552	1.25	1.06
ogbn-products	copy_u	64	23.337	25.500	41.274	1.77	1.62
ogbn-products	copy_u	128	39.971	41.807	80.926	2.02	1.94
ogbn-products	copy_u	256	75.551	76.787	164.818	2.18	2.15
ogbn-products	copy_v	32	5.651	11.461	21.625	3.83	1.89
ogbn-products	copy_v	64	10.944	13.028	41.348	3.78	3.17
ogbn-products	copy_v	128	21.319	23.579	80.733	3.79	3.42
ogbn-products	copy_v	256	40.994	46.021	164.809	4.02	3.58
ogbn-products	e_add_u	32	20.805	23.358	26.863	1.29	1.15
ogbn-products	e_add_u	64	32.005	32.785	50.391	1.57	1.54
ogbn-products	e_add_u	128	57.809	58.721	96.314	1.67	1.64
ogbn-products	e_add_u	256	OOM	OOM	OOM	—	—
ogbn-products	e_add_v	32	13.421	18.877	26.866	2.00	1.42
ogbn-products	e_add_v	64	22.234	24.708	50.394	2.27	2.04
ogbn-products	e_add_v	128	40.115	42.499	96.210	2.40	2.26
ogbn-products	e_add_v	256	OOM	OOM	OOM	—	—
ogbn-products	e_div_u	32	21.398	24.383	27.220	1.27	1.12
ogbn-products	e_div_u	64	32.672	33.738	51.116	1.56	1.52
ogbn-products	e_div_u	128	59.568	59.554	97.750	1.64	1.64
ogbn-products	e_div_u	256	OOM	OOM	OOM	—	—
ogbn-products	e_div_v	32	13.920	22.301	27.227	1.96	1.22
ogbn-products	e_div_v	64	22.527	27.999	51.120	2.27	1.83
ogbn-products	e_div_v	128	40.375	43.667	97.659	2.42	2.24
ogbn-products	e_div_v	256	OOM	OOM	OOM	—	—
ogbn-products	e_dot_u	32	23.675	22.702	30.988	1.31	1.36
ogbn-products	e_dot_u	64	27.386	25.268	34.188	1.25	1.35
ogbn-products	e_dot_u	128	40.771	38.356	52.462	1.29	1.37
ogbn-products	e_dot_u	256	73.609	72.101	83.062	1.13	1.15
ogbn-products	e_dot_v	32	16.831	19.400	30.701	1.82	1.58
ogbn-products	e_dot_v	64	18.671	20.867	33.593	1.80	1.61
ogbn-products	e_dot_v	128	23.881	23.927	52.517	2.20	2.19
ogbn-products	e_dot_v	256	39.880	39.816	83.074	2.08	2.09
ogbn-products	e_mul_u	32	20.966	23.359	26.859	1.28	1.15
ogbn-products	e_mul_u	64	32.029	32.798	50.386	1.57	1.54
ogbn-products	e_mul_u	128	57.793	58.721	96.273	1.67	1.64
ogbn-products	e_mul_u	256	OOM	OOM	OOM	—	—
ogbn-products	e_mul_v	32	13.416	18.876	26.862	2.00	1.42
ogbn-products	e_mul_v	64	22.234	24.710	50.408	2.27	2.04
ogbn-products	e_mul_v	128	40.133	42.506	96.179	2.40	2.26
ogbn-products	e_mul_v	256	OOM	OOM	OOM	—	—
ogbn-products	e_sub_u	32	20.978	23.370	27.035	1.29	1.16
ogbn-products	e_sub_u	64	32.034	32.785	50.752	1.58	1.55
ogbn-products	e_sub_u	128	57.795	58.717	97.022	1.68	1.65
ogbn-products	e_sub_u	256	OOM	OOM	OOM	—	—
ogbn-products	e_sub_v	32	13.413	18.878	27.040	2.02	1.43
ogbn-products	e_sub_v	64	22.238	24.694	50.755	2.28	2.06
ogbn-products	e_sub_v	128	40.122	42.513	96.910	2.42	2.28
ogbn-products	e_sub_v	256	OOM	OOM	OOM	—	—
ogbn-products	u_add_e	32	20.899	23.360	26.960	1.29	1.15
ogbn-products	u_add_e	64	31.980	32.782	50.598	1.58	1.54
ogbn-products	u_add_e	128	57.788	58.714	96.949	1.68	1.65

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
ogbn-products	u_add_e	256	OOM	OOM	—	—	—
ogbn-products	u_add_v	32	18.020	20.824	27.452	1.52	1.32
ogbn-products	u_add_v	64	24.472	25.885	50.639	2.07	1.96
ogbn-products	u_add_v	128	41.090	43.704	96.333	2.34	2.20
ogbn-products	u_add_v	256	76.335	78.300	187.142	2.45	2.39
ogbn-products	u_div_e	32	20.814	24.008	46.524	2.24	1.94
ogbn-products	u_div_e	64	32.027	33.516	89.867	2.81	2.68
ogbn-products	u_div_e	128	59.496	59.506	OOM	—	—
ogbn-products	u_div_e	256	OOM	OOM	—	—	—
ogbn-products	u_div_v	32	18.562	24.199	27.890	1.50	1.15
ogbn-products	u_div_v	64	24.619	29.120	51.506	2.09	1.77
ogbn-products	u_div_v	128	40.481	43.461	97.833	2.42	2.25
ogbn-products	u_div_v	256	78.338	80.850	190.007	2.43	2.35
ogbn-products	u_dot_e	32	23.050	22.914	30.672	1.33	1.34
ogbn-products	u_dot_e	64	25.652	26.118	33.408	1.30	1.28
ogbn-products	u_dot_e	128	38.758	40.911	51.484	1.33	1.26
ogbn-products	u_dot_e	256	OOM	OOM	—	—	—
ogbn-products	u_dot_v	32	21.609	20.461	32.200	1.49	1.57
ogbn-products	u_dot_v	64	22.762	21.653	34.264	1.51	1.58
ogbn-products	u_dot_v	128	25.620	25.115	51.900	2.03	2.07
ogbn-products	u_dot_v	256	38.342	37.652	82.032	2.14	2.18
ogbn-products	u_mul_e	32	20.899	23.361	26.956	1.29	1.15
ogbn-products	u_mul_e	64	31.995	32.782	50.577	1.58	1.54
ogbn-products	u_mul_e	128	57.787	58.719	96.919	1.68	1.65
ogbn-products	u_mul_e	256	OOM	OOM	—	—	—
ogbn-products	u_mul_v	32	18.175	20.823	27.591	1.52	1.32
ogbn-products	u_mul_v	64	24.470	26.161	50.888	2.08	1.95
ogbn-products	u_mul_v	128	40.341	43.705	96.366	2.39	2.20
ogbn-products	u_mul_v	256	76.333	78.303	187.123	2.45	2.39
ogbn-products	u_sub_e	32	20.898	23.361	36.611	1.75	1.57
ogbn-products	u_sub_e	64	31.995	32.786	69.957	2.19	2.13
ogbn-products	u_sub_e	128	57.800	58.726	OOM	—	—
ogbn-products	u_sub_e	256	OOM	OOM	—	—	—
ogbn-products	u_sub_v	32	18.173	20.823	27.693	1.52	1.33
ogbn-products	u_sub_v	64	24.472	26.167	51.130	2.09	1.95
ogbn-products	u_sub_v	128	40.337	43.708	97.074	2.41	2.22
ogbn-products	u_sub_v	256	76.330	78.296	188.530	2.47	2.41
ogbn-products	v_add_e	32	13.269	18.852	26.956	2.03	1.43
ogbn-products	v_add_e	64	22.020	24.472	50.578	2.30	2.07
ogbn-products	v_add_e	128	40.131	42.390	96.822	2.41	2.28
ogbn-products	v_add_e	256	OOM	OOM	—	—	—
ogbn-products	v_add_u	32	18.021	20.832	27.529	1.53	1.32
ogbn-products	v_add_u	64	24.231	25.871	50.780	2.10	1.96
ogbn-products	v_add_u	128	40.355	43.739	96.382	2.39	2.20
ogbn-products	v_add_u	256	76.341	78.285	187.153	2.45	2.39
ogbn-products	v_div_e	32	13.933	22.908	46.521	3.34	2.03
ogbn-products	v_div_e	64	22.254	28.168	89.869	4.04	3.19
ogbn-products	v_div_e	128	41.117	43.635	OOM	—	—
ogbn-products	v_div_e	256	OOM	OOM	—	—	—
ogbn-products	v_div_u	32	18.646	24.387	27.896	1.50	1.14
ogbn-products	v_div_u	64	24.600	29.461	51.517	2.09	1.75
ogbn-products	v_div_u	128	40.492	43.701	97.869	2.42	2.24
ogbn-products	v_div_u	256	79.323	79.569	189.957	2.39	2.39
ogbn-products	v_dot_e	32	16.611	19.534	30.664	1.85	1.57
ogbn-products	v_dot_e	64	18.047	21.453	33.408	1.85	1.56
ogbn-products	v_dot_e	128	22.744	24.982	51.477	2.26	2.06
ogbn-products	v_dot_e	256	OOM	OOM	—	—	—
ogbn-products	v_dot_u	32	21.606	20.460	32.194	1.49	1.57
ogbn-products	v_dot_u	64	22.761	21.661	34.262	1.51	1.58
ogbn-products	v_dot_u	128	25.691	25.126	51.931	2.02	2.07
ogbn-products	v_dot_u	256	38.324	37.641	82.058	2.14	2.18
ogbn-products	v_mul_e	32	13.268	18.852	26.955	2.03	1.43
ogbn-products	v_mul_e	64	22.018	24.479	50.569	2.30	2.07
ogbn-products	v_mul_e	128	40.121	42.501	96.818	2.41	2.28
ogbn-products	v_mul_e	256	OOM	OOM	—	—	—
ogbn-products	v_mul_u	32	18.178	20.830	27.596	1.52	1.32
ogbn-products	v_mul_u	64	24.476	26.173	50.898	2.08	1.94
ogbn-products	v_mul_u	128	40.350	43.726	96.364	2.39	2.20
ogbn-products	v_mul_u	256	76.327	78.292	187.090	2.45	2.39
ogbn-products	v_sub_e	32	13.270	18.851	36.614	2.76	1.94
ogbn-products	v_sub_e	64	22.012	24.485	69.960	3.18	2.86
ogbn-products	v_sub_e	128	40.118	42.493	OOM	—	—
ogbn-products	v_sub_e	256	OOM	OOM	—	—	—
ogbn-products	v_sub_u	32	18.174	20.844	27.709	1.52	1.33
ogbn-products	v_sub_u	64	24.473	26.173	51.143	2.09	1.95
ogbn-products	v_sub_u	128	40.349	43.714	97.075	2.41	2.22
ogbn-products	v_sub_u	256	76.329	78.287	188.532	2.47	2.41
pokec-regions	copy_u	32	5.269	5.097	5.865	1.11	1.15

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
pokec-regions	copy_u	64	6.439	4.827	10.951	1.70	2.27
pokec-regions	copy_u	128	10.152	7.342	20.675	2.04	2.82
pokec-regions	copy_u	256	18.862	13.967	40.087	2.13	2.87
pokec-regions	copy_v	32	2.516	3.102	6.621	2.63	2.13
pokec-regions	copy_v	64	3.485	3.521	12.418	3.56	3.53
pokec-regions	copy_v	128	6.140	6.577	23.824	3.88	3.62
pokec-regions	copy_v	256	11.752	12.856	46.529	3.96	3.62
pokec-regions	e_add_u	32	6.103	5.927	6.709	1.10	1.13
pokec-regions	e_add_u	64	8.381	8.052	12.774	1.52	1.59
pokec-regions	e_add_u	128	14.931	12.234	24.561	1.64	2.01
pokec-regions	e_add_u	256	28.614	22.485	47.501	1.66	2.11
pokec-regions	e_add_v	32	4.617	5.052	7.453	1.61	1.48
pokec-regions	e_add_v	64	6.516	6.587	13.942	2.14	2.12
pokec-regions	e_add_v	128	11.315	11.606	26.606	2.35	2.29
pokec-regions	e_add_v	256	21.492	21.768	51.690	2.41	2.37
pokec-regions	e_div_u	32	6.330	6.216	6.941	1.10	1.12
pokec-regions	e_div_u	64	8.635	8.421	13.256	1.54	1.57
pokec-regions	e_div_u	128	15.670	12.490	25.532	1.63	2.04
pokec-regions	e_div_u	256	29.236	22.918	49.219	1.68	2.15
pokec-regions	e_div_v	32	4.838	5.927	7.688	1.59	1.30
pokec-regions	e_div_v	64	6.696	7.432	14.430	2.15	1.94
pokec-regions	e_div_v	128	11.395	11.924	27.576	2.42	2.31
pokec-regions	e_div_v	256	22.137	22.298	53.611	2.42	2.40
pokec-regions	e_dot_u	32	6.848	5.817	7.761	1.13	1.33
pokec-regions	e_dot_u	64	7.677	7.656	8.308	1.08	1.09
pokec-regions	e_dot_u	128	10.323	9.289	12.918	1.25	1.39
pokec-regions	e_dot_u	256	19.144	14.423	21.176	1.11	1.47
pokec-regions	e_dot_v	32	5.456	5.173	8.254	1.51	1.60
pokec-regions	e_dot_v	64	5.902	5.547	9.180	1.56	1.65
pokec-regions	e_dot_v	128	7.149	6.414	14.836	2.08	2.31
pokec-regions	e_dot_v	256	11.489	11.549	25.420	2.21	2.20
pokec-regions	e_mul_u	32	6.136	5.925	6.704	1.09	1.13
pokec-regions	e_mul_u	64	8.503	8.052	12.773	1.50	1.59
pokec-regions	e_mul_u	128	15.042	12.332	24.558	1.63	1.99
pokec-regions	e_mul_u	256	28.287	22.479	47.459	1.68	2.11
pokec-regions	e_mul_v	32	4.617	5.046	7.453	1.61	1.48
pokec-regions	e_mul_v	64	6.513	6.585	13.941	2.14	2.12
pokec-regions	e_mul_v	128	11.305	11.608	26.602	2.35	2.29
pokec-regions	e_mul_v	256	21.491	21.764	51.660	2.40	2.37
pokec-regions	e_sub_u	32	6.136	5.925	6.821	1.11	1.15
pokec-regions	e_sub_u	64	8.505	8.055	13.014	1.53	1.62
pokec-regions	e_sub_u	128	15.046	12.329	25.041	1.66	2.03
pokec-regions	e_sub_u	256	28.291	22.492	48.413	1.71	2.15
pokec-regions	e_sub_v	32	4.618	5.046	7.568	1.64	1.50
pokec-regions	e_sub_v	64	6.513	6.547	14.188	2.18	2.17
pokec-regions	e_sub_v	128	11.308	11.609	27.083	2.40	2.33
pokec-regions	e_sub_v	256	21.490	21.763	52.630	2.45	2.42
pokec-regions	u_add_e	32	6.090	5.929	6.721	1.10	1.13
pokec-regions	u_add_e	64	8.386	8.039	12.799	1.53	1.59
pokec-regions	u_add_e	128	14.935	12.246	24.618	1.65	2.01
pokec-regions	u_add_e	256	28.582	22.474	47.538	1.66	2.12
pokec-regions	u_add_v	32	5.871	5.259	7.181	1.22	1.37
pokec-regions	u_add_v	64	7.129	6.486	13.352	1.87	2.06
pokec-regions	u_add_v	128	10.785	10.884	25.256	2.34	2.32
pokec-regions	u_add_v	256	19.704	19.686	49.015	2.49	2.49
pokec-regions	u_div_e	32	6.102	6.110	11.827	1.94	1.94
pokec-regions	u_div_e	64	8.427	8.447	23.119	2.74	2.74
pokec-regions	u_div_e	128	15.565	12.371	45.334	2.91	3.66
pokec-regions	u_div_e	256	29.514	22.286	89.049	3.02	4.00
pokec-regions	u_div_v	32	6.074	6.076	7.433	1.22	1.22
pokec-regions	u_div_v	64	7.262	7.321	13.874	1.91	1.90
pokec-regions	u_div_v	128	10.872	10.824	26.288	2.42	2.43
pokec-regions	u_div_v	256	20.632	20.432	51.137	2.48	2.50
pokec-regions	u_dot_e	32	6.730	5.873	7.681	1.14	1.31
pokec-regions	u_dot_e	64	7.233	7.689	8.179	1.13	1.06
pokec-regions	u_dot_e	128	9.810	9.280	12.927	1.32	1.39
pokec-regions	u_dot_e	256	19.058	14.423	21.220	1.11	1.47
pokec-regions	u_dot_v	32	6.587	5.201	8.321	1.26	1.60
pokec-regions	u_dot_v	64	6.964	5.417	8.869	1.27	1.64
pokec-regions	u_dot_v	128	7.489	6.186	13.402	1.79	2.17
pokec-regions	u_dot_v	256	9.546	8.514	21.455	2.25	2.52
pokec-regions	u_mul_e	32	6.081	5.929	6.721	1.11	1.13
pokec-regions	u_mul_e	64	8.385	8.034	12.795	1.53	1.59
pokec-regions	u_mul_e	128	15.007	12.223	24.619	1.64	2.01
pokec-regions	u_mul_e	256	28.608	22.537	47.574	1.66	2.11
pokec-regions	u_mul_v	32	5.901	5.260	7.217	1.22	1.37
pokec-regions	u_mul_v	64	7.129	6.490	13.421	1.88	2.07
pokec-regions	u_mul_v	128	10.786	10.862	25.377	2.35	2.34

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
pokec-regions	u_mul_v	256	19.709	19.687	49.281	2.50	2.50
pokec-regions	u_sub_e	32	6.081	5.929	9.239	1.52	1.56
pokec-regions	u_sub_e	64	8.385	8.038	17.891	2.13	2.23
pokec-regions	u_sub_e	128	15.015	12.214	34.843	2.32	2.85
pokec-regions	u_sub_e	256	28.610	22.542	68.045	2.38	3.02
pokec-regions	u_sub_v	32	5.900	5.260	7.310	1.24	1.39
pokec-regions	u_sub_v	64	7.137	6.486	13.623	1.91	2.10
pokec-regions	u_sub_v	128	10.775	10.868	25.796	2.39	2.37
pokec-regions	u_sub_v	256	19.717	19.675	50.139	2.54	2.55
pokec-regions	v_add_e	32	4.567	5.046	7.472	1.64	1.48
pokec-regions	v_add_e	64	6.432	6.534	13.985	2.17	2.14
pokec-regions	v_add_e	128	11.223	11.530	26.689	2.38	2.31
pokec-regions	v_add_e	256	21.369	21.642	51.732	2.42	2.39
pokec-regions	v_add_u	32	5.873	5.263	7.214	1.23	1.37
pokec-regions	v_add_u	64	7.036	6.465	13.416	1.91	2.08
pokec-regions	v_add_u	128	10.725	10.802	25.365	2.37	2.35
pokec-regions	v_add_u	256	19.718	19.681	49.185	2.49	2.50
pokec-regions	v_div_e	32	4.864	6.061	12.589	2.59	2.08
pokec-regions	v_div_e	64	6.626	7.486	24.308	3.67	3.25
pokec-regions	v_div_e	128	11.827	11.857	47.403	4.01	4.00
pokec-regions	v_div_e	256	22.349	21.719	93.236	4.17	4.29
pokec-regions	v_div_u	32	6.087	6.128	7.458	1.23	1.22
pokec-regions	v_div_u	64	7.249	7.426	13.905	1.92	1.87
pokec-regions	v_div_u	128	10.858	10.873	26.342	2.43	2.42
pokec-regions	v_div_u	256	20.610	19.997	51.143	2.48	2.56
pokec-regions	v_dot_e	32	5.417	5.219	8.246	1.52	1.58
pokec-regions	v_dot_e	64	5.757	5.702	9.121	1.58	1.60
pokec-regions	v_dot_e	128	6.995	6.681	14.810	2.12	2.22
pokec-regions	v_dot_e	256	11.484	11.559	25.444	2.22	2.20
pokec-regions	v_dot_u	32	6.591	5.202	8.315	1.26	1.60
pokec-regions	v_dot_u	64	6.962	5.416	8.864	1.27	1.64
pokec-regions	v_dot_u	128	7.507	6.181	13.377	1.78	2.16
pokec-regions	v_dot_u	256	9.548	8.517	21.412	2.24	2.51
pokec-regions	v_mul_e	32	4.566	5.063	7.470	1.64	1.48
pokec-regions	v_mul_e	64	6.432	6.537	13.999	2.18	2.14
pokec-regions	v_mul_e	128	11.309	11.584	26.686	2.36	2.30
pokec-regions	v_mul_e	256	21.371	21.629	51.766	2.42	2.39
pokec-regions	v_mul_u	32	5.911	5.262	7.234	1.22	1.37
pokec-regions	v_mul_u	64	7.102	6.507	13.454	1.89	2.07
pokec-regions	v_mul_u	128	10.784	10.860	25.420	2.36	2.34
pokec-regions	v_mul_u	256	19.660	19.641	49.345	2.51	2.51
pokec-regions	v_sub_e	32	4.566	5.046	10.004	2.19	1.98
pokec-regions	v_sub_e	64	6.433	6.542	19.090	2.97	2.92
pokec-regions	v_sub_e	128	11.309	11.578	36.903	3.26	3.19
pokec-regions	v_sub_e	256	21.490	21.754	72.214	3.36	3.32
pokec-regions	v_sub_u	32	5.902	5.264	7.331	1.24	1.39
pokec-regions	v_sub_u	64	7.104	6.501	13.656	1.92	2.10
pokec-regions	v_sub_u	128	10.783	10.867	25.863	2.40	2.38
pokec-regions	v_sub_u	256	19.717	19.671	50.179	2.54	2.55
pubmed	copy_u	32	0.063	0.064	0.061	0.96	0.96
pubmed	copy_u	64	0.062	0.064	0.056	0.90	0.88
pubmed	copy_u	128	0.063	0.063	0.103	1.63	1.64
pubmed	copy_u	256	0.066	0.064	0.189	2.88	2.94
pubmed	copy_v	32	0.065	0.063	0.059	0.90	0.94
pubmed	copy_v	64	0.062	0.061	0.056	0.91	0.92
pubmed	copy_v	128	0.062	0.064	0.103	1.65	1.60
pubmed	copy_v	256	0.063	0.063	0.191	3.02	3.03
pubmed	e_add_u	32	0.044	0.044	0.062	1.39	1.40
pubmed	e_add_u	64	0.050	0.046	0.065	1.31	1.43
pubmed	e_add_u	128	0.064	0.053	0.122	1.92	2.32
pubmed	e_add_u	256	0.107	0.096	0.222	2.07	2.30
pubmed	e_add_v	32	0.044	0.044	0.064	1.48	1.46
pubmed	e_add_v	64	0.051	0.043	0.066	1.30	1.53
pubmed	e_add_v	128	0.062	0.052	0.123	1.99	2.35
pubmed	e_add_v	256	0.102	0.092	0.222	2.17	2.42
pubmed	e_div_u	32	0.045	0.043	0.110	2.45	2.53
pubmed	e_div_u	64	0.056	0.044	0.109	1.96	2.47
pubmed	e_div_u	128	0.075	0.052	0.139	1.85	2.69
pubmed	e_div_u	256	0.116	0.098	0.247	2.14	2.51
pubmed	e_div_v	32	0.044	0.044	0.107	2.44	2.44
pubmed	e_div_v	64	0.053	0.045	0.108	2.03	2.43
pubmed	e_div_v	128	0.065	0.052	0.139	2.16	2.66
pubmed	e_div_v	256	0.108	0.095	0.247	2.29	2.60
pubmed	e_dot_u	32	0.045	0.045	0.065	1.44	1.45
pubmed	e_dot_u	64	0.045	0.046	0.062	1.38	1.35
pubmed	e_dot_u	128	0.056	0.046	0.065	1.15	1.39
pubmed	e_dot_u	256	0.073	0.055	0.090	1.23	1.64
pubmed	e_dot_v	32	0.046	0.046	0.066	1.45	1.44

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
pubmed	e_dot_v	64	0.045	0.045	0.064	1.43	1.41
pubmed	e_dot_v	128	0.054	0.045	0.079	1.45	1.74
pubmed	e_dot_v	256	0.065	0.054	0.085	1.30	1.59
pubmed	e_mul_u	32	0.044	0.043	0.062	1.41	1.45
pubmed	e_mul_u	64	0.050	0.045	0.066	1.32	1.45
pubmed	e_mul_u	128	0.064	0.052	0.122	1.92	2.37
pubmed	e_mul_u	256	0.107	0.097	0.222	2.06	2.30
pubmed	e_mul_v	32	0.044	0.045	0.062	1.40	1.39
pubmed	e_mul_v	64	0.050	0.045	0.065	1.28	1.43
pubmed	e_mul_v	128	0.062	0.052	0.122	1.97	2.35
pubmed	e_mul_v	256	0.102	0.092	0.222	2.17	2.41
pubmed	e_sub_u	32	0.054	0.043	0.084	1.57	1.94
pubmed	e_sub_u	64	0.051	0.046	0.084	1.67	1.83
pubmed	e_sub_u	128	0.064	0.052	0.131	2.05	2.50
pubmed	e_sub_u	256	0.107	0.096	0.235	2.19	2.44
pubmed	e_sub_v	32	0.044	0.044	0.085	1.93	1.95
pubmed	e_sub_v	64	0.061	0.045	0.085	1.39	1.88
pubmed	e_sub_v	128	0.062	0.053	0.130	2.10	2.47
pubmed	e_sub_v	256	0.102	0.092	0.236	2.32	2.56
pubmed	u_add_e	32	0.045	0.044	0.064	1.42	1.45
pubmed	u_add_e	64	0.050	0.045	0.067	1.34	1.47
pubmed	u_add_e	128	0.065	0.052	0.123	1.91	2.37
pubmed	u_add_e	256	0.107	0.097	0.223	2.09	2.31
pubmed	u_add_v	32	0.046	0.046	0.068	1.50	1.50
pubmed	u_add_v	64	0.044	0.045	0.064	1.46	1.42
pubmed	u_add_v	128	0.060	0.044	0.118	1.97	2.65
pubmed	u_add_v	256	0.076	0.064	0.217	2.87	3.40
pubmed	u_div_e	32	0.045	0.045	0.107	2.37	2.36
pubmed	u_div_e	64	0.052	0.046	0.108	2.07	2.35
pubmed	u_div_e	128	0.076	0.053	0.205	2.69	3.88
pubmed	u_div_e	256	0.117	0.097	0.375	3.20	3.87
pubmed	u_div_v	32	0.047	0.045	0.106	2.28	2.35
pubmed	u_div_v	64	0.044	0.044	0.108	2.46	2.44
pubmed	u_div_v	128	0.064	0.045	0.135	2.11	3.03
pubmed	u_div_v	256	0.099	0.063	0.245	2.47	3.90
pubmed	u_dot_e	32	0.047	0.047	0.064	1.38	1.38
pubmed	u_dot_e	64	0.044	0.047	0.063	1.43	1.35
pubmed	u_dot_e	128	0.058	0.047	0.065	1.11	1.36
pubmed	u_dot_e	256	0.071	0.059	0.086	1.21	1.46
pubmed	u_dot_v	32	0.047	0.046	0.063	1.34	1.38
pubmed	u_dot_v	64	0.044	0.045	0.063	1.44	1.41
pubmed	u_dot_v	128	0.045	0.044	0.063	1.41	1.42
pubmed	u_dot_v	256	0.048	0.044	0.071	1.49	1.61
pubmed	u_mul_e	32	0.045	0.046	0.064	1.42	1.39
pubmed	u_mul_e	64	0.050	0.045	0.066	1.32	1.46
pubmed	u_mul_e	128	0.065	0.054	0.123	1.89	2.29
pubmed	u_mul_e	256	0.107	0.096	0.223	2.08	2.31
pubmed	u_mul_v	32	0.046	0.046	0.063	1.38	1.37
pubmed	u_mul_v	64	0.044	0.044	0.063	1.43	1.44
pubmed	u_mul_v	128	0.060	0.045	0.118	1.99	2.65
pubmed	u_mul_v	256	0.075	0.064	0.219	2.91	3.42
pubmed	u_sub_e	32	0.045	0.046	0.084	1.88	1.84
pubmed	u_sub_e	64	0.051	0.045	0.088	1.73	1.94
pubmed	u_sub_e	128	0.065	0.052	0.161	2.50	3.08
pubmed	u_sub_e	256	0.107	0.096	0.295	2.76	3.07
pubmed	u_sub_v	32	0.047	0.045	0.088	1.88	1.94
pubmed	u_sub_v	64	0.044	0.045	0.086	1.98	1.93
pubmed	u_sub_v	128	0.060	0.047	0.126	2.11	2.69
pubmed	u_sub_v	256	0.075	0.064	0.231	3.07	3.62
pubmed	v_add_e	32	0.045	0.044	0.062	1.37	1.40
pubmed	v_add_e	64	0.050	0.045	0.066	1.31	1.48
pubmed	v_add_e	128	0.063	0.052	0.124	1.96	2.38
pubmed	v_add_e	256	0.101	0.092	0.224	2.22	2.43
pubmed	v_add_u	32	0.045	0.046	0.079	1.77	1.74
pubmed	v_add_u	64	0.044	0.044	0.063	1.42	1.42
pubmed	v_add_u	128	0.060	0.044	0.125	2.10	2.83
pubmed	v_add_u	256	0.075	0.064	0.220	2.95	3.44
pubmed	v_div_e	32	0.044	0.044	0.107	2.45	2.44
pubmed	v_div_e	64	0.054	0.043	0.110	2.04	2.56
pubmed	v_div_e	128	0.071	0.054	0.202	2.83	3.77
pubmed	v_div_e	256	0.111	0.093	0.376	3.40	4.05
pubmed	v_div_u	32	0.045	0.044	0.115	2.57	2.60
pubmed	v_div_u	64	0.043	0.045	0.115	2.67	2.57
pubmed	v_div_u	128	0.062	0.045	0.137	2.20	3.07
pubmed	v_div_u	256	0.095	0.063	0.244	2.57	3.84
pubmed	v_dot_e	32	0.045	0.044	0.065	1.46	1.47
pubmed	v_dot_e	64	0.045	0.045	0.063	1.39	1.42
pubmed	v_dot_e	128	0.056	0.046	0.068	1.21	1.49

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
pubmed	v_dot_e	256	0.066	0.058	0.085	1.30	1.48
pubmed	v_dot_u	32	0.045	0.045	0.063	1.38	1.40
pubmed	v_dot_u	64	0.045	0.044	0.067	1.47	1.51
pubmed	v_dot_u	128	0.045	0.045	0.066	1.48	1.48
pubmed	v_dot_u	256	0.046	0.045	0.069	1.50	1.53
pubmed	v_mul_e	32	0.044	0.044	0.062	1.41	1.42
pubmed	v_mul_e	64	0.051	0.045	0.066	1.30	1.47
pubmed	v_mul_e	128	0.062	0.052	0.123	1.99	2.38
pubmed	v_mul_e	256	0.101	0.092	0.224	2.22	2.43
pubmed	v_mul_u	32	0.045	0.045	0.065	1.43	1.43
pubmed	v_mul_u	64	0.044	0.044	0.065	1.46	1.46
pubmed	v_mul_u	128	0.058	0.044	0.118	2.05	2.67
pubmed	v_mul_u	256	0.076	0.064	0.218	2.86	3.42
pubmed	v_sub_e	32	0.045	0.044	0.083	1.85	1.90
pubmed	v_sub_e	64	0.050	0.045	0.087	1.74	1.93
pubmed	v_sub_e	128	0.062	0.052	0.163	2.61	3.13
pubmed	v_sub_e	256	0.101	0.092	0.295	2.92	3.20
pubmed	v_sub_u	32	0.046	0.045	0.082	1.79	1.84
pubmed	v_sub_u	64	0.044	0.044	0.084	1.91	1.90
pubmed	v_sub_u	128	0.058	0.044	0.127	2.18	2.85
pubmed	v_sub_u	256	0.076	0.064	0.231	3.05	3.63
reddit	copy_u	32	11.446	15.536	16.168	1.41	1.04
reddit	copy_u	64	16.239	18.484	31.374	1.93	1.70
reddit	copy_u	128	30.917	30.744	65.397	2.12	2.13
reddit	copy_u	256	63.002	60.974	131.505	2.09	2.16
reddit	copy_v	32	4.639	10.137	20.257	4.37	2.00
reddit	copy_v	64	9.152	11.500	38.987	4.26	3.39
reddit	copy_v	128	17.472	20.679	76.984	4.41	3.72
reddit	copy_v	256	33.482	40.169	153.581	4.59	3.82
reddit	e_add_u	32	15.252	18.931	22.252	1.46	1.18
reddit	e_add_u	64	34.611	35.585	42.436	1.23	1.19
reddit	e_add_u	128	47.073	48.001	81.679	1.74	1.70
reddit	e_add_u	256	OOM	OOM	OOM	—	—
reddit	e_add_v	32	11.433	16.676	23.530	2.06	1.41
reddit	e_add_v	64	26.483	23.287	45.186	1.71	1.94
reddit	e_add_v	128	35.563	37.663	87.370	2.46	2.32
reddit	e_add_v	256	OOM	OOM	OOM	—	—
reddit	e_div_u	32	15.750	19.969	22.290	1.42	1.12
reddit	e_div_u	64	35.456	37.312	42.497	1.20	1.14
reddit	e_div_u	128	48.472	48.693	81.837	1.69	1.68
reddit	e_div_u	256	OOM	OOM	OOM	—	—
reddit	e_div_v	32	11.616	19.501	23.564	2.03	1.21
reddit	e_div_v	64	27.744	27.107	45.256	1.63	1.67
reddit	e_div_v	128	35.709	38.675	87.490	2.45	2.26
reddit	e_div_v	256	OOM	OOM	OOM	—	—
reddit	e_dot_u	32	18.005	18.742	25.917	1.44	1.38
reddit	e_dot_u	64	23.414	21.109	27.354	1.17	1.30
reddit	e_dot_u	128	29.254	28.332	41.636	1.42	1.47
reddit	e_dot_u	256	58.506	57.866	65.401	1.12	1.13
reddit	e_dot_v	32	13.888	17.226	26.629	1.92	1.55
reddit	e_dot_v	64	15.492	18.580	29.747	1.92	1.60
reddit	e_dot_v	128	20.585	21.293	47.826	2.32	2.25
reddit	e_dot_v	256	35.233	35.020	78.157	2.22	2.23
reddit	e_mul_u	32	15.446	18.932	22.247	1.44	1.18
reddit	e_mul_u	64	35.171	27.353	42.430	1.21	1.55
reddit	e_mul_u	128	47.069	47.976	81.692	1.74	1.70
reddit	e_mul_u	256	OOM	OOM	OOM	—	—
reddit	e_mul_v	32	11.432	16.676	23.527	2.06	1.41
reddit	e_mul_v	64	20.545	30.544	45.188	2.20	1.48
reddit	e_mul_v	128	35.558	37.675	87.348	2.46	2.32
reddit	e_mul_v	256	OOM	OOM	OOM	—	—
reddit	e_sub_u	32	15.443	18.931	22.273	1.44	1.18
reddit	e_sub_u	64	27.006	36.024	42.460	1.57	1.18
reddit	e_sub_u	128	47.072	47.975	81.756	1.74	1.70
reddit	e_sub_u	256	OOM	OOM	OOM	—	—
reddit	e_sub_v	32	11.439	16.677	23.549	2.06	1.41
reddit	e_sub_v	64	27.556	30.291	45.222	1.64	1.49
reddit	e_sub_v	128	35.554	37.665	87.434	2.46	2.32
reddit	e_sub_v	256	OOM	OOM	OOM	—	—
reddit	u_add_e	32	15.440	18.952	22.298	1.44	1.18
reddit	u_add_e	64	25.173	25.732	42.506	1.69	1.65
reddit	u_add_e	128	47.069	47.990	82.111	1.74	1.71
reddit	u_add_e	256	OOM	OOM	—	—	—
reddit	u_add_v	32	11.495	15.942	22.070	1.92	1.38
reddit	u_add_v	64	16.687	18.701	42.086	2.52	2.25
reddit	u_add_v	128	31.463	32.924	82.386	2.62	2.50
reddit	u_add_v	256	63.045	61.494	162.512	2.58	2.64
reddit	u_div_e	32	15.234	19.615	39.803	2.61	2.03

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
reddit	u_div_e	64	25.360	26.888	77.655	3.06	2.89
reddit	u_div_e	128	48.452	48.663	OOM	—	—
reddit	u_div_e	256	OOM	OOM	—	—	—
reddit	u_div_v	32	11.868	18.346	22.166	1.87	1.21
reddit	u_div_v	64	16.724	22.163	42.285	2.53	1.91
reddit	u_div_v	128	30.724	32.590	82.512	2.69	2.53
reddit	u_div_v	256	63.242	64.133	162.776	2.57	2.54
reddit	u_dot_e	32	17.569	18.911	25.678	1.46	1.36
reddit	u_dot_e	64	19.590	21.330	27.027	1.38	1.27
reddit	u_dot_e	128	29.229	30.775	41.280	1.41	1.34
reddit	u_dot_e	256	OOM	OOM	—	—	—
reddit	u_dot_v	32	13.424	15.498	26.226	1.95	1.69
reddit	u_dot_v	64	14.453	16.637	27.362	1.89	1.64
reddit	u_dot_v	128	16.617	18.681	40.579	2.44	2.17
reddit	u_dot_v	256	22.626	23.839	66.268	2.93	2.78
reddit	u_mul_e	32	15.442	18.953	22.293	1.44	1.18
reddit	u_mul_e	64	25.389	25.727	42.500	1.67	1.65
reddit	u_mul_e	128	47.081	47.974	82.105	1.74	1.71
reddit	u_mul_e	256	OOM	OOM	—	—	—
reddit	u_mul_v	32	11.569	15.965	22.186	1.92	1.39
reddit	u_mul_v	64	16.656	18.699	42.306	2.54	2.26
reddit	u_mul_v	128	30.610	32.947	82.335	2.69	2.50
reddit	u_mul_v	256	63.044	61.484	162.426	2.58	2.64
reddit	u_sub_e	32	15.443	18.957	30.934	2.00	1.63
reddit	u_sub_e	64	25.404	25.728	59.843	2.36	2.33
reddit	u_sub_e	128	47.082	47.982	OOM	—	—
reddit	u_sub_e	256	OOM	OOM	—	—	—
reddit	u_sub_v	32	11.559	15.964	22.152	1.92	1.39
reddit	u_sub_v	64	16.647	18.700	42.242	2.54	2.26
reddit	u_sub_v	128	30.602	32.933	82.444	2.69	2.50
reddit	u_sub_v	256	63.054	61.497	162.686	2.58	2.65
reddit	v_add_e	32	11.292	16.657	23.597	2.09	1.42
reddit	v_add_e	64	19.651	23.172	45.314	2.31	1.96
reddit	v_add_e	128	35.560	37.725	87.899	2.47	2.33
reddit	v_add_e	256	OOM	OOM	—	—	—
reddit	v_add_u	32	11.460	15.944	22.192	1.94	1.39
reddit	v_add_u	64	16.612	18.662	42.288	2.55	2.27
reddit	v_add_u	128	31.463	32.916	82.514	2.62	2.51
reddit	v_add_u	256	63.057	61.494	162.492	2.58	2.64
reddit	v_div_e	32	11.510	20.090	41.091	3.57	2.05
reddit	v_div_e	64	20.277	27.471	80.474	3.97	2.93
reddit	v_div_e	128	36.158	38.665	OOM	—	—
reddit	v_div_e	256	OOM	OOM	—	—	—
reddit	v_div_u	32	11.985	18.516	22.220	1.85	1.20
reddit	v_div_u	64	23.742	32.852	42.371	1.78	1.29
reddit	v_div_u	128	30.728	33.000	82.618	2.69	2.50
reddit	v_div_u	256	63.768	62.799	162.800	2.55	2.59
reddit	v_dot_e	32	13.646	17.342	26.610	1.95	1.53
reddit	v_dot_e	64	19.276	27.861	29.644	1.54	1.06
reddit	v_dot_e	128	19.438	22.171	46.803	2.41	2.11
reddit	v_dot_e	256	OOM	OOM	—	—	—
reddit	v_dot_u	32	13.429	15.495	26.204	1.95	1.69
reddit	v_dot_u	64	15.136	16.630	27.341	1.81	1.64
reddit	v_dot_u	128	16.684	18.682	40.426	2.42	2.16
reddit	v_dot_u	256	22.623	23.844	66.045	2.92	2.77
reddit	v_mul_e	32	11.290	16.660	23.586	2.09	1.42
reddit	v_mul_e	64	27.504	30.263	45.332	1.65	1.50
reddit	v_mul_e	128	35.576	37.717	87.908	2.47	2.33
reddit	v_mul_e	256	OOM	OOM	—	—	—
reddit	v_mul_u	32	11.553	15.961	22.246	1.93	1.39
reddit	v_mul_u	64	17.204	19.799	42.385	2.46	2.14
reddit	v_mul_u	128	30.595	32.933	82.482	2.70	2.50
reddit	v_mul_u	256	63.063	61.496	162.536	2.58	2.64
reddit	v_sub_e	32	11.293	16.657	32.219	2.85	1.93
reddit	v_sub_e	64	20.628	25.926	62.664	3.04	2.42
reddit	v_sub_e	128	35.560	37.724	OOM	—	—
reddit	v_sub_e	256	OOM	OOM	—	—	—
reddit	v_sub_u	32	11.558	15.966	22.207	1.92	1.39
reddit	v_sub_u	64	18.937	20.219	42.333	2.24	2.09
reddit	v_sub_u	128	30.577	32.912	82.575	2.70	2.51
reddit	v_sub_u	256	63.044	61.498	162.696	2.58	2.65
tolokers-2	copy_u	32	0.161	0.130	0.194	1.20	1.48
tolokers-2	copy_u	64	0.185	0.137	0.337	1.82	2.46
tolokers-2	copy_u	128	0.267	0.199	0.594	2.23	2.99
tolokers-2	copy_u	256	0.489	0.366	1.058	2.16	2.89
tolokers-2	copy_v	32	0.068	0.101	0.187	2.75	1.85
tolokers-2	copy_v	64	0.102	0.113	0.327	3.21	2.89
tolokers-2	copy_v	128	0.191	0.201	0.607	3.18	3.02

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
tolokers-2	copy_v	256	0.363	0.381	1.168	3.22	3.06
tolokers-2	e_add_u	32	0.234	0.172	0.230	0.98	1.34
tolokers-2	e_add_u	64	0.264	0.210	0.427	1.62	2.03
tolokers-2	e_add_u	128	0.441	0.368	0.806	1.83	2.19
tolokers-2	e_add_u	256	0.766	0.699	1.541	2.01	2.21
tolokers-2	e_add_v	32	0.168	0.162	0.239	1.42	1.48
tolokers-2	e_add_v	64	0.239	0.211	0.428	1.79	2.03
tolokers-2	e_add_v	128	0.396	0.363	0.806	2.04	2.22
tolokers-2	e_add_v	256	0.726	0.680	1.549	2.13	2.28
tolokers-2	e_div_u	32	0.242	0.182	0.239	0.99	1.31
tolokers-2	e_div_u	64	0.301	0.227	0.437	1.45	1.93
tolokers-2	e_div_u	128	0.470	0.374	0.827	1.76	2.21
tolokers-2	e_div_u	256	0.891	0.722	1.561	1.75	2.16
tolokers-2	e_div_v	32	0.176	0.191	0.238	1.35	1.25
tolokers-2	e_div_v	64	0.247	0.236	0.439	1.78	1.86
tolokers-2	e_div_v	128	0.412	0.372	0.819	1.99	2.20
tolokers-2	e_div_v	256	0.760	0.697	1.567	2.06	2.25
tolokers-2	e_dot_u	32	0.306	0.176	0.246	0.80	1.40
tolokers-2	e_dot_u	64	0.330	0.187	0.261	0.79	1.39
tolokers-2	e_dot_u	128	0.372	0.216	0.401	1.08	1.86
tolokers-2	e_dot_u	256	0.517	0.371	0.651	1.26	1.75
tolokers-2	e_dot_v	32	0.259	0.185	0.244	0.94	1.32
tolokers-2	e_dot_v	64	0.274	0.179	0.256	0.94	1.43
tolokers-2	e_dot_v	128	0.318	0.203	0.404	1.27	1.98
tolokers-2	e_dot_v	256	0.454	0.343	0.671	1.48	1.96
tolokers-2	e_mul_u	32	0.234	0.172	0.230	0.98	1.34
tolokers-2	e_mul_u	64	0.270	0.211	0.427	1.58	2.02
tolokers-2	e_mul_u	128	0.447	0.367	0.807	1.81	2.20
tolokers-2	e_mul_u	256	0.785	0.705	1.542	1.96	2.19
tolokers-2	e_mul_v	32	0.167	0.162	0.229	1.38	1.41
tolokers-2	e_mul_v	64	0.239	0.207	0.429	1.80	2.07
tolokers-2	e_mul_v	128	0.394	0.362	0.806	2.04	2.23
tolokers-2	e_mul_v	256	0.728	0.679	1.550	2.13	2.28
tolokers-2	e_sub_u	32	0.234	0.172	0.235	1.01	1.37
tolokers-2	e_sub_u	64	0.270	0.210	0.432	1.60	2.06
tolokers-2	e_sub_u	128	0.446	0.369	0.813	1.82	2.20
tolokers-2	e_sub_u	256	0.785	0.704	1.553	1.98	2.21
tolokers-2	e_sub_v	32	0.167	0.163	0.235	1.40	1.44
tolokers-2	e_sub_v	64	0.238	0.207	0.434	1.82	2.10
tolokers-2	e_sub_v	128	0.396	0.369	0.812	2.05	2.20
tolokers-2	e_sub_v	256	0.725	0.680	1.558	2.15	2.29
tolokers-2	u_add_e	32	0.232	0.171	0.232	1.00	1.35
tolokers-2	u_add_e	64	0.266	0.210	0.429	1.61	2.04
tolokers-2	u_add_e	128	0.441	0.369	0.808	1.83	2.19
tolokers-2	u_add_e	256	0.780	0.699	1.538	1.97	2.20
tolokers-2	u_add_v	32	0.165	0.136	0.213	1.29	1.57
tolokers-2	u_add_v	64	0.188	0.141	0.388	2.07	2.75
tolokers-2	u_add_v	128	0.278	0.206	0.718	2.58	3.48
tolokers-2	u_add_v	256	0.494	0.373	1.358	2.75	3.64
tolokers-2	u_div_e	32	0.217	0.179	0.389	1.79	2.18
tolokers-2	u_div_e	64	0.277	0.223	0.741	2.67	3.33
tolokers-2	u_div_e	128	0.463	0.373	1.442	3.11	3.86
tolokers-2	u_div_e	256	0.879	0.699	2.800	3.18	4.01
tolokers-2	u_div_v	32	0.174	0.150	0.223	1.28	1.48
tolokers-2	u_div_v	64	0.200	0.175	0.400	2.00	2.28
tolokers-2	u_div_v	128	0.302	0.220	0.734	2.43	3.33
tolokers-2	u_div_v	256	0.545	0.387	1.379	2.53	3.56
tolokers-2	u_dot_e	32	0.318	0.177	0.248	0.78	1.40
tolokers-2	u_dot_e	64	0.323	0.192	0.257	0.79	1.34
tolokers-2	u_dot_e	128	0.360	0.223	0.401	1.11	1.80
tolokers-2	u_dot_e	256	0.494	0.378	0.627	1.27	1.66
tolokers-2	u_dot_v	32	0.166	0.139	0.221	1.33	1.59
tolokers-2	u_dot_v	64	0.172	0.144	0.244	1.42	1.69
tolokers-2	u_dot_v	128	0.189	0.156	0.331	1.75	2.13
tolokers-2	u_dot_v	256	0.241	0.175	0.502	2.08	2.86
tolokers-2	u_mul_e	32	0.237	0.172	0.232	0.98	1.35
tolokers-2	u_mul_e	64	0.267	0.211	0.429	1.61	2.04
tolokers-2	u_mul_e	128	0.448	0.375	0.804	1.80	2.15
tolokers-2	u_mul_e	256	0.781	0.697	1.552	1.99	2.23
tolokers-2	u_mul_v	32	0.166	0.137	0.214	1.29	1.57
tolokers-2	u_mul_v	64	0.190	0.141	0.391	2.06	2.78
tolokers-2	u_mul_v	128	0.279	0.206	0.724	2.60	3.51
tolokers-2	u_mul_v	256	0.497	0.373	1.366	2.75	3.66
tolokers-2	u_sub_e	32	0.233	0.171	0.312	1.34	1.82
tolokers-2	u_sub_e	64	0.267	0.210	0.579	2.17	2.76
tolokers-2	u_sub_e	128	0.445	0.369	1.114	2.50	3.02
tolokers-2	u_sub_e	256	0.787	0.704	2.169	2.75	3.08
tolokers-2	u_sub_v	32	0.166	0.136	0.219	1.32	1.61

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
tolokers-2	u_sub_v	64	0.190	0.141	0.394	2.07	2.79
tolokers-2	u_sub_v	128	0.280	0.206	0.728	2.60	3.53
tolokers-2	u_sub_v	256	0.500	0.373	1.371	2.74	3.68
tolokers-2	v_add_e	32	0.167	0.162	0.231	1.38	1.43
tolokers-2	v_add_e	64	0.235	0.207	0.429	1.82	2.07
tolokers-2	v_add_e	128	0.386	0.357	0.808	2.09	2.27
tolokers-2	v_add_e	256	0.719	0.674	1.548	2.15	2.30
tolokers-2	v_add_u	32	0.164	0.136	0.213	1.30	1.57
tolokers-2	v_add_u	64	0.204	0.142	0.395	1.93	2.79
tolokers-2	v_add_u	128	0.277	0.206	0.720	2.60	3.49
tolokers-2	v_add_u	256	0.496	0.372	1.356	2.73	3.65
tolokers-2	v_div_e	32	0.179	0.196	0.390	2.18	1.99
tolokers-2	v_div_e	64	0.244	0.238	0.744	3.05	3.13
tolokers-2	v_div_e	128	0.421	0.371	1.433	3.41	3.86
tolokers-2	v_div_e	256	0.814	0.677	2.807	3.45	4.14
tolokers-2	v_div_u	32	0.177	0.152	0.222	1.25	1.46
tolokers-2	v_div_u	64	0.198	0.178	0.400	2.02	2.25
tolokers-2	v_div_u	128	0.302	0.230	0.733	2.43	3.18
tolokers-2	v_div_u	256	0.571	0.376	1.384	2.42	3.68
tolokers-2	v_dot_e	32	0.259	0.169	0.244	0.94	1.45
tolokers-2	v_dot_e	64	0.274	0.185	0.256	0.93	1.38
tolokers-2	v_dot_e	128	0.323	0.214	0.408	1.26	1.91
tolokers-2	v_dot_e	256	0.455	0.362	0.672	1.48	1.85
tolokers-2	v_dot_u	32	0.166	0.139	0.221	1.33	1.60
tolokers-2	v_dot_u	64	0.172	0.146	0.245	1.43	1.68
tolokers-2	v_dot_u	128	0.190	0.156	0.329	1.73	2.10
tolokers-2	v_dot_u	256	0.238	0.176	0.502	2.11	2.85
tolokers-2	v_mul_e	32	0.182	0.162	0.231	1.27	1.43
tolokers-2	v_mul_e	64	0.235	0.207	0.430	1.83	2.08
tolokers-2	v_mul_e	128	0.394	0.363	0.808	2.05	2.22
tolokers-2	v_mul_e	256	0.725	0.678	1.554	2.14	2.29
tolokers-2	v_mul_u	32	0.166	0.137	0.214	1.29	1.57
tolokers-2	v_mul_u	64	0.189	0.142	0.391	2.07	2.76
tolokers-2	v_mul_u	128	0.278	0.206	0.723	2.60	3.50
tolokers-2	v_mul_u	256	0.497	0.372	1.363	2.74	3.67
tolokers-2	v_sub_e	32	0.167	0.163	0.306	1.83	1.88
tolokers-2	v_sub_e	64	0.234	0.207	0.580	2.47	2.80
tolokers-2	v_sub_e	128	0.387	0.362	1.115	2.88	3.08
tolokers-2	v_sub_e	256	0.715	0.674	2.169	3.03	3.22
tolokers-2	v_sub_u	32	0.165	0.136	0.218	1.32	1.60
tolokers-2	v_sub_u	64	0.189	0.141	0.394	2.09	2.79
tolokers-2	v_sub_u	128	0.277	0.205	0.726	2.62	3.55
tolokers-2	v_sub_u	256	0.494	0.371	1.369	2.77	3.69
twitch-views	copy_u	32	1.770	1.786	2.154	1.22	1.21
twitch-views	copy_u	64	2.230	2.078	3.896	1.75	1.87
twitch-views	copy_u	128	3.808	3.388	7.332	1.93	2.16
twitch-views	copy_u	256	7.588	7.090	15.425	2.03	2.18
twitch-views	copy_v	32	0.607	1.243	2.352	3.87	1.89
twitch-views	copy_v	64	1.209	1.409	4.515	3.73	3.20
twitch-views	copy_v	128	2.388	2.607	9.073	3.80	3.48
twitch-views	copy_v	256	4.672	5.063	18.068	3.87	3.57
twitch-views	e_add_u	32	2.283	2.265	2.762	1.21	1.22
twitch-views	e_add_u	64	3.300	3.002	5.210	1.58	1.74
twitch-views	e_add_u	128	5.914	5.593	10.034	1.70	1.79
twitch-views	e_add_u	256	11.585	10.965	19.384	1.67	1.77
twitch-views	e_add_v	32	1.676	2.035	2.908	1.73	1.43
twitch-views	e_add_v	64	2.657	2.656	5.463	2.06	2.06
twitch-views	e_add_v	128	4.719	4.700	10.526	2.23	2.24
twitch-views	e_add_v	256	9.023	8.807	20.564	2.28	2.34
twitch-views	e_div_u	32	2.387	2.389	2.807	1.18	1.17
twitch-views	e_div_u	64	3.456	3.195	5.261	1.52	1.65
twitch-views	e_div_u	128	6.180	5.716	10.143	1.64	1.77
twitch-views	e_div_u	256	12.423	11.266	19.565	1.57	1.74
twitch-views	e_div_v	32	1.741	2.395	2.872	1.65	1.20
twitch-views	e_div_v	64	2.724	3.012	5.513	2.02	1.83
twitch-views	e_div_v	128	4.854	4.828	10.623	2.19	2.20
twitch-views	e_div_v	256	9.281	9.026	20.765	2.24	2.30
twitch-views	e_dot_u	32	2.973	2.256	3.159	1.06	1.40
twitch-views	e_dot_u	64	3.353	2.471	3.352	1.00	1.36
twitch-views	e_dot_u	128	4.271	3.403	5.178	1.21	1.52
twitch-views	e_dot_u	256	7.704	6.874	8.461	1.10	1.23
twitch-views	e_dot_v	32	2.268	2.103	3.202	1.41	1.52
twitch-views	e_dot_v	64	2.478	2.263	3.533	1.43	1.56
twitch-views	e_dot_v	128	3.104	2.577	5.740	1.85	2.23
twitch-views	e_dot_v	256	5.109	4.416	9.850	1.93	2.23
twitch-views	e_mul_u	32	2.308	2.260	2.781	1.20	1.23
twitch-views	e_mul_u	64	3.358	2.999	5.217	1.55	1.74
twitch-views	e_mul_u	128	5.966	5.627	10.032	1.68	1.78

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
twitch-views	e_mul_u	256	11.577	10.985	19.369	1.67	1.76
twitch-views	e_mul_v	32	1.668	2.035	2.846	1.71	1.40
twitch-views	e_mul_v	64	2.653	2.657	5.468	2.06	2.06
twitch-views	e_mul_v	128	4.718	4.700	10.525	2.23	2.24
twitch-views	e_mul_v	256	9.030	8.807	20.562	2.28	2.33
twitch-views	e_sub_u	32	2.304	2.260	2.793	1.21	1.24
twitch-views	e_sub_u	64	3.359	3.000	5.236	1.56	1.75
twitch-views	e_sub_u	128	5.978	5.632	10.082	1.69	1.79
twitch-views	e_sub_u	256	11.591	11.005	19.468	1.68	1.77
twitch-views	e_sub_v	32	1.667	2.035	2.872	1.72	1.41
twitch-views	e_sub_v	64	2.655	2.660	5.487	2.07	2.06
twitch-views	e_sub_v	128	4.725	4.702	10.574	2.24	2.25
twitch-views	e_sub_v	256	9.019	8.807	20.663	2.29	2.35
twitch-views	u_add_e	32	2.323	2.276	2.765	1.19	1.22
twitch-views	u_add_e	64	3.281	2.999	5.214	1.59	1.74
twitch-views	u_add_e	128	5.924	5.594	10.052	1.70	1.80
twitch-views	u_add_e	256	11.533	10.893	19.404	1.68	1.78
twitch-views	u_add_v	32	1.843	1.881	2.686	1.46	1.43
twitch-views	u_add_v	64	2.308	2.148	5.088	2.20	2.37
twitch-views	u_add_v	128	3.893	3.619	9.837	2.53	2.72
twitch-views	u_add_v	256	7.781	7.134	19.031	2.45	2.67
twitch-views	u_div_e	32	2.309	2.360	4.877	2.11	2.07
twitch-views	u_div_e	64	3.351	3.155	9.354	2.79	2.96
twitch-views	u_div_e	128	6.162	5.675	18.452	2.99	3.25
twitch-views	u_div_e	256	12.338	10.813	36.325	2.94	3.36
twitch-views	u_div_v	32	1.911	2.142	2.712	1.42	1.27
twitch-views	u_div_v	64	2.393	2.575	5.154	2.15	2.00
twitch-views	u_div_v	128	4.034	3.580	9.987	2.48	2.79
twitch-views	u_div_v	256	8.029	7.271	19.293	2.40	2.65
twitch-views	u_dot_e	32	3.121	2.329	3.207	1.03	1.38
twitch-views	u_dot_e	64	3.195	2.545	3.304	1.03	1.30
twitch-views	u_dot_e	128	4.099	3.446	5.180	1.26	1.50
twitch-views	u_dot_e	256	7.702	6.875	8.482	1.10	1.23
twitch-views	u_dot_v	32	2.339	1.934	3.197	1.37	1.65
twitch-views	u_dot_v	64	2.483	1.959	3.313	1.33	1.69
twitch-views	u_dot_v	128	2.771	2.189	4.827	1.74	2.21
twitch-views	u_dot_v	256	3.329	2.658	7.851	2.36	2.95
twitch-views	u_mul_e	32	2.320	2.276	2.775	1.20	1.22
twitch-views	u_mul_e	64	3.314	3.003	5.213	1.57	1.74
twitch-views	u_mul_e	128	5.972	5.588	10.057	1.68	1.80
twitch-views	u_mul_e	256	11.597	10.916	19.430	1.68	1.78
twitch-views	u_mul_v	32	1.845	1.882	2.686	1.46	1.43
twitch-views	u_mul_v	64	2.322	2.151	5.115	2.20	2.38
twitch-views	u_mul_v	128	3.908	3.602	9.892	2.53	2.75
twitch-views	u_mul_v	256	7.775	7.141	19.140	2.46	2.68
twitch-views	u_sub_e	32	2.322	2.277	3.809	1.64	1.67
twitch-views	u_sub_e	64	3.326	2.992	7.255	2.18	2.43
twitch-views	u_sub_e	128	5.968	5.590	14.194	2.38	2.54
twitch-views	u_sub_e	256	11.559	10.926	27.755	2.40	2.54
twitch-views	u_sub_v	32	1.846	1.881	2.700	1.46	1.44
twitch-views	u_sub_v	64	2.327	2.151	5.129	2.20	2.38
twitch-views	u_sub_v	128	3.910	3.602	9.918	2.54	2.75
twitch-views	u_sub_v	256	7.773	7.133	19.192	2.47	2.69
twitch-views	v_add_e	32	1.669	2.049	2.911	1.74	1.42
twitch-views	v_add_e	64	2.625	2.640	5.452	2.08	2.07
twitch-views	v_add_e	128	4.677	4.669	10.542	2.25	2.26
twitch-views	v_add_e	256	8.931	8.774	20.581	2.30	2.35
twitch-views	v_add_u	32	1.836	1.877	2.686	1.46	1.43
twitch-views	v_add_u	64	2.309	2.149	5.104	2.21	2.37
twitch-views	v_add_u	128	3.907	3.605	9.887	2.53	2.74
twitch-views	v_add_u	256	7.778	7.142	19.139	2.46	2.68
twitch-views	v_div_e	32	1.736	2.464	5.009	2.89	2.03
twitch-views	v_div_e	64	2.697	3.032	9.591	3.56	3.16
twitch-views	v_div_e	128	4.925	4.817	18.928	3.84	3.93
twitch-views	v_div_e	256	9.582	8.844	37.489	3.91	4.24
twitch-views	v_div_u	32	1.922	2.140	2.717	1.41	1.27
twitch-views	v_div_u	64	2.401	2.621	5.153	2.15	1.97
twitch-views	v_div_u	128	4.018	3.654	9.987	2.49	2.73
twitch-views	v_div_u	256	8.189	7.182	19.292	2.36	2.69
twitch-views	v_dot_e	32	2.248	2.109	3.287	1.46	1.56
twitch-views	v_dot_e	64	2.422	2.326	3.516	1.45	1.51
twitch-views	v_dot_e	128	3.035	2.705	5.766	1.90	2.13
twitch-views	v_dot_e	256	5.096	4.599	9.857	1.93	2.14
twitch-views	v_dot_u	32	2.314	1.892	3.200	1.38	1.69
twitch-views	v_dot_u	64	2.480	1.959	3.313	1.34	1.69
twitch-views	v_dot_u	128	2.772	2.189	4.815	1.74	2.20
twitch-views	v_dot_u	256	3.326	2.654	7.829	2.35	2.95
twitch-views	v_mul_e	32	1.664	2.037	2.897	1.74	1.42

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
twitch-views	v_mul_e	64	2.644	2.641	5.456	2.06	2.07
twitch-views	v_mul_e	128	4.725	4.701	10.548	2.23	2.24
twitch-views	v_mul_e	256	9.018	8.819	20.602	2.28	2.34
twitch-views	v_mul_u	32	1.831	1.876	2.689	1.47	1.43
twitch-views	v_mul_u	64	2.315	2.155	5.117	2.21	2.37
twitch-views	v_mul_u	128	3.910	3.604	9.909	2.53	2.75
twitch-views	v_mul_u	256	7.798	7.144	19.143	2.45	2.68
twitch-views	v_sub_e	32	1.666	2.045	3.914	2.35	1.91
twitch-views	v_sub_e	64	2.642	2.636	7.501	2.84	2.85
twitch-views	v_sub_e	128	4.711	4.677	14.680	3.12	3.14
twitch-views	v_sub_e	256	9.038	8.809	28.938	3.20	3.28
twitch-views	v_sub_u	32	1.842	1.876	2.707	1.47	1.44
twitch-views	v_sub_u	64	2.324	2.153	5.130	2.21	2.38
twitch-views	v_sub_u	128	3.909	3.605	9.937	2.54	2.76
twitch-views	v_sub_u	256	7.782	7.141	19.210	2.47	2.69
web-topics	copy_u	32	7.737	2.269	3.002	0.39	1.32
web-topics	copy_u	64	8.313	2.698	5.690	0.68	2.11
web-topics	copy_u	128	9.497	4.314	11.000	1.16	2.55
web-topics	copy_u	256	13.152	8.204	21.290	1.62	2.59
web-topics	copy_v	32	3.843	1.853	3.399	0.88	1.83
web-topics	copy_v	64	4.413	2.124	6.463	1.46	3.04
web-topics	copy_v	128	6.074	3.934	12.651	2.08	3.22
web-topics	copy_v	256	9.873	7.726	25.060	2.54	3.24
web-topics	e_add_u	32	8.348	3.070	3.820	0.46	1.24
web-topics	e_add_u	64	9.005	4.328	7.193	0.80	1.66
web-topics	e_add_u	128	11.553	6.939	13.912	1.20	2.00
web-topics	e_add_u	256	18.366	14.887	26.983	1.47	1.81
web-topics	e_add_v	32	6.931	2.884	3.963	0.57	1.37
web-topics	e_add_v	64	7.766	3.731	7.574	0.98	2.03
web-topics	e_add_v	128	10.085	6.627	14.536	1.44	2.19
web-topics	e_add_v	256	21.298	16.154	28.226	1.33	1.75
web-topics	e_div_u	32	9.029	3.252	4.240	0.47	1.30
web-topics	e_div_u	64	9.936	4.491	8.091	0.81	1.80
web-topics	e_div_u	128	13.310	7.033	15.644	1.18	2.22
web-topics	e_div_u	256	30.849	16.532	30.373	0.98	1.84
web-topics	e_div_v	32	7.301	3.241	4.413	0.60	1.36
web-topics	e_div_v	64	8.271	4.112	8.431	1.02	2.05
web-topics	e_div_v	128	10.982	6.771	16.265	1.48	2.40
web-topics	e_div_v	256	24.315	16.116	31.697	1.30	1.97
web-topics	e_dot_u	32	11.480	3.076	4.330	0.38	1.41
web-topics	e_dot_u	64	11.953	3.853	4.649	0.39	1.21
web-topics	e_dot_u	128	12.912	4.691	7.293	0.56	1.55
web-topics	e_dot_u	256	18.927	12.248	12.255	0.65	1.00
web-topics	e_dot_v	32	8.905	2.931	4.432	0.50	1.51
web-topics	e_dot_v	64	9.215	3.130	4.936	0.54	1.58
web-topics	e_dot_v	128	9.921	3.655	8.002	0.81	2.19
web-topics	e_dot_v	256	16.311	9.049	13.682	0.84	1.51
web-topics	e_mul_u	32	8.370	3.069	3.820	0.46	1.24
web-topics	e_mul_u	64	9.069	4.326	7.228	0.80	1.67
web-topics	e_mul_u	128	11.654	6.941	13.909	1.19	2.00
web-topics	e_mul_u	256	18.111	12.904	26.919	1.49	2.09
web-topics	e_mul_v	32	6.932	2.884	3.984	0.57	1.38
web-topics	e_mul_v	64	7.766	3.731	7.574	0.98	2.03
web-topics	e_mul_v	128	10.084	6.627	14.538	1.44	2.19
web-topics	e_mul_v	256	22.543	16.190	28.222	1.25	1.74
web-topics	e_sub_u	32	8.374	3.077	4.021	0.48	1.31
web-topics	e_sub_u	64	9.070	4.327	7.653	0.84	1.77
web-topics	e_sub_u	128	11.659	6.941	14.768	1.27	2.13
web-topics	e_sub_u	256	24.097	16.533	28.627	1.19	1.73
web-topics	e_sub_v	32	6.938	2.884	4.188	0.60	1.45
web-topics	e_sub_v	64	7.763	3.731	7.995	1.03	2.14
web-topics	e_sub_v	128	10.085	6.629	15.386	1.53	2.32
web-topics	e_sub_v	256	16.947	12.862	29.934	1.77	2.33
web-topics	u_add_e	32	8.284	3.068	3.829	0.46	1.25
web-topics	u_add_e	64	8.986	4.314	7.261	0.81	1.68
web-topics	u_add_e	128	11.529	6.920	13.959	1.21	2.02
web-topics	u_add_e	256	17.977	12.801	26.999	1.50	2.11
web-topics	u_add_v	32	8.704	2.550	3.964	0.46	1.55
web-topics	u_add_v	64	9.394	2.957	7.497	0.80	2.54
web-topics	u_add_v	128	10.663	5.022	14.337	1.34	2.86
web-topics	u_add_v	256	14.415	9.517	27.469	1.91	2.89
web-topics	u_div_e	32	8.418	3.179	6.580	0.78	2.07
web-topics	u_div_e	64	9.412	4.482	12.900	1.37	2.88
web-topics	u_div_e	128	12.759	7.007	25.319	1.98	3.61
web-topics	u_div_e	256	22.701	12.732	49.880	2.20	3.92
web-topics	u_div_v	32	8.964	2.784	4.408	0.49	1.58
web-topics	u_div_v	64	9.733	3.380	8.383	0.86	2.48
web-topics	u_div_v	128	11.679	5.012	16.093	1.38	3.21

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
web-topics	u_div_v	256	18.675	9.563	30.999	1.66	3.24
web-topics	u_dot_e	32	11.660	3.101	4.274	0.37	1.38
web-topics	u_dot_e	64	11.889	3.889	4.607	0.39	1.18
web-topics	u_dot_e	128	12.558	4.783	7.305	0.58	1.53
web-topics	u_dot_e	256	15.538	7.987	12.279	0.79	1.54
web-topics	u_dot_v	32	11.589	2.615	4.510	0.39	1.72
web-topics	u_dot_v	64	11.973	2.659	4.789	0.40	1.80
web-topics	u_dot_v	128	12.620	2.891	7.322	0.58	2.53
web-topics	u_dot_v	256	13.414	3.742	12.101	0.90	3.23
web-topics	u_mul_e	32	8.287	3.068	3.828	0.46	1.25
web-topics	u_mul_e	64	8.989	4.313	7.261	0.81	1.68
web-topics	u_mul_e	128	11.557	6.922	13.956	1.21	2.02
web-topics	u_mul_e	256	18.122	12.792	27.031	1.49	2.11
web-topics	u_mul_v	32	8.719	2.550	3.984	0.46	1.56
web-topics	u_mul_v	64	9.406	2.956	7.528	0.80	2.55
web-topics	u_mul_v	128	10.740	5.023	14.410	1.34	2.87
web-topics	u_mul_v	256	14.427	9.502	27.614	1.91	2.91
web-topics	u_sub_e	32	8.298	3.069	5.176	0.62	1.69
web-topics	u_sub_e	64	8.989	4.313	10.035	1.12	2.33
web-topics	u_sub_e	128	11.544	6.917	19.565	1.69	2.83
web-topics	u_sub_e	256	18.138	12.797	38.291	2.11	2.99
web-topics	u_sub_v	32	8.723	2.553	4.190	0.48	1.64
web-topics	u_sub_v	64	9.406	2.956	7.946	0.84	2.69
web-topics	u_sub_v	128	10.733	5.023	15.220	1.42	3.03
web-topics	u_sub_v	256	14.422	9.501	29.257	2.03	3.08
web-topics	v_add_e	32	6.899	2.882	4.020	0.58	1.39
web-topics	v_add_e	64	7.656	3.727	7.593	0.99	2.04
web-topics	v_add_e	128	9.995	6.612	14.578	1.46	2.20
web-topics	v_add_e	256	15.739	12.380	28.303	1.80	2.29
web-topics	v_add_u	32	8.708	2.550	3.976	0.46	1.56
web-topics	v_add_u	64	9.337	2.958	7.528	0.81	2.54
web-topics	v_add_u	128	10.584	5.028	14.392	1.36	2.86
web-topics	v_add_u	256	14.427	9.503	27.601	1.91	2.90
web-topics	v_div_e	32	7.335	3.258	6.772	0.92	2.08
web-topics	v_div_e	64	8.365	4.118	13.244	1.58	3.22
web-topics	v_div_e	128	12.081	6.752	25.946	2.15	3.84
web-topics	v_div_e	256	19.242	12.454	51.153	2.66	4.11
web-topics	v_div_u	32	9.019	2.796	4.403	0.49	1.57
web-topics	v_div_u	64	9.874	3.406	8.402	0.85	2.47
web-topics	v_div_u	128	11.710	5.018	16.090	1.37	3.21
web-topics	v_div_u	256	20.268	10.041	30.985	1.53	3.09
web-topics	v_dot_e	32	8.906	2.952	4.422	0.50	1.50
web-topics	v_dot_e	64	9.203	3.218	4.910	0.53	1.53
web-topics	v_dot_e	128	9.804	3.899	7.990	0.81	2.05
web-topics	v_dot_e	256	14.043	6.972	13.666	0.97	1.96
web-topics	v_dot_u	32	11.618	2.626	4.507	0.39	1.72
web-topics	v_dot_u	64	11.971	2.647	4.786	0.40	1.81
web-topics	v_dot_u	128	12.634	2.881	7.305	0.58	2.54
web-topics	v_dot_u	256	14.248	4.273	12.077	0.85	2.83
web-topics	v_mul_e	32	6.903	2.882	4.019	0.58	1.39
web-topics	v_mul_e	64	7.657	3.726	7.590	0.99	2.04
web-topics	v_mul_e	128	9.998	6.608	14.577	1.46	2.21
web-topics	v_mul_e	256	16.820	12.728	28.301	1.68	2.22
web-topics	v_mul_u	32	8.724	2.549	3.987	0.46	1.56
web-topics	v_mul_u	64	9.399	2.959	7.547	0.80	2.55
web-topics	v_mul_u	128	10.738	5.023	14.411	1.34	2.87
web-topics	v_mul_u	256	14.453	9.504	27.623	1.91	2.91
web-topics	v_sub_e	32	6.899	2.882	5.362	0.78	1.86
web-topics	v_sub_e	64	7.656	3.724	10.371	1.35	2.79
web-topics	v_sub_e	128	10.002	6.607	20.195	2.02	3.06
web-topics	v_sub_e	256	15.864	12.446	39.565	2.49	3.18
web-topics	v_sub_u	32	8.712	2.550	4.190	0.48	1.64
web-topics	v_sub_u	64	9.413	2.957	7.969	0.85	2.69
web-topics	v_sub_u	128	10.733	5.024	15.216	1.42	3.03
web-topics	v_sub_u	256	14.466	9.504	29.251	2.02	3.08
WikiCS	copy_u	32	0.093	0.065	0.092	0.98	1.41
WikiCS	copy_u	64	0.108	0.066	0.165	1.53	2.50
WikiCS	copy_u	128	0.145	0.086	0.293	2.03	3.41
WikiCS	copy_u	256	0.245	0.162	0.523	2.14	3.23
WikiCS	copy_v	32	0.064	0.062	0.090	1.42	1.45
WikiCS	copy_v	64	0.065	0.064	0.161	2.49	2.52
WikiCS	copy_v	128	0.099	0.090	0.282	2.86	3.15
WikiCS	copy_v	256	0.190	0.168	0.521	2.75	3.11
WikiCS	e_add_u	32	0.135	0.078	0.110	0.81	1.41
WikiCS	e_add_u	64	0.149	0.092	0.199	1.33	2.15
WikiCS	e_add_u	128	0.225	0.162	0.368	1.63	2.27
WikiCS	e_add_u	256	0.379	0.304	0.690	1.82	2.27
WikiCS	e_add_v	32	0.099	0.075	0.109	1.11	1.47

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
WikiCS	e_add_v	64	0.126	0.101	0.198	1.57	1.96
WikiCS	e_add_v	128	0.200	0.159	0.368	1.85	2.32
WikiCS	e_add_v	256	0.346	0.296	0.685	1.98	2.32
WikiCS	e_div_u	32	0.141	0.083	0.119	0.84	1.44
WikiCS	e_div_u	64	0.167	0.101	0.210	1.26	2.07
WikiCS	e_div_u	128	0.238	0.163	0.381	1.60	2.33
WikiCS	e_div_u	256	0.460	0.311	0.703	1.53	2.26
WikiCS	e_div_v	32	0.106	0.087	0.118	1.12	1.36
WikiCS	e_div_v	64	0.135	0.106	0.208	1.54	1.97
WikiCS	e_div_v	128	0.216	0.163	0.380	1.76	2.33
WikiCS	e_div_v	256	0.380	0.302	0.703	1.85	2.33
WikiCS	e_dot_u	32	0.175	0.077	0.107	0.62	1.40
WikiCS	e_dot_u	64	0.194	0.084	0.116	0.60	1.37
WikiCS	e_dot_u	128	0.231	0.095	0.177	0.77	1.86
WikiCS	e_dot_u	256	0.295	0.164	0.286	0.97	1.75
WikiCS	e_dot_v	32	0.141	0.075	0.107	0.76	1.44
WikiCS	e_dot_v	64	0.160	0.082	0.115	0.72	1.41
WikiCS	e_dot_v	128	0.180	0.092	0.175	0.98	1.90
WikiCS	e_dot_v	256	0.240	0.151	0.292	1.22	1.94
WikiCS	e_mul_u	32	0.137	0.078	0.110	0.80	1.40
WikiCS	e_mul_u	64	0.149	0.092	0.199	1.33	2.15
WikiCS	e_mul_u	128	0.228	0.162	0.367	1.61	2.27
WikiCS	e_mul_u	256	0.383	0.305	0.685	1.79	2.25
WikiCS	e_mul_v	32	0.098	0.075	0.109	1.12	1.46
WikiCS	e_mul_v	64	0.126	0.091	0.200	1.59	2.20
WikiCS	e_mul_v	128	0.200	0.159	0.367	1.83	2.31
WikiCS	e_mul_v	256	0.348	0.294	0.690	1.98	2.35
WikiCS	e_sub_u	32	0.135	0.078	0.122	0.90	1.56
WikiCS	e_sub_u	64	0.149	0.092	0.204	1.36	2.21
WikiCS	e_sub_u	128	0.228	0.162	0.374	1.64	2.31
WikiCS	e_sub_u	256	0.382	0.305	0.695	1.82	2.28
WikiCS	e_sub_v	32	0.098	0.075	0.114	1.17	1.52
WikiCS	e_sub_v	64	0.127	0.091	0.203	1.61	2.23
WikiCS	e_sub_v	128	0.200	0.159	0.374	1.87	2.34
WikiCS	e_sub_v	256	0.347	0.295	0.696	2.01	2.36
WikiCS	u_add_e	32	0.134	0.078	0.111	0.83	1.42
WikiCS	u_add_e	64	0.149	0.093	0.201	1.35	2.16
WikiCS	u_add_e	128	0.224	0.167	0.369	1.65	2.20
WikiCS	u_add_e	256	0.379	0.304	0.684	1.80	2.25
WikiCS	u_add_v	32	0.099	0.062	0.102	1.04	1.64
WikiCS	u_add_v	64	0.112	0.064	0.184	1.65	2.85
WikiCS	u_add_v	128	0.151	0.091	0.334	2.21	3.67
WikiCS	u_add_v	256	0.254	0.170	0.620	2.44	3.65
WikiCS	u_div_e	32	0.129	0.081	0.183	1.42	2.26
WikiCS	u_div_e	64	0.158	0.100	0.336	2.12	3.37
WikiCS	u_div_e	128	0.236	0.164	0.640	2.71	3.91
WikiCS	u_div_e	256	0.457	0.306	1.221	2.68	3.99
WikiCS	u_div_v	32	0.105	0.068	0.113	1.08	1.66
WikiCS	u_div_v	64	0.122	0.080	0.195	1.60	2.45
WikiCS	u_div_v	128	0.174	0.098	0.348	2.00	3.54
WikiCS	u_div_v	256	0.299	0.173	0.642	2.15	3.72
WikiCS	u_dot_e	32	0.183	0.077	0.108	0.59	1.40
WikiCS	u_dot_e	64	0.202	0.086	0.115	0.57	1.33
WikiCS	u_dot_e	128	0.215	0.100	0.175	0.82	1.76
WikiCS	u_dot_e	256	0.289	0.168	0.286	0.99	1.71
WikiCS	u_dot_v	32	0.104	0.061	0.090	0.86	1.48
WikiCS	u_dot_v	64	0.108	0.061	0.092	0.85	1.51
WikiCS	u_dot_v	128	0.115	0.070	0.127	1.10	1.81
WikiCS	u_dot_v	256	0.136	0.079	0.211	1.56	2.67
WikiCS	u_mul_e	32	0.135	0.078	0.111	0.82	1.42
WikiCS	u_mul_e	64	0.149	0.092	0.200	1.34	2.17
WikiCS	u_mul_e	128	0.224	0.162	0.368	1.64	2.27
WikiCS	u_mul_e	256	0.381	0.304	0.684	1.80	2.25
WikiCS	u_mul_v	32	0.098	0.066	0.103	1.05	1.56
WikiCS	u_mul_v	64	0.113	0.064	0.184	1.64	2.86
WikiCS	u_mul_v	128	0.153	0.091	0.337	2.20	3.70
WikiCS	u_mul_v	256	0.255	0.170	0.625	2.45	3.68
WikiCS	u_sub_e	32	0.135	0.078	0.145	1.08	1.87
WikiCS	u_sub_e	64	0.149	0.092	0.264	1.78	2.86
WikiCS	u_sub_e	128	0.224	0.162	0.497	2.22	3.07
WikiCS	u_sub_e	256	0.383	0.304	0.947	2.47	3.11
WikiCS	u_sub_v	32	0.099	0.063	0.108	1.10	1.72
WikiCS	u_sub_v	64	0.113	0.064	0.189	1.67	2.93
WikiCS	u_sub_v	128	0.153	0.091	0.342	2.23	3.76
WikiCS	u_sub_v	256	0.256	0.170	0.634	2.48	3.72
WikiCS	v_add_e	32	0.098	0.075	0.112	1.14	1.50
WikiCS	v_add_e	64	0.127	0.091	0.199	1.57	2.19
WikiCS	v_add_e	128	0.197	0.159	0.368	1.87	2.31

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graph	op	d	node (ms)	edge (ms)	DGL (ms)	node vs DGL	edge vs DGL
WikiCS	v_add_e	256	0.344	0.295	0.685	1.99	2.33
WikiCS	v_add_u	32	0.098	0.063	0.103	1.05	1.64
WikiCS	v_add_u	64	0.112	0.065	0.184	1.64	2.84
WikiCS	v_add_u	128	0.151	0.091	0.335	2.22	3.69
WikiCS	v_add_u	256	0.254	0.169	0.624	2.45	3.68
WikiCS	v_div_e	32	0.106	0.089	0.182	1.71	2.05
WikiCS	v_div_e	64	0.138	0.106	0.336	2.43	3.16
WikiCS	v_div_e	128	0.217	0.163	0.638	2.94	3.90
WikiCS	v_div_e	256	0.402	0.296	1.221	3.03	4.12
WikiCS	v_div_u	32	0.107	0.069	0.114	1.07	1.65
WikiCS	v_div_u	64	0.124	0.081	0.194	1.56	2.40
WikiCS	v_div_u	128	0.174	0.103	0.346	1.99	3.36
WikiCS	v_div_u	256	0.311	0.171	0.641	2.06	3.74
WikiCS	v_dot_e	32	0.149	0.074	0.107	0.72	1.46
WikiCS	v_dot_e	64	0.160	0.083	0.114	0.71	1.36
WikiCS	v_dot_e	128	0.178	0.097	0.177	0.99	1.83
WikiCS	v_dot_e	256	0.240	0.160	0.293	1.22	1.83
WikiCS	v_dot_u	32	0.105	0.061	0.089	0.86	1.47
WikiCS	v_dot_u	64	0.108	0.061	0.091	0.85	1.49
WikiCS	v_dot_u	128	0.116	0.071	0.127	1.10	1.80
WikiCS	v_dot_u	256	0.136	0.079	0.213	1.57	2.72
WikiCS	v_mul_e	32	0.098	0.075	0.111	1.13	1.49
WikiCS	v_mul_e	64	0.127	0.091	0.200	1.57	2.19
WikiCS	v_mul_e	128	0.197	0.159	0.369	1.87	2.32
WikiCS	v_mul_e	256	0.349	0.294	0.685	1.96	2.33
WikiCS	v_mul_u	32	0.098	0.062	0.104	1.06	1.66
WikiCS	v_mul_u	64	0.113	0.065	0.185	1.63	2.84
WikiCS	v_mul_u	128	0.151	0.091	0.336	2.22	3.69
WikiCS	v_mul_u	256	0.255	0.171	0.625	2.45	3.64
WikiCS	v_sub_e	32	0.098	0.075	0.145	1.47	1.94
WikiCS	v_sub_e	64	0.128	0.091	0.264	2.07	2.89
WikiCS	v_sub_e	128	0.198	0.165	0.498	2.52	3.03
WikiCS	v_sub_e	256	0.348	0.294	0.947	2.72	3.22
WikiCS	v_sub_u	32	0.098	0.062	0.107	1.09	1.71
WikiCS	v_sub_u	64	0.113	0.065	0.187	1.66	2.87
WikiCS	v_sub_u	128	0.154	0.091	0.339	2.21	3.72
WikiCS	v_sub_u	256	0.255	0.170	0.634	2.49	3.73

K.5 ASYNCHRONOUS STAGING SWEEP

Table 10: The complete asynchronous-staging sweep for both primitive families, raw milliseconds. Ratio is $t_{\text{depth}=0}/t_{\text{depth}=N}$; above 1.000 would mean the pipeline helps. For g-SDDMM, epw is edges per warp — epw1 is the control, where a pipeline has nothing to prefetch across.

family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	artnet-exp	bwd	add/max	64	0.1916	0.1753	1.092
g-SpMM	1	artnet-exp	bwd	add/min	64	0.2348	0.1754	1.338
g-SpMM	1	artnet-exp	bwd	add/sum	64	0.3018	0.2492	1.211
g-SpMM	1	artnet-exp	bwd	copy_e/max	64	0.1869	0.1355	1.379
g-SpMM	1	artnet-exp	bwd	copy_e/min	64	0.1819	0.1362	1.336
g-SpMM	1	artnet-exp	bwd	copy_e/sum	64	0.2062	0.1453	1.419
g-SpMM	1	artnet-exp	bwd	copy_u/max	64	0.2039	0.1454	1.402
g-SpMM	1	artnet-exp	bwd	copy_u/min	64	0.2034	0.1451	1.402
g-SpMM	1	artnet-exp	bwd	copy_u/sum	64	0.2448	0.1756	1.394
g-SpMM	1	artnet-exp	bwd	div/max	64	0.2148	0.2130	1.009
g-SpMM	1	artnet-exp	bwd	div/min	64	0.2274	0.2123	1.071
g-SpMM	1	artnet-exp	bwd	div/sum	64	0.4886	0.7543	0.648
g-SpMM	1	artnet-exp	bwd	mul/max	64	0.2148	0.2122	1.013
g-SpMM	1	artnet-exp	bwd	mul/min	64	0.2146	0.2130	1.008
g-SpMM	1	artnet-exp	bwd	mul/sum	64	0.3649	0.5827	0.626
g-SpMM	1	artnet-exp	bwd	sub/max	64	0.2015	0.1758	1.146
g-SpMM	1	artnet-exp	bwd	sub/min	64	0.2005	0.1760	1.140
g-SpMM	1	artnet-exp	bwd	sub/sum	64	0.2572	0.2461	1.045
g-SpMM	1	artnet-exp	fb	add/max	64	0.5123	0.5191	0.987
g-SpMM	1	artnet-exp	fb	add/min	64	0.4940	0.5191	0.952
g-SpMM	1	artnet-exp	fb	add/sum	64	0.5275	0.5534	0.953
g-SpMM	1	artnet-exp	fb	copy_e/max	64	0.4805	0.3295	1.459
g-SpMM	1	artnet-exp	fb	copy_e/min	64	0.4351	0.3267	1.332
g-SpMM	1	artnet-exp	fb	copy_e/sum	64	0.4287	0.3119	1.374
g-SpMM	1	artnet-exp	fb	copy_u/max	64	0.4471	0.3328	1.343
g-SpMM	1	artnet-exp	fb	copy_u/min	64	0.4626	0.3332	1.388
g-SpMM	1	artnet-exp	fb	copy_u/sum	64	0.4854	0.3435	1.413

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	artnet-exp	fb	div/max	64	0.4204	0.5535	0.760
g-SpMM	1	artnet-exp	fb	div/min	64	0.4234	0.5533	0.765
g-SpMM	1	artnet-exp	fb	div/sum	64	0.6981	1.0434	0.669
g-SpMM	1	artnet-exp	fb	mul/max	64	0.4234	0.5531	0.766
g-SpMM	1	artnet-exp	fb	mul/min	64	0.4122	0.5536	0.745
g-SpMM	1	artnet-exp	fb	mul/sum	64	0.5592	0.8564	0.653
g-SpMM	1	artnet-exp	fb	sub/max	64	0.4087	0.5202	0.786
g-SpMM	1	artnet-exp	fb	sub/min	64	0.4004	0.5200	0.770
g-SpMM	1	artnet-exp	fb	sub/sum	64	0.4861	0.5559	0.874
g-SpMM	1	artnet-exp	fwd	add/max	64	0.1729	0.3465	0.499
g-SpMM	1	artnet-exp	fwd	add/min	64	0.1770	0.3470	0.510
g-SpMM	1	artnet-exp	fwd	add/sum	64	0.2135	0.3046	0.701
g-SpMM	1	artnet-exp	fwd	copy_e/max	64	0.1145	0.1144	1.000
g-SpMM	1	artnet-exp	fwd	copy_e/min	64	0.1139	0.1142	0.998
g-SpMM	1	artnet-exp	fwd	copy_e/sum	64	0.1420	0.1375	1.033
g-SpMM	1	artnet-exp	fwd	copy_u/max	64	0.1014	0.1874	0.541
g-SpMM	1	artnet-exp	fwd	copy_u/min	64	0.1022	0.1871	0.546
g-SpMM	1	artnet-exp	fwd	copy_u/sum	64	0.0898	0.1139	0.788
g-SpMM	1	artnet-exp	fwd	div/max	64	0.1739	0.3497	0.497
g-SpMM	1	artnet-exp	fwd	div/min	64	0.1784	0.3491	0.511
g-SpMM	1	artnet-exp	fwd	div/sum	64	0.2160	0.2951	0.732
g-SpMM	1	artnet-exp	fwd	mul/max	64	0.1736	0.3467	0.501
g-SpMM	1	artnet-exp	fwd	mul/min	64	0.1806	0.3575	0.505
g-SpMM	1	artnet-exp	fwd	mul/sum	64	0.2022	0.2825	0.716
g-SpMM	1	artnet-exp	fwd	sub/max	64	0.1740	0.3468	0.502
g-SpMM	1	artnet-exp	fwd	sub/min	64	0.1739	0.3480	0.500
g-SpMM	1	artnet-exp	fwd	sub/sum	64	0.2148	0.3015	0.713
g-SpMM	1	artnet-exp	bwd	add/max	128	0.3427	0.3427	1.000
g-SpMM	1	artnet-exp	bwd	add/min	128	0.3432	0.3429	1.001
g-SpMM	1	artnet-exp	bwd	add/sum	128	0.3233	0.4636	0.697
g-SpMM	1	artnet-exp	bwd	copy_e/max	128	0.2444	0.2445	0.999
g-SpMM	1	artnet-exp	bwd	copy_e/min	128	0.2437	0.2440	0.999
g-SpMM	1	artnet-exp	bwd	copy_e/sum	128	0.2010	0.1926	1.043
g-SpMM	1	artnet-exp	bwd	copy_u/max	128	0.1978	0.1871	1.057
g-SpMM	1	artnet-exp	bwd	copy_u/min	128	0.2296	0.1986	1.156
g-SpMM	1	artnet-exp	bwd	copy_u/sum	128	0.2664	0.2838	0.939
g-SpMM	1	artnet-exp	bwd	div/max	128	0.4240	0.4236	1.001
g-SpMM	1	artnet-exp	bwd	div/min	128	0.4237	0.4250	0.997
g-SpMM	1	artnet-exp	bwd	div/sum	128	0.8772	1.3616	0.644
g-SpMM	1	artnet-exp	bwd	mul/max	128	0.4244	0.4237	1.002
g-SpMM	1	artnet-exp	bwd	mul/min	128	0.4241	0.4256	0.996
g-SpMM	1	artnet-exp	bwd	mul/sum	128	0.6538	1.0816	0.604
g-SpMM	1	artnet-exp	bwd	sub/max	128	0.3451	0.3432	1.005
g-SpMM	1	artnet-exp	bwd	sub/min	128	0.3436	0.3424	1.003
g-SpMM	1	artnet-exp	bwd	sub/sum	128	0.3267	0.4639	0.704
g-SpMM	1	artnet-exp	fb	add/max	128	0.6605	0.9677	0.683
g-SpMM	1	artnet-exp	fb	add/min	128	0.6572	0.9694	0.678
g-SpMM	1	artnet-exp	fb	add/sum	128	0.7052	1.0154	0.695
g-SpMM	1	artnet-exp	fb	copy_e/max	128	0.4434	0.4886	0.908
g-SpMM	1	artnet-exp	fb	copy_e/min	128	0.4446	0.4426	1.004
g-SpMM	1	artnet-exp	fb	copy_e/sum	128	0.4066	0.4117	0.988
g-SpMM	1	artnet-exp	fb	copy_u/max	128	0.4769	0.5172	0.922
g-SpMM	1	artnet-exp	fb	copy_u/min	128	0.4919	0.5168	0.952
g-SpMM	1	artnet-exp	fb	copy_u/sum	128	0.5100	0.6313	0.808
g-SpMM	1	artnet-exp	fb	div/max	128	0.7434	1.0507	0.708
g-SpMM	1	artnet-exp	fb	div/min	128	0.7451	1.0524	0.708
g-SpMM	1	artnet-exp	fb	div/sum	128	1.2630	1.9060	0.663
g-SpMM	1	artnet-exp	fb	mul/max	128	0.7406	1.0436	0.710
g-SpMM	1	artnet-exp	fb	mul/min	128	0.7436	1.0420	0.714
g-SpMM	1	artnet-exp	fb	mul/sum	128	1.0152	1.5678	0.648
g-SpMM	1	artnet-exp	fb	sub/max	128	0.6582	0.9669	0.681
g-SpMM	1	artnet-exp	fb	sub/min	128	0.6597	0.9742	0.677
g-SpMM	1	artnet-exp	fb	sub/sum	128	0.8401	1.0126	0.830
g-SpMM	1	artnet-exp	fwd	add/max	128	0.3280	0.6305	0.520
g-SpMM	1	artnet-exp	fwd	add/min	128	0.3231	0.6420	0.503
g-SpMM	1	artnet-exp	fwd	add/sum	128	0.3957	0.5520	0.717
g-SpMM	1	artnet-exp	fwd	copy_e/max	128	0.2144	0.2682	0.799
g-SpMM	1	artnet-exp	fwd	copy_e/min	128	0.2132	0.2125	1.003
g-SpMM	1	artnet-exp	fwd	copy_e/sum	128	0.2533	0.2541	0.997
g-SpMM	1	artnet-exp	fwd	copy_u/max	128	0.1960	0.3741	0.524
g-SpMM	1	artnet-exp	fwd	copy_u/min	128	0.1951	0.3763	0.518
g-SpMM	1	artnet-exp	fwd	copy_u/sum	128	0.1643	0.2805	0.585
g-SpMM	1	artnet-exp	fwd	div/max	128	0.3262	0.6310	0.517
g-SpMM	1	artnet-exp	fwd	div/min	128	0.3296	0.6547	0.503
g-SpMM	1	artnet-exp	fwd	div/sum	128	0.3879	0.5427	0.715
g-SpMM	1	artnet-exp	fwd	mul/max	128	0.3923	0.6319	0.621
g-SpMM	1	artnet-exp	fwd	mul/min	128	0.3311	0.6495	0.510
g-SpMM	1	artnet-exp	fwd	mul/sum	128	0.3647	0.5202	0.701

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	artnet-exp	fwd	sub/max	128	0.3213	0.6303	0.510
g-SpMM	1	artnet-exp	fwd	sub/min	128	0.3228	0.6421	0.503
g-SpMM	1	artnet-exp	fwd	sub/sum	128	0.3851	0.5530	0.696
g-SpMM	1	artnet-exp	bwd	add/max	256	0.7015	0.7036	0.997
g-SpMM	1	artnet-exp	bwd	add/min	256	0.7018	0.7025	0.999
g-SpMM	1	artnet-exp	bwd	add/sum	256	0.6362	0.9031	0.704
g-SpMM	1	artnet-exp	bwd	copy_e/max	256	0.4684	0.4677	1.002
g-SpMM	1	artnet-exp	bwd	copy_e/min	256	0.4692	0.4717	0.995
g-SpMM	1	artnet-exp	bwd	copy_e/sum	256	0.2924	0.2885	1.013
g-SpMM	1	artnet-exp	bwd	copy_u/max	256	0.2644	0.2638	1.002
g-SpMM	1	artnet-exp	bwd	copy_u/min	256	0.2647	0.2645	1.001
g-SpMM	1	artnet-exp	bwd	copy_u/sum	256	0.3375	0.5958	0.566
g-SpMM	1	artnet-exp	bwd	div/max	256	0.8784	0.8789	0.999
g-SpMM	1	artnet-exp	bwd	div/min	256	0.8751	0.8780	0.997
g-SpMM	1	artnet-exp	bwd	div/sum	256	1.6723	2.6005	0.643
g-SpMM	1	artnet-exp	bwd	mul/max	256	0.8727	0.8748	0.998
g-SpMM	1	artnet-exp	bwd	mul/min	256	0.8800	0.8762	1.004
g-SpMM	1	artnet-exp	bwd	mul/sum	256	1.2434	2.0196	0.616
g-SpMM	1	artnet-exp	bwd	sub/max	256	0.7010	0.7095	0.988
g-SpMM	1	artnet-exp	bwd	sub/min	256	0.7028	0.7030	1.000
g-SpMM	1	artnet-exp	bwd	sub/sum	256	0.6373	0.9127	0.698
g-SpMM	1	artnet-exp	fb	add/max	256	1.3061	1.8921	0.690
g-SpMM	1	artnet-exp	fb	add/min	256	1.3071	1.8821	0.695
g-SpMM	1	artnet-exp	fb	add/sum	256	1.3606	1.9561	0.696
g-SpMM	1	artnet-exp	fb	copy_e/max	256	0.8528	0.8517	1.001
g-SpMM	1	artnet-exp	fb	copy_e/min	256	0.8552	0.8502	1.006
g-SpMM	1	artnet-exp	fb	copy_e/sum	256	0.7609	0.7690	0.990
g-SpMM	1	artnet-exp	fb	copy_u/max	256	0.6381	1.0411	0.613
g-SpMM	1	artnet-exp	fb	copy_u/min	256	0.6384	1.0448	0.611
g-SpMM	1	artnet-exp	fb	copy_u/sum	256	0.6830	1.2442	0.549
g-SpMM	1	artnet-exp	fb	div/max	256	1.4940	2.0823	0.717
g-SpMM	1	artnet-exp	fb	div/min	256	1.5028	2.0816	0.722
g-SpMM	1	artnet-exp	fb	div/sum	256	2.4097	3.6320	0.663
g-SpMM	1	artnet-exp	fb	mul/max	256	1.4859	2.0724	0.717
g-SpMM	1	artnet-exp	fb	mul/min	256	1.4975	2.0721	0.723
g-SpMM	1	artnet-exp	fb	mul/sum	256	1.9188	3.0065	0.638
g-SpMM	1	artnet-exp	fb	sub/max	256	1.2952	1.8936	0.684
g-SpMM	1	artnet-exp	fb	sub/min	256	1.3043	1.8928	0.689
g-SpMM	1	artnet-exp	fb	sub/sum	256	1.3578	1.9719	0.689
g-SpMM	1	artnet-exp	fwd	add/max	256	0.6153	1.2007	0.512
g-SpMM	1	artnet-exp	fwd	add/min	256	0.6306	1.2304	0.513
g-SpMM	1	artnet-exp	fwd	add/sum	256	0.7361	1.0479	0.702
g-SpMM	1	artnet-exp	fwd	copy_e/max	256	0.3955	0.3958	0.999
g-SpMM	1	artnet-exp	fwd	copy_e/min	256	0.4247	0.4040	1.051
g-SpMM	1	artnet-exp	fwd	copy_e/sum	256	0.4897	0.4855	1.009
g-SpMM	1	artnet-exp	fwd	copy_u/max	256	0.3791	0.7475	0.507
g-SpMM	1	artnet-exp	fwd	copy_u/min	256	0.3741	0.7513	0.498
g-SpMM	1	artnet-exp	fwd	copy_u/sum	256	0.3337	0.5886	0.567
g-SpMM	1	artnet-exp	fwd	div/max	256	0.6253	1.2067	0.518
g-SpMM	1	artnet-exp	fwd	div/min	256	0.6341	1.2430	0.510
g-SpMM	1	artnet-exp	fwd	div/sum	256	0.7436	1.0356	0.718
g-SpMM	1	artnet-exp	fwd	mul/max	256	0.6182	1.2235	0.505
g-SpMM	1	artnet-exp	fwd	mul/min	256	0.8611	1.2400	0.694
g-SpMM	1	artnet-exp	fwd	mul/sum	256	0.6778	1.0081	0.672
g-SpMM	1	artnet-exp	fwd	sub/max	256	0.6140	1.1974	0.513
g-SpMM	1	artnet-exp	fwd	sub/min	256	0.6345	1.2450	0.510
g-SpMM	1	artnet-exp	fwd	sub/sum	256	0.7318	1.0357	0.706
g-SpMM	1	artnet-exp	bwd	add/max	512	1.5567	1.5610	0.997
g-SpMM	1	artnet-exp	bwd	add/min	512	1.5636	1.5612	1.002
g-SpMM	1	artnet-exp	bwd	add/sum	512	1.2048	1.8105	0.665
g-SpMM	1	artnet-exp	bwd	copy_e/max	512	0.9502	0.9497	1.001
g-SpMM	1	artnet-exp	bwd	copy_e/min	512	0.9494	0.9475	1.002
g-SpMM	1	artnet-exp	bwd	copy_e/sum	512	0.6041	0.6879	0.878
g-SpMM	1	artnet-exp	bwd	copy_u/max	512	0.5815	0.5814	1.000
g-SpMM	1	artnet-exp	bwd	copy_u/min	512	0.5817	0.5810	1.001
g-SpMM	1	artnet-exp	bwd	copy_u/sum	512	0.6122	1.2013	0.510
g-SpMM	1	artnet-exp	bwd	div/max	512	1.9724	1.9607	1.006
g-SpMM	1	artnet-exp	bwd	div/min	512	1.9644	1.9628	1.001
g-SpMM	1	artnet-exp	bwd	div/sum	512	3.2054	5.0088	0.640
g-SpMM	1	artnet-exp	bwd	mul/max	512	1.9565	1.9602	0.998
g-SpMM	1	artnet-exp	bwd	mul/min	512	1.9542	1.9561	0.999
g-SpMM	1	artnet-exp	bwd	mul/sum	512	2.3023	3.8769	0.594
g-SpMM	1	artnet-exp	bwd	sub/max	512	1.5597	1.5619	0.999
g-SpMM	1	artnet-exp	bwd	sub/min	512	1.5665	1.5646	1.001
g-SpMM	1	artnet-exp	bwd	sub/sum	512	1.1972	1.8185	0.658
g-SpMM	1	artnet-exp	fb	add/max	512	2.7451	3.8852	0.707
g-SpMM	1	artnet-exp	fb	add/min	512	2.7415	3.8974	0.703
g-SpMM	1	artnet-exp	fb	add/sum	512	2.9775	3.8859	0.766

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	artnet-exp	fb	copy_e/max	512	1.7314	1.7180	1.008
g-SpMM	1	artnet-exp	fb	copy_e/min	512	1.7141	1.7149	1.000
g-SpMM	1	artnet-exp	fb	copy_e/sum	512	1.5090	1.4903	1.013
g-SpMM	1	artnet-exp	fb	copy_u/max	512	1.2421	2.1057	0.590
g-SpMM	1	artnet-exp	fb	copy_u/min	512	1.2369	2.0965	0.590
g-SpMM	1	artnet-exp	fb	copy_u/sum	512	1.2209	2.4408	0.500
g-SpMM	1	artnet-exp	fb	div/max	512	3.1317	4.3010	0.728
g-SpMM	1	artnet-exp	fb	div/min	512	3.1822	4.2917	0.741
g-SpMM	1	artnet-exp	fb	div/sum	512	4.6294	7.0293	0.659
g-SpMM	1	artnet-exp	fb	mul/max	512	3.1133	4.2760	0.728
g-SpMM	1	artnet-exp	fb	mul/min	512	3.1267	4.2871	0.729
g-SpMM	1	artnet-exp	fb	mul/sum	512	3.6147	5.8311	0.620
g-SpMM	1	artnet-exp	fb	sub/max	512	2.7428	3.8990	0.703
g-SpMM	1	artnet-exp	fb	sub/min	512	2.7351	3.9046	0.700
g-SpMM	1	artnet-exp	fb	sub/sum	512	2.6000	3.8966	0.667
g-SpMM	1	artnet-exp	fwd	add/max	512	1.1827	2.3437	0.505
g-SpMM	1	artnet-exp	fwd	add/min	512	1.2087	2.4319	0.497
g-SpMM	1	artnet-exp	fwd	add/sum	512	1.4036	2.0734	0.677
g-SpMM	1	artnet-exp	fwd	copy_e/max	512	0.7763	0.7802	0.995
g-SpMM	1	artnet-exp	fwd	copy_e/min	512	0.7986	0.8325	0.959
g-SpMM	1	artnet-exp	fwd	copy_e/sum	512	0.9142	0.9484	0.964
g-SpMM	1	artnet-exp	fwd	copy_u/max	512	0.7532	1.5157	0.497
g-SpMM	1	artnet-exp	fwd	copy_u/min	512	0.6610	1.5079	0.438
g-SpMM	1	artnet-exp	fwd	copy_u/sum	512	0.6109	1.2022	0.508
g-SpMM	1	artnet-exp	fwd	div/max	512	1.1865	2.3482	0.505
g-SpMM	1	artnet-exp	fwd	div/min	512	1.2283	2.4274	0.506
g-SpMM	1	artnet-exp	fwd	div/sum	512	1.4184	2.0187	0.703
g-SpMM	1	artnet-exp	fwd	mul/max	512	1.1690	2.3295	0.502
g-SpMM	1	artnet-exp	fwd	mul/min	512	1.2192	2.4172	0.504
g-SpMM	1	artnet-exp	fwd	mul/sum	512	1.3106	1.9363	0.677
g-SpMM	1	artnet-exp	fwd	sub/max	512	1.1846	2.3323	0.508
g-SpMM	1	artnet-exp	fwd	sub/min	512	1.2636	2.4009	0.526
g-SpMM	1	artnet-exp	fwd	sub/sum	512	1.4055	2.0862	0.674
g-SpMM	1	avazu-ctr	bwd	copy_u/max	64	0.2630	0.2634	0.999
g-SpMM	1	avazu-ctr	bwd	copy_u/min	64	0.2812	0.2825	0.995
g-SpMM	1	avazu-ctr	bwd	copy_u/sum	64	3.6112	6.6107	0.546
g-SpMM	1	avazu-ctr	fb	copy_u/max	64	2.9174	7.8606	0.371
g-SpMM	1	avazu-ctr	fb	copy_u/min	64	2.9609	7.8609	0.377
g-SpMM	1	avazu-ctr	fb	copy_u/sum	64	7.2759	13.7804	0.528
g-SpMM	1	avazu-ctr	fwd	copy_u/max	64	2.5988	7.5791	0.343
g-SpMM	1	avazu-ctr	fwd	copy_u/min	64	2.5724	7.5677	0.340
g-SpMM	1	avazu-ctr	fwd	copy_u/sum	64	3.5313	6.5830	0.536
g-SpMM	1	avazu-ctr	bwd	copy_u/max	128	0.4053	0.4044	1.002
g-SpMM	1	avazu-ctr	bwd	copy_u/min	128	0.4146	0.4159	0.997
g-SpMM	1	avazu-ctr	bwd	copy_u/sum	128	7.2122	12.7122	0.567
g-SpMM	1	avazu-ctr	fb	copy_u/max	128	5.5951	15.3283	0.365
g-SpMM	1	avazu-ctr	fb	copy_u/min	128	5.5243	15.1685	0.364
g-SpMM	1	avazu-ctr	fb	copy_u/sum	128	14.5191	25.6887	0.565
g-SpMM	1	avazu-ctr	fwd	copy_u/max	128	5.2039	14.7442	0.353
g-SpMM	1	avazu-ctr	fwd	copy_u/min	128	5.2965	14.9628	0.354
g-SpMM	1	avazu-ctr	fwd	copy_u/sum	128	7.2027	12.5114	0.576
g-SpMM	1	avazu-ctr	bwd	copy_u/max	256	0.7147	0.7202	0.992
g-SpMM	1	avazu-ctr	bwd	copy_u/min	256	0.7269	0.7394	0.983
g-SpMM	1	avazu-ctr	bwd	copy_u/sum	256	14.8422	25.2796	0.587
g-SpMM	1	avazu-ctr	fb	copy_u/max	256	11.2733	30.1164	0.374
g-SpMM	1	avazu-ctr	fb	copy_u/min	256	11.2188	29.7970	0.377
g-SpMM	1	avazu-ctr	fb	copy_u/sum	256	30.1132	51.3376	0.587
g-SpMM	1	avazu-ctr	fwd	copy_u/max	256	10.3586	29.8776	0.347
g-SpMM	1	avazu-ctr	fwd	copy_u/min	256	10.2659	29.8279	0.344
g-SpMM	1	avazu-ctr	fwd	copy_u/sum	256	14.9378	24.7170	0.604
g-SpMM	1	avazu-ctr	bwd	copy_u/max	512	1.2005	1.2064	0.995
g-SpMM	1	avazu-ctr	bwd	copy_u/min	512	1.2457	1.2461	1.000
g-SpMM	1	avazu-ctr	bwd	copy_u/sum	512	30.4540	50.7190	0.600
g-SpMM	1	avazu-ctr	fb	copy_u/max	512	22.6107	61.7671	0.366
g-SpMM	1	avazu-ctr	fb	copy_u/min	512	21.9430	62.1399	0.353
g-SpMM	1	avazu-ctr	fb	copy_u/sum	512	60.6918	103.2510	0.588
g-SpMM	1	avazu-ctr	fwd	copy_u/max	512	21.4633	61.1551	0.351
g-SpMM	1	avazu-ctr	fwd	copy_u/min	512	21.4109	61.2617	0.349
g-SpMM	1	avazu-ctr	fwd	copy_u/sum	512	29.8641	51.3646	0.581
g-SpMM	1	citeseer	bwd	add/max	64	0.2281	0.2182	1.046
g-SpMM	1	citeseer	bwd	add/min	64	0.2218	0.2201	1.008
g-SpMM	1	citeseer	bwd	add/sum	64	0.3161	0.2671	1.183
g-SpMM	1	citeseer	bwd	copy_e/max	64	0.2036	0.1917	1.062
g-SpMM	1	citeseer	bwd	copy_e/min	64	0.2023	0.1945	1.040
g-SpMM	1	citeseer	bwd	copy_e/sum	64	0.2040	0.1972	1.035
g-SpMM	1	citeseer	bwd	copy_u/max	64	0.2082	0.2050	1.015
g-SpMM	1	citeseer	bwd	copy_u/min	64	0.2053	0.1986	1.034
g-SpMM	1	citeseer	bwd	copy_u/sum	64	0.2270	0.2258	1.005

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	citeseer	bwd	div/max	64	0.2383	0.2077	1.148
g-SpMM	1	citeseer	bwd	div/min	64	0.2261	0.2070	1.092
g-SpMM	1	citeseer	bwd	div/sum	64	0.2686	0.2464	1.090
g-SpMM	1	citeseer	bwd	mul/max	64	0.2469	0.2115	1.168
g-SpMM	1	citeseer	bwd	mul/min	64	0.2250	0.2705	0.832
g-SpMM	1	citeseer	bwd	mul/sum	64	0.2598	0.2645	0.982
g-SpMM	1	citeseer	bwd	sub/max	64	0.2391	0.2244	1.065
g-SpMM	1	citeseer	bwd	sub/min	64	0.2250	0.2257	0.997
g-SpMM	1	citeseer	bwd	sub/sum	64	0.3182	0.2857	1.114
g-SpMM	1	citeseer	fb	add/max	64	0.4873	0.4451	1.095
g-SpMM	1	citeseer	fb	add/min	64	0.4679	0.4730	0.989
g-SpMM	1	citeseer	fb	add/sum	64	0.6091	0.5101	1.194
g-SpMM	1	citeseer	fb	copy_e/max	64	0.4485	0.4430	1.012
g-SpMM	1	citeseer	fb	copy_e/min	64	0.4399	0.4245	1.036
g-SpMM	1	citeseer	fb	copy_e/sum	64	0.4450	0.4119	1.080
g-SpMM	1	citeseer	fb	copy_u/max	64	0.4446	0.4364	1.019
g-SpMM	1	citeseer	fb	copy_u/min	64	0.4765	0.4331	1.100
g-SpMM	1	citeseer	fb	copy_u/sum	64	0.5366	0.4577	1.173
g-SpMM	1	citeseer	fb	div/max	64	0.4933	0.4390	1.124
g-SpMM	1	citeseer	fb	div/min	64	0.4671	0.4483	1.042
g-SpMM	1	citeseer	fb	div/sum	64	0.5263	0.4718	1.116
g-SpMM	1	citeseer	fb	mul/max	64	0.4976	0.4460	1.116
g-SpMM	1	citeseer	fb	mul/min	64	0.5012	0.5102	0.982
g-SpMM	1	citeseer	fb	mul/sum	64	0.5194	0.4742	1.095
g-SpMM	1	citeseer	fb	sub/max	64	0.5078	0.4539	1.119
g-SpMM	1	citeseer	fb	sub/min	64	0.4855	0.4785	1.015
g-SpMM	1	citeseer	fb	sub/sum	64	0.5313	0.5052	1.052
g-SpMM	1	citeseer	fwd	add/max	64	0.0890	0.0930	0.957
g-SpMM	1	citeseer	fwd	add/min	64	0.0985	0.0886	1.111
g-SpMM	1	citeseer	fwd	add/sum	64	0.0813	0.0805	1.010
g-SpMM	1	citeseer	fwd	copy_e/max	64	0.0887	0.0876	1.013
g-SpMM	1	citeseer	fwd	copy_e/min	64	0.0884	0.0867	1.020
g-SpMM	1	citeseer	fwd	copy_e/sum	64	0.0818	0.0815	1.003
g-SpMM	1	citeseer	fwd	copy_u/max	64	0.0954	0.0868	1.099
g-SpMM	1	citeseer	fwd	copy_u/min	64	0.0975	0.0880	1.108
g-SpMM	1	citeseer	fwd	copy_u/sum	64	0.0920	0.0831	1.107
g-SpMM	1	citeseer	fwd	div/max	64	0.0877	0.0867	1.012
g-SpMM	1	citeseer	fwd	div/min	64	0.0897	0.0865	1.037
g-SpMM	1	citeseer	fwd	div/sum	64	0.0906	0.0804	1.126
g-SpMM	1	citeseer	fwd	mul/max	64	0.0867	0.0867	1.000
g-SpMM	1	citeseer	fwd	mul/min	64	0.0894	0.0881	1.015
g-SpMM	1	citeseer	fwd	mul/sum	64	0.0817	0.0806	1.015
g-SpMM	1	citeseer	fwd	sub/max	64	0.0880	0.0879	1.001
g-SpMM	1	citeseer	fwd	sub/min	64	0.0898	0.0868	1.035
g-SpMM	1	citeseer	fwd	sub/sum	64	0.0822	0.0806	1.019
g-SpMM	1	citeseer	bwd	add/max	128	0.1903	0.2155	0.883
g-SpMM	1	citeseer	bwd	add/min	128	0.1929	0.2166	0.890
g-SpMM	1	citeseer	bwd	add/sum	128	0.2526	0.2972	0.850
g-SpMM	1	citeseer	bwd	copy_e/max	128	0.1686	0.1912	0.882
g-SpMM	1	citeseer	bwd	copy_e/min	128	0.1728	0.1901	0.909
g-SpMM	1	citeseer	bwd	copy_e/sum	128	0.1656	0.1878	0.882
g-SpMM	1	citeseer	bwd	copy_u/max	128	0.1803	0.1929	0.935
g-SpMM	1	citeseer	bwd	copy_u/min	128	0.1675	0.1896	0.883
g-SpMM	1	citeseer	bwd	copy_u/sum	128	0.1952	0.2146	0.910
g-SpMM	1	citeseer	bwd	div/max	128	0.1989	0.2136	0.931
g-SpMM	1	citeseer	bwd	div/min	128	0.1978	0.2147	0.921
g-SpMM	1	citeseer	bwd	div/sum	128	0.2291	0.2451	0.934
g-SpMM	1	citeseer	bwd	mul/max	128	0.1894	0.2136	0.887
g-SpMM	1	citeseer	bwd	mul/min	128	0.1966	0.2116	0.929
g-SpMM	1	citeseer	bwd	mul/sum	128	0.2177	0.2535	0.859
g-SpMM	1	citeseer	bwd	sub/max	128	0.1954	0.2145	0.911
g-SpMM	1	citeseer	bwd	sub/min	128	0.1911	0.2184	0.875
g-SpMM	1	citeseer	bwd	sub/sum	128	0.2460	0.2807	0.876
g-SpMM	1	citeseer	fb	add/max	128	0.4022	0.4826	0.833
g-SpMM	1	citeseer	fb	add/min	128	0.4106	0.5079	0.808
g-SpMM	1	citeseer	fb	add/sum	128	0.4586	0.5167	0.888
g-SpMM	1	citeseer	fb	copy_e/max	128	0.3707	0.4231	0.876
g-SpMM	1	citeseer	fb	copy_e/min	128	0.3814	0.4319	0.883
g-SpMM	1	citeseer	fb	copy_e/sum	128	0.3616	0.3924	0.922
g-SpMM	1	citeseer	fb	copy_u/max	128	0.3757	0.4258	0.882
g-SpMM	1	citeseer	fb	copy_u/min	128	0.3714	0.4272	0.869
g-SpMM	1	citeseer	fb	copy_u/sum	128	0.3886	0.4521	0.860
g-SpMM	1	citeseer	fb	div/max	128	0.4110	0.4526	0.908
g-SpMM	1	citeseer	fb	div/min	128	0.4085	0.4443	0.919
g-SpMM	1	citeseer	fb	div/sum	128	0.4303	0.4844	0.888
g-SpMM	1	citeseer	fb	mul/max	128	0.4755	0.4418	1.076
g-SpMM	1	citeseer	fb	mul/min	128	0.4116	0.4585	0.898
g-SpMM	1	citeseer	fb	mul/sum	128	0.4120	0.4814	0.856

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	citeseer	fb	sub/max	128	0.3915	0.4418	0.886
g-SpMM	1	citeseer	fb	sub/min	128	0.3957	0.4465	0.886
g-SpMM	1	citeseer	fb	sub/sum	128	0.4607	0.5077	0.907
g-SpMM	1	citeseer	fwd	add/max	128	0.0911	0.0876	1.039
g-SpMM	1	citeseer	fwd	add/min	128	0.0935	0.0889	1.052
g-SpMM	1	citeseer	fwd	add/sum	128	0.0802	0.0817	0.982
g-SpMM	1	citeseer	fwd	copy_e/max	128	0.0905	0.0856	1.056
g-SpMM	1	citeseer	fwd	copy_e/min	128	0.0853	0.0862	0.990
g-SpMM	1	citeseer	fwd	copy_e/sum	128	0.0785	0.0792	0.991
g-SpMM	1	citeseer	fwd	copy_u/max	128	0.0848	0.0876	0.968
g-SpMM	1	citeseer	fwd	copy_u/min	128	0.0861	0.1039	0.829
g-SpMM	1	citeseer	fwd	copy_u/sum	128	0.0790	0.0840	0.940
g-SpMM	1	citeseer	fwd	div/max	128	0.0865	0.0854	1.013
g-SpMM	1	citeseer	fwd	div/min	128	0.0869	0.0871	0.997
g-SpMM	1	citeseer	fwd	div/sum	128	0.0807	0.0813	0.992
g-SpMM	1	citeseer	fwd	mul/max	128	0.0874	0.0868	1.007
g-SpMM	1	citeseer	fwd	mul/min	128	0.0870	0.0950	0.916
g-SpMM	1	citeseer	fwd	mul/sum	128	0.0863	0.0806	1.071
g-SpMM	1	citeseer	fwd	sub/max	128	0.0876	0.0870	1.006
g-SpMM	1	citeseer	fwd	sub/min	128	0.0921	0.0868	1.061
g-SpMM	1	citeseer	fwd	sub/sum	128	0.0861	0.0820	1.050
g-SpMM	1	citeseer	bwd	add/max	256	0.1983	0.2205	0.899
g-SpMM	1	citeseer	bwd	add/min	256	0.1880	0.2176	0.864
g-SpMM	1	citeseer	bwd	add/sum	256	0.2392	0.2908	0.823
g-SpMM	1	citeseer	bwd	copy_e/max	256	0.1779	0.1987	0.895
g-SpMM	1	citeseer	bwd	copy_e/min	256	0.1788	0.1928	0.928
g-SpMM	1	citeseer	bwd	copy_e/sum	256	0.1729	0.1966	0.879
g-SpMM	1	citeseer	bwd	copy_u/max	256	0.1730	0.1959	0.883
g-SpMM	1	citeseer	bwd	copy_u/min	256	0.1703	0.1936	0.880
g-SpMM	1	citeseer	bwd	copy_u/sum	256	0.1995	0.2211	0.902
g-SpMM	1	citeseer	bwd	div/max	256	0.1872	0.2263	0.827
g-SpMM	1	citeseer	bwd	div/min	256	0.1947	0.2218	0.878
g-SpMM	1	citeseer	bwd	div/sum	256	0.2157	0.2570	0.839
g-SpMM	1	citeseer	bwd	mul/max	256	0.1898	0.2239	0.848
g-SpMM	1	citeseer	bwd	mul/min	256	0.1865	0.2177	0.857
g-SpMM	1	citeseer	bwd	mul/sum	256	0.2325	0.2488	0.934
g-SpMM	1	citeseer	bwd	sub/max	256	0.1890	0.2186	0.865
g-SpMM	1	citeseer	bwd	sub/min	256	0.1964	0.2208	0.890
g-SpMM	1	citeseer	bwd	sub/sum	256	0.2526	0.2848	0.887
g-SpMM	1	citeseer	fb	add/max	256	0.4002	0.4548	0.880
g-SpMM	1	citeseer	fb	add/min	256	0.3893	0.4563	0.853
g-SpMM	1	citeseer	fb	add/sum	256	0.4606	0.5156	0.893
g-SpMM	1	citeseer	fb	copy_e/max	256	0.3804	0.4240	0.897
g-SpMM	1	citeseer	fb	copy_e/min	256	0.3907	0.4186	0.933
g-SpMM	1	citeseer	fb	copy_e/sum	256	0.3598	0.4125	0.872
g-SpMM	1	citeseer	fb	copy_u/max	256	0.3783	0.4173	0.906
g-SpMM	1	citeseer	fb	copy_u/min	256	0.3795	0.4338	0.875
g-SpMM	1	citeseer	fb	copy_u/sum	256	0.4042	0.4456	0.907
g-SpMM	1	citeseer	fb	div/max	256	0.3851	0.4612	0.835
g-SpMM	1	citeseer	fb	div/min	256	0.4006	0.4480	0.894
g-SpMM	1	citeseer	fb	div/sum	256	0.4023	0.5040	0.798
g-SpMM	1	citeseer	fb	mul/max	256	0.3864	0.4681	0.825
g-SpMM	1	citeseer	fb	mul/min	256	0.3829	0.4428	0.865
g-SpMM	1	citeseer	fb	mul/sum	256	0.4074	0.4910	0.830
g-SpMM	1	citeseer	fb	sub/max	256	0.4149	0.4537	0.915
g-SpMM	1	citeseer	fb	sub/min	256	0.3988	0.4655	0.857
g-SpMM	1	citeseer	fb	sub/sum	256	0.4536	0.5384	0.843
g-SpMM	1	citeseer	fwd	add/max	256	0.0856	0.0892	0.959
g-SpMM	1	citeseer	fwd	add/min	256	0.0880	0.0967	0.909
g-SpMM	1	citeseer	fwd	add/sum	256	0.0805	0.0847	0.951
g-SpMM	1	citeseer	fwd	copy_e/max	256	0.0866	0.0877	0.988
g-SpMM	1	citeseer	fwd	copy_e/min	256	0.0829	0.0890	0.932
g-SpMM	1	citeseer	fwd	copy_e/sum	256	0.0762	0.0802	0.950
g-SpMM	1	citeseer	fwd	copy_u/max	256	0.0834	0.0928	0.898
g-SpMM	1	citeseer	fwd	copy_u/min	256	0.0848	0.0879	0.965
g-SpMM	1	citeseer	fwd	copy_u/sum	256	0.0765	0.0793	0.965
g-SpMM	1	citeseer	fwd	div/max	256	0.0849	0.0948	0.895
g-SpMM	1	citeseer	fwd	div/min	256	0.0841	0.0900	0.934
g-SpMM	1	citeseer	fwd	div/sum	256	0.0787	0.0855	0.921
g-SpMM	1	citeseer	fwd	mul/max	256	0.0837	0.0894	0.937
g-SpMM	1	citeseer	fwd	mul/min	256	0.0842	0.0905	0.931
g-SpMM	1	citeseer	fwd	mul/sum	256	0.0776	0.0829	0.936
g-SpMM	1	citeseer	fwd	sub/max	256	0.0902	0.0890	1.014
g-SpMM	1	citeseer	fwd	sub/min	256	0.0848	0.0894	0.949
g-SpMM	1	citeseer	fwd	sub/sum	256	0.0829	0.0858	0.967
g-SpMM	1	citeseer	bwd	add/max	512	0.2390	0.1857	1.287
g-SpMM	1	citeseer	bwd	add/min	512	0.2363	0.1818	1.300
g-SpMM	1	citeseer	bwd	add/sum	512	0.2995	0.2189	1.368

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	citeseer	bwd	copy_e/max	512	0.1992	0.1562	1.276
g-SpMM	1	citeseer	bwd	copy_e/min	512	0.2047	0.1583	1.293
g-SpMM	1	citeseer	bwd	copy_e/sum	512	0.2004	0.1452	1.380
g-SpMM	1	citeseer	bwd	copy_u/max	512	0.1950	0.1903	1.025
g-SpMM	1	citeseer	bwd	copy_u/min	512	0.1968	0.1908	1.032
g-SpMM	1	citeseer	bwd	copy_u/sum	512	0.2242	0.2103	1.066
g-SpMM	1	citeseer	bwd	div/max	512	0.2855	0.2944	0.970
g-SpMM	1	citeseer	bwd	div/min	512	0.3075	0.3097	0.993
g-SpMM	1	citeseer	bwd	div/sum	512	0.2722	0.3517	0.774
g-SpMM	1	citeseer	bwd	mul/max	512	0.2764	0.2943	0.939
g-SpMM	1	citeseer	bwd	mul/min	512	0.2735	0.3012	0.908
g-SpMM	1	citeseer	bwd	mul/sum	512	0.2482	0.2453	1.012
g-SpMM	1	citeseer	bwd	sub/max	512	0.2258	0.1857	1.216
g-SpMM	1	citeseer	bwd	sub/min	512	0.2241	0.1811	1.238
g-SpMM	1	citeseer	bwd	sub/sum	512	0.2863	0.2174	1.317
g-SpMM	1	citeseer	fb	add/max	512	0.4757	0.3648	1.304
g-SpMM	1	citeseer	fb	add/min	512	0.4689	0.3621	1.295
g-SpMM	1	citeseer	fb	add/sum	512	0.5014	0.3941	1.272
g-SpMM	1	citeseer	fb	copy_e/max	512	0.4395	0.3387	1.297
g-SpMM	1	citeseer	fb	copy_e/min	512	0.4336	0.3591	1.207
g-SpMM	1	citeseer	fb	copy_e/sum	512	0.4139	0.3992	1.037
g-SpMM	1	citeseer	fb	copy_u/max	512	0.4393	0.4234	1.037
g-SpMM	1	citeseer	fb	copy_u/min	512	0.4438	0.4395	1.010
g-SpMM	1	citeseer	fb	copy_u/sum	512	0.4423	0.4348	1.017
g-SpMM	1	citeseer	fb	div/max	512	0.4973	0.4796	1.037
g-SpMM	1	citeseer	fb	div/min	512	0.5929	0.4847	1.223
g-SpMM	1	citeseer	fb	div/sum	512	0.5116	0.5253	0.974
g-SpMM	1	citeseer	fb	mul/max	512	0.4993	0.4750	1.051
g-SpMM	1	citeseer	fb	mul/min	512	0.4892	0.4758	1.028
g-SpMM	1	citeseer	fb	mul/sum	512	0.4751	0.4142	1.147
g-SpMM	1	citeseer	fb	sub/max	512	0.4651	0.3638	1.279
g-SpMM	1	citeseer	fb	sub/min	512	0.4634	0.3911	1.185
g-SpMM	1	citeseer	fb	sub/sum	512	0.5172	0.3928	1.317
g-SpMM	1	citeseer	fwd	add/max	512	0.1215	0.1812	0.671
g-SpMM	1	citeseer	fwd	add/min	512	0.1215	0.1829	0.664
g-SpMM	1	citeseer	fwd	add/sum	512	0.0920	0.1311	0.701
g-SpMM	1	citeseer	fwd	copy_e/max	512	0.0870	0.0877	0.992
g-SpMM	1	citeseer	fwd	copy_e/min	512	0.0915	0.0887	1.032
g-SpMM	1	citeseer	fwd	copy_e/sum	512	0.0817	0.0807	1.014
g-SpMM	1	citeseer	fwd	copy_u/max	512	0.0914	0.0888	1.029
g-SpMM	1	citeseer	fwd	copy_u/min	512	0.0861	0.0893	0.964
g-SpMM	1	citeseer	fwd	copy_u/sum	512	0.0795	0.0810	0.981
g-SpMM	1	citeseer	fwd	div/max	512	0.1230	0.2216	0.555
g-SpMM	1	citeseer	fwd	div/min	512	0.1220	0.1828	0.667
g-SpMM	1	citeseer	fwd	div/sum	512	0.0886	0.1367	0.648
g-SpMM	1	citeseer	fwd	mul/max	512	0.1208	0.1787	0.676
g-SpMM	1	citeseer	fwd	mul/min	512	0.1224	0.1780	0.688
g-SpMM	1	citeseer	fwd	mul/sum	512	0.0854	0.1265	0.675
g-SpMM	1	citeseer	fwd	sub/max	512	0.1220	0.1796	0.679
g-SpMM	1	citeseer	fwd	sub/min	512	0.1199	0.1792	0.669
g-SpMM	1	citeseer	fwd	sub/sum	512	0.0914	0.1326	0.689
g-SpMM	1	city-reviews	bwd	add/max	64	0.6338	0.6318	1.003
g-SpMM	1	city-reviews	bwd	add/min	64	0.6352	0.6302	1.008
g-SpMM	1	city-reviews	bwd	add/sum	64	0.8802	1.3231	0.665
g-SpMM	1	city-reviews	bwd	copy_e/max	64	0.4018	0.3996	1.005
g-SpMM	1	city-reviews	bwd	copy_e/min	64	0.4002	0.4003	1.000
g-SpMM	1	city-reviews	bwd	copy_e/sum	64	0.4334	0.4288	1.011
g-SpMM	1	city-reviews	bwd	copy_u/max	64	0.2142	0.2161	0.991
g-SpMM	1	city-reviews	bwd	copy_u/min	64	0.2161	0.2156	1.002
g-SpMM	1	city-reviews	bwd	copy_u/sum	64	0.5205	0.9411	0.553
g-SpMM	1	city-reviews	bwd	div/max	64	0.7908	0.7905	1.000
g-SpMM	1	city-reviews	bwd	div/min	64	0.7933	0.7982	0.994
g-SpMM	1	city-reviews	bwd	div/sum	64	2.2805	3.7958	0.601
g-SpMM	1	city-reviews	bwd	mul/max	64	0.7880	0.7892	0.999
g-SpMM	1	city-reviews	bwd	mul/min	64	0.7989	0.7913	1.010
g-SpMM	1	city-reviews	bwd	mul/sum	64	1.8219	3.0669	0.594
g-SpMM	1	city-reviews	bwd	sub/max	64	0.6309	0.6325	0.997
g-SpMM	1	city-reviews	bwd	sub/min	64	0.6325	0.6324	1.000
g-SpMM	1	city-reviews	bwd	sub/sum	64	0.8932	1.3126	0.680
g-SpMM	1	city-reviews	fb	add/max	64	1.7362	2.4922	0.697
g-SpMM	1	city-reviews	fb	add/min	64	1.7458	2.5509	0.684
g-SpMM	1	city-reviews	fb	add/sum	64	2.2693	3.4643	0.655
g-SpMM	1	city-reviews	fb	copy_e/max	64	0.8627	0.8686	0.993
g-SpMM	1	city-reviews	fb	copy_e/min	64	0.8643	0.8599	1.005
g-SpMM	1	city-reviews	fb	copy_e/sum	64	1.4027	1.4081	0.996
g-SpMM	1	city-reviews	fb	copy_u/max	64	0.7016	1.4436	0.486
g-SpMM	1	city-reviews	fb	copy_u/min	64	0.7062	1.4345	0.492
g-SpMM	1	city-reviews	fb	copy_u/sum	64	1.0873	1.9528	0.557

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-reviews	fb	div/max	64	1.9272	2.7117	0.711
g-SpMM	1	city-reviews	fb	div/min	64	1.9243	2.7345	0.704
g-SpMM	1	city-reviews	fb	div/sum	64	3.6276	5.9705	0.608
g-SpMM	1	city-reviews	fb	mul/max	64	1.8912	2.7418	0.690
g-SpMM	1	city-reviews	fb	mul/min	64	1.9022	2.7542	0.691
g-SpMM	1	city-reviews	fb	mul/sum	64	3.0020	5.1254	0.586
g-SpMM	1	city-reviews	fb	sub/max	64	1.7288	2.5509	0.678
g-SpMM	1	city-reviews	fb	sub/min	64	1.7300	2.5441	0.680
g-SpMM	1	city-reviews	fb	sub/sum	64	2.2200	3.3944	0.654
g-SpMM	1	city-reviews	fwd	add/max	64	1.1196	1.9332	0.579
g-SpMM	1	city-reviews	fwd	add/min	64	1.1359	1.9839	0.573
g-SpMM	1	city-reviews	fwd	add/sum	64	1.3162	2.0804	0.633
g-SpMM	1	city-reviews	fwd	copy_e/max	64	0.4872	0.4940	0.986
g-SpMM	1	city-reviews	fwd	copy_e/min	64	0.5359	0.4923	1.089
g-SpMM	1	city-reviews	fwd	copy_e/sum	64	1.0820	1.0770	1.005
g-SpMM	1	city-reviews	fwd	copy_u/max	64	0.4686	1.1758	0.399
g-SpMM	1	city-reviews	fwd	copy_u/min	64	0.4633	1.1738	0.395
g-SpMM	1	city-reviews	fwd	copy_u/sum	64	0.5340	0.9275	0.576
g-SpMM	1	city-reviews	fwd	div/max	64	1.1209	1.9472	0.576
g-SpMM	1	city-reviews	fwd	div/min	64	1.1687	1.9997	0.584
g-SpMM	1	city-reviews	fwd	div/sum	64	1.3190	2.1647	0.609
g-SpMM	1	city-reviews	fwd	mul/max	64	1.1109	1.9153	0.580
g-SpMM	1	city-reviews	fwd	mul/min	64	1.1231	1.9887	0.565
g-SpMM	1	city-reviews	fwd	mul/sum	64	1.1233	1.9958	0.563
g-SpMM	1	city-reviews	fwd	sub/max	64	1.1091	1.9487	0.569
g-SpMM	1	city-reviews	fwd	sub/min	64	1.1494	2.0248	0.568
g-SpMM	1	city-reviews	fwd	sub/sum	64	1.3382	2.1012	0.637
g-SpMM	1	city-reviews	bwd	add/max	128	1.3897	1.3891	1.000
g-SpMM	1	city-reviews	bwd	add/min	128	1.3912	1.3939	0.998
g-SpMM	1	city-reviews	bwd	add/sum	128	1.7032	2.5519	0.667
g-SpMM	1	city-reviews	bwd	copy_e/max	128	0.7714	0.7747	0.996
g-SpMM	1	city-reviews	bwd	copy_e/min	128	0.7733	0.7728	1.001
g-SpMM	1	city-reviews	bwd	copy_e/sum	128	0.5689	0.5693	0.999
g-SpMM	1	city-reviews	bwd	copy_u/max	128	0.5104	0.5096	1.002
g-SpMM	1	city-reviews	bwd	copy_u/min	128	0.5130	0.5108	1.004
g-SpMM	1	city-reviews	bwd	copy_u/sum	128	1.1231	1.9552	0.574
g-SpMM	1	city-reviews	bwd	div/max	128	1.6842	1.6722	1.007
g-SpMM	1	city-reviews	bwd	div/min	128	1.6763	1.6694	1.004
g-SpMM	1	city-reviews	bwd	div/sum	128	4.2206	6.9189	0.610
g-SpMM	1	city-reviews	bwd	mul/max	128	1.6662	1.6663	1.000
g-SpMM	1	city-reviews	bwd	mul/min	128	1.6762	1.6719	1.003
g-SpMM	1	city-reviews	bwd	mul/sum	128	3.4167	5.8005	0.589
g-SpMM	1	city-reviews	bwd	sub/max	128	1.3984	1.3893	1.007
g-SpMM	1	city-reviews	bwd	sub/min	128	1.3930	1.3947	0.999
g-SpMM	1	city-reviews	bwd	sub/sum	128	1.7054	2.5676	0.664
g-SpMM	1	city-reviews	fb	add/max	128	3.6067	5.2142	0.692
g-SpMM	1	city-reviews	fb	add/min	128	3.5930	5.0859	0.706
g-SpMM	1	city-reviews	fb	add/sum	128	4.3664	6.7381	0.648
g-SpMM	1	city-reviews	fb	copy_e/max	128	1.6974	1.7427	0.974
g-SpMM	1	city-reviews	fb	copy_e/min	128	1.7183	1.6787	1.024
g-SpMM	1	city-reviews	fb	copy_e/sum	128	2.6400	2.6538	0.995
g-SpMM	1	city-reviews	fb	copy_u/max	128	1.4592	2.9802	0.490
g-SpMM	1	city-reviews	fb	copy_u/min	128	1.4582	2.9746	0.490
g-SpMM	1	city-reviews	fb	copy_u/sum	128	2.2559	3.9353	0.573
g-SpMM	1	city-reviews	fb	div/max	128	3.8912	5.5288	0.704
g-SpMM	1	city-reviews	fb	div/min	128	3.8735	5.5415	0.699
g-SpMM	1	city-reviews	fb	div/sum	128	6.9209	11.2291	0.616
g-SpMM	1	city-reviews	fb	mul/max	128	3.8765	5.4833	0.707
g-SpMM	1	city-reviews	fb	mul/min	128	3.8691	5.4997	0.704
g-SpMM	1	city-reviews	fb	mul/sum	128	5.6864	9.8078	0.580
g-SpMM	1	city-reviews	fb	sub/max	128	3.5739	5.1919	0.688
g-SpMM	1	city-reviews	fb	sub/min	128	3.5874	5.0794	0.706
g-SpMM	1	city-reviews	fb	sub/sum	128	4.3783	6.7509	0.649
g-SpMM	1	city-reviews	fwd	add/max	128	2.2050	3.7384	0.590
g-SpMM	1	city-reviews	fwd	add/min	128	2.2715	3.8906	0.584
g-SpMM	1	city-reviews	fwd	add/sum	128	2.5510	4.1077	0.621
g-SpMM	1	city-reviews	fwd	copy_e/max	128	0.9561	1.0030	0.953
g-SpMM	1	city-reviews	fwd	copy_e/min	128	0.9987	1.0097	0.989
g-SpMM	1	city-reviews	fwd	copy_e/sum	128	2.1098	2.1407	0.986
g-SpMM	1	city-reviews	fwd	copy_u/max	128	0.9209	2.4445	0.377
g-SpMM	1	city-reviews	fwd	copy_u/min	128	0.9327	2.4448	0.381
g-SpMM	1	city-reviews	fwd	copy_u/sum	128	1.1121	1.9438	0.572
g-SpMM	1	city-reviews	fwd	div/max	128	2.2186	3.7917	0.585
g-SpMM	1	city-reviews	fwd	div/min	128	2.3144	3.8635	0.599
g-SpMM	1	city-reviews	fwd	div/sum	128	2.6435	4.1251	0.641
g-SpMM	1	city-reviews	fwd	mul/max	128	2.2006	3.8655	0.569
g-SpMM	1	city-reviews	fwd	mul/min	128	2.2511	3.8902	0.579
g-SpMM	1	city-reviews	fwd	mul/sum	128	2.2527	4.0015	0.563

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-reviews	fwd	sub/max	128	2.2003	3.8199	0.576
g-SpMM	1	city-reviews	fwd	sub/min	128	2.2931	3.8674	0.593
g-SpMM	1	city-reviews	fwd	sub/sum	128	2.5859	4.1096	0.629
g-SpMM	1	city-reviews	bwd	add/max	256	3.0436	3.0433	1.000
g-SpMM	1	city-reviews	bwd	add/min	256	3.0474	3.0020	1.015
g-SpMM	1	city-reviews	bwd	add/sum	256	3.4864	5.2677	0.662
g-SpMM	1	city-reviews	bwd	copy_e/max	256	1.5089	1.5092	1.000
g-SpMM	1	city-reviews	bwd	copy_e/min	256	1.5136	1.5117	1.001
g-SpMM	1	city-reviews	bwd	copy_e/sum	256	1.0621	1.0673	0.995
g-SpMM	1	city-reviews	bwd	copy_u/max	256	1.1946	1.1897	1.004
g-SpMM	1	city-reviews	bwd	copy_u/min	256	1.1576	1.1896	0.973
g-SpMM	1	city-reviews	bwd	copy_u/sum	256	2.4380	4.2042	0.580
g-SpMM	1	city-reviews	bwd	div/max	256	3.5436	3.5461	0.999
g-SpMM	1	city-reviews	bwd	div/min	256	3.4990	3.5511	0.985
g-SpMM	1	city-reviews	bwd	div/sum	256	8.2809	13.7565	0.602
g-SpMM	1	city-reviews	bwd	mul/max	256	3.5354	3.5348	1.000
g-SpMM	1	city-reviews	bwd	mul/min	256	3.5364	3.4927	1.013
g-SpMM	1	city-reviews	bwd	mul/sum	256	6.6588	11.1320	0.598
g-SpMM	1	city-reviews	bwd	sub/max	256	3.0476	3.0445	1.001
g-SpMM	1	city-reviews	bwd	sub/min	256	2.9968	3.0484	0.983
g-SpMM	1	city-reviews	bwd	sub/sum	256	3.4982	5.2901	0.661
g-SpMM	1	city-reviews	fb	add/max	256	7.4640	10.4557	0.714
g-SpMM	1	city-reviews	fb	add/min	256	7.4707	10.5031	0.711
g-SpMM	1	city-reviews	fb	add/sum	256	8.6967	13.7868	0.631
g-SpMM	1	city-reviews	fb	copy_e/max	256	3.3509	3.4078	0.983
g-SpMM	1	city-reviews	fb	copy_e/min	256	3.4096	3.4035	1.002
g-SpMM	1	city-reviews	fb	copy_e/sum	256	5.2504	5.1720	1.015
g-SpMM	1	city-reviews	fb	copy_u/max	256	3.1004	6.4522	0.481
g-SpMM	1	city-reviews	fb	copy_u/min	256	3.0771	6.4676	0.476
g-SpMM	1	city-reviews	fb	copy_u/sum	256	4.9132	8.4682	0.580
g-SpMM	1	city-reviews	fb	div/max	256	7.9632	11.1051	0.717
g-SpMM	1	city-reviews	fb	div/min	256	7.9821	11.2821	0.707
g-SpMM	1	city-reviews	fb	div/sum	256	13.6333	22.3021	0.611
g-SpMM	1	city-reviews	fb	mul/max	256	7.9078	10.9167	0.724
g-SpMM	1	city-reviews	fb	mul/min	256	7.9140	10.8769	0.728
g-SpMM	1	city-reviews	fb	mul/sum	256	11.1614	19.1476	0.583
g-SpMM	1	city-reviews	fb	sub/max	256	7.4608	10.4083	0.717
g-SpMM	1	city-reviews	fb	sub/min	256	7.4112	10.5102	0.705
g-SpMM	1	city-reviews	fb	sub/sum	256	8.7767	13.7317	0.639
g-SpMM	1	city-reviews	fwd	add/max	256	4.4090	7.6899	0.573
g-SpMM	1	city-reviews	fwd	add/min	256	4.5730	7.5449	0.606
g-SpMM	1	city-reviews	fwd	add/sum	256	5.2288	8.3898	0.623
g-SpMM	1	city-reviews	fwd	copy_e/max	256	1.8830	1.8821	1.000
g-SpMM	1	city-reviews	fwd	copy_e/min	256	1.8965	2.0301	0.934
g-SpMM	1	city-reviews	fwd	copy_e/sum	256	4.1811	4.1617	1.005
g-SpMM	1	city-reviews	fwd	copy_u/max	256	1.9304	5.3017	0.364
g-SpMM	1	city-reviews	fwd	copy_u/min	256	1.9121	5.2884	0.362
g-SpMM	1	city-reviews	fwd	copy_u/sum	256	2.4219	4.1672	0.581
g-SpMM	1	city-reviews	fwd	div/max	256	4.4818	7.5040	0.597
g-SpMM	1	city-reviews	fwd	div/min	256	4.6450	7.6952	0.604
g-SpMM	1	city-reviews	fwd	div/sum	256	5.1788	8.3514	0.620
g-SpMM	1	city-reviews	fwd	mul/max	256	4.3840	7.5449	0.581
g-SpMM	1	city-reviews	fwd	mul/min	256	4.5265	7.6688	0.590
g-SpMM	1	city-reviews	fwd	mul/sum	256	4.3449	7.7660	0.559
g-SpMM	1	city-reviews	fwd	sub/max	256	4.4158	7.5342	0.586
g-SpMM	1	city-reviews	fwd	sub/min	256	4.5561	7.6319	0.597
g-SpMM	1	city-reviews	fwd	sub/sum	256	5.2021	8.2741	0.629
g-SpMM	1	city-reviews	bwd	add/max	512	6.7927	6.7814	1.002
g-SpMM	1	city-reviews	bwd	add/min	512	6.7881	6.8036	0.998
g-SpMM	1	city-reviews	bwd	add/sum	512	7.5080	11.1921	0.671
g-SpMM	1	city-reviews	bwd	copy_e/max	512	3.1265	3.1073	1.006
g-SpMM	1	city-reviews	bwd	copy_e/min	512	3.1144	3.1133	1.000
g-SpMM	1	city-reviews	bwd	copy_e/sum	512	2.3528	2.3608	0.997
g-SpMM	1	city-reviews	bwd	copy_u/max	512	2.9253	2.9214	1.001
g-SpMM	1	city-reviews	bwd	copy_u/min	512	2.9301	2.9201	1.003
g-SpMM	1	city-reviews	bwd	copy_u/sum	512	5.1277	8.7252	0.588
g-SpMM	1	city-reviews	bwd	div/max	512	7.8901	7.8890	1.000
g-SpMM	1	city-reviews	bwd	div/min	512	7.9002	7.8821	1.002
g-SpMM	1	city-reviews	bwd	div/sum	512	35.0477	27.4742	1.276
g-SpMM	1	city-reviews	bwd	mul/max	512	7.8875	7.8763	1.001
g-SpMM	1	city-reviews	bwd	mul/min	512	7.8837	7.8597	1.003
g-SpMM	1	city-reviews	bwd	mul/sum	512	39.6287	22.1546	1.789
g-SpMM	1	city-reviews	bwd	sub/max	512	6.8098	6.7239	1.013
g-SpMM	1	city-reviews	bwd	sub/min	512	6.8136	6.7201	1.014
g-SpMM	1	city-reviews	bwd	sub/sum	512	29.0129	11.2441	2.580
g-SpMM	1	city-reviews	fb	add/max	512	15.8097	22.1036	0.715
g-SpMM	1	city-reviews	fb	add/min	512	15.9319	21.9600	0.725
g-SpMM	1	city-reviews	fb	add/sum	512	18.0748	28.5459	0.633

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-reviews	fb	copy_e/max	512	7.0893	7.0880	1.000
g-SpMM	1	city-reviews	fb	copy_e/min	512	7.0789	7.2031	0.983
g-SpMM	1	city-reviews	fb	copy_e/sum	512	10.5094	10.5571	0.995
g-SpMM	1	city-reviews	fb	copy_u/max	512	6.7766	13.9893	0.484
g-SpMM	1	city-reviews	fb	copy_u/min	512	6.6884	14.0682	0.475
g-SpMM	1	city-reviews	fb	copy_u/sum	512	10.2676	17.9891	0.571
g-SpMM	1	city-reviews	fb	div/max	512	16.9879	23.1042	0.735
g-SpMM	1	city-reviews	fb	div/min	512	16.9804	23.1421	0.734
g-SpMM	1	city-reviews	fb	div/sum	512	26.9111	52.9573	0.508
g-SpMM	1	city-reviews	fb	mul/max	512	16.8319	23.2237	0.725
g-SpMM	1	city-reviews	fb	mul/min	512	16.9212	23.1092	0.732
g-SpMM	1	city-reviews	fb	mul/sum	512	22.1662	44.8750	0.494
g-SpMM	1	city-reviews	fb	sub/max	512	15.7610	22.1162	0.713
g-SpMM	1	city-reviews	fb	sub/min	512	15.7485	21.4630	0.734
g-SpMM	1	city-reviews	fb	sub/sum	512	18.0978	28.5250	0.634
g-SpMM	1	city-reviews	fwd	add/max	512	8.9977	14.9835	0.601
g-SpMM	1	city-reviews	fwd	add/min	512	9.3003	15.3612	0.605
g-SpMM	1	city-reviews	fwd	add/sum	512	10.4733	17.0817	0.613
g-SpMM	1	city-reviews	fwd	copy_e/max	512	3.9732	3.8292	1.038
g-SpMM	1	city-reviews	fwd	copy_e/min	512	4.0946	4.0793	1.004
g-SpMM	1	city-reviews	fwd	copy_e/sum	512	8.2123	8.2300	0.998
g-SpMM	1	city-reviews	fwd	copy_u/max	512	3.8819	11.1645	0.348
g-SpMM	1	city-reviews	fwd	copy_u/min	512	3.8874	11.1289	0.349
g-SpMM	1	city-reviews	fwd	copy_u/sum	512	5.0675	8.7660	0.578
g-SpMM	1	city-reviews	fwd	div/max	512	9.1828	15.0396	0.611
g-SpMM	1	city-reviews	fwd	div/min	512	9.1031	15.1938	0.599
g-SpMM	1	city-reviews	fwd	div/sum	512	10.5206	16.9163	0.622
g-SpMM	1	city-reviews	fwd	mul/max	512	8.8606	14.8679	0.596
g-SpMM	1	city-reviews	fwd	mul/min	512	9.0958	15.6708	0.580
g-SpMM	1	city-reviews	fwd	mul/sum	512	8.8674	15.9535	0.556
g-SpMM	1	city-reviews	fwd	sub/max	512	9.0384	15.0283	0.601
g-SpMM	1	city-reviews	fwd	sub/min	512	9.0353	15.2151	0.594
g-SpMM	1	city-reviews	fwd	sub/sum	512	10.4049	16.9311	0.615
g-SpMM	1	city-roads-L	bwd	add/max	64	0.5158	0.5624	0.917
g-SpMM	1	city-roads-L	bwd	add/min	64	0.5189	0.5617	0.924
g-SpMM	1	city-roads-L	bwd	add/sum	64	0.4036	0.4910	0.822
g-SpMM	1	city-roads-L	bwd	copy_e/max	64	0.3571	0.4906	0.728
g-SpMM	1	city-roads-L	bwd	copy_e/min	64	0.3573	0.4901	0.729
g-SpMM	1	city-roads-L	bwd	copy_e/sum	64	0.2191	0.2029	1.080
g-SpMM	1	city-roads-L	bwd	copy_u/max	64	0.1952	0.1910	1.022
g-SpMM	1	city-roads-L	bwd	copy_u/min	64	0.2020	0.2035	0.993
g-SpMM	1	city-roads-L	bwd	copy_u/sum	64	0.2316	0.3110	0.745
g-SpMM	1	city-roads-L	bwd	div/max	64	0.6222	0.6632	0.938
g-SpMM	1	city-roads-L	bwd	div/min	64	0.6211	0.6638	0.936
g-SpMM	1	city-roads-L	bwd	div/sum	64	1.1240	1.0001	1.124
g-SpMM	1	city-roads-L	bwd	mul/max	64	0.6184	0.6618	0.934
g-SpMM	1	city-roads-L	bwd	mul/min	64	0.6208	0.6627	0.937
g-SpMM	1	city-roads-L	bwd	mul/sum	64	0.6476	0.8581	0.755
g-SpMM	1	city-roads-L	bwd	sub/max	64	0.5170	0.5633	0.918
g-SpMM	1	city-roads-L	bwd	sub/min	64	0.5173	0.5633	0.918
g-SpMM	1	city-roads-L	bwd	sub/sum	64	0.4038	0.4922	0.820
g-SpMM	1	city-roads-L	fb	add/max	64	0.8099	1.0483	0.773
g-SpMM	1	city-roads-L	fb	add/min	64	0.8100	1.0481	0.773
g-SpMM	1	city-roads-L	fb	add/sum	64	0.7407	0.8784	0.843
g-SpMM	1	city-roads-L	fb	copy_e/max	64	0.5945	0.7275	0.817
g-SpMM	1	city-roads-L	fb	copy_e/min	64	0.5949	0.7363	0.808
g-SpMM	1	city-roads-L	fb	copy_e/sum	64	0.4225	0.4197	1.007
g-SpMM	1	city-roads-L	fb	copy_u/max	64	0.4423	0.5731	0.772
g-SpMM	1	city-roads-L	fb	copy_u/min	64	0.4426	0.5727	0.773
g-SpMM	1	city-roads-L	fb	copy_u/sum	64	0.4623	0.6365	0.726
g-SpMM	1	city-roads-L	fb	div/max	64	0.9178	1.1510	0.797
g-SpMM	1	city-roads-L	fb	div/min	64	0.9180	1.1489	0.799
g-SpMM	1	city-roads-L	fb	div/sum	64	1.1275	1.3778	0.818
g-SpMM	1	city-roads-L	fb	mul/max	64	0.9120	1.1514	0.792
g-SpMM	1	city-roads-L	fb	mul/min	64	0.9139	1.1506	0.794
g-SpMM	1	city-roads-L	fb	mul/sum	64	0.9642	1.2254	0.787
g-SpMM	1	city-roads-L	fb	sub/max	64	0.8129	1.0507	0.774
g-SpMM	1	city-roads-L	fb	sub/min	64	1.2709	1.0513	1.209
g-SpMM	1	city-roads-L	fb	sub/sum	64	0.7182	0.8789	0.817
g-SpMM	1	city-roads-L	fwd	add/max	64	0.2996	0.4971	0.603
g-SpMM	1	city-roads-L	fwd	add/min	64	0.2999	0.4937	0.607
g-SpMM	1	city-roads-L	fwd	add/sum	64	0.3158	0.3884	0.813
g-SpMM	1	city-roads-L	fwd	copy_e/max	64	0.2416	0.2415	1.000
g-SpMM	1	city-roads-L	fwd	copy_e/min	64	0.2413	0.2411	1.001
g-SpMM	1	city-roads-L	fwd	copy_e/sum	64	0.2108	0.3888	0.542
g-SpMM	1	city-roads-L	fwd	copy_u/max	64	0.2642	0.4404	0.600
g-SpMM	1	city-roads-L	fwd	copy_u/min	64	0.2619	0.3950	0.663
g-SpMM	1	city-roads-L	fwd	copy_u/sum	64	0.2236	0.3094	0.723

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-roads-L	fwd	div/max	64	0.3081	0.4988	0.618
g-SpMM	1	city-roads-L	fwd	div/min	64	0.3003	0.4974	0.604
g-SpMM	1	city-roads-L	fwd	div/sum	64	0.3250	0.3935	0.826
g-SpMM	1	city-roads-L	fwd	mul/max	64	0.3066	0.4995	0.614
g-SpMM	1	city-roads-L	fwd	mul/min	64	0.2999	0.4955	0.605
g-SpMM	1	city-roads-L	fwd	mul/sum	64	0.3274	0.3875	0.845
g-SpMM	1	city-roads-L	fwd	sub/max	64	0.3002	0.5093	0.589
g-SpMM	1	city-roads-L	fwd	sub/min	64	0.4181	0.4986	0.839
g-SpMM	1	city-roads-L	fwd	sub/sum	64	0.3232	0.3966	0.815
g-SpMM	1	city-roads-L	bwd	add/max	128	0.9262	1.0017	0.925
g-SpMM	1	city-roads-L	bwd	add/min	128	0.9272	1.0007	0.927
g-SpMM	1	city-roads-L	bwd	add/sum	128	0.6983	0.8720	0.801
g-SpMM	1	city-roads-L	bwd	copy_e/max	128	0.6349	0.8583	0.740
g-SpMM	1	city-roads-L	bwd	copy_e/min	128	0.6343	0.8571	0.740
g-SpMM	1	city-roads-L	bwd	copy_e/sum	128	0.2938	0.2937	1.000
g-SpMM	1	city-roads-L	bwd	copy_u/max	128	0.2987	0.2982	1.002
g-SpMM	1	city-roads-L	bwd	copy_u/min	128	0.2992	0.2985	1.002
g-SpMM	1	city-roads-L	bwd	copy_u/sum	128	0.4005	0.5674	0.706
g-SpMM	1	city-roads-L	bwd	div/max	128	1.1476	1.1948	0.960
g-SpMM	1	city-roads-L	bwd	div/min	128	1.1484	1.1941	0.962
g-SpMM	1	city-roads-L	bwd	div/sum	128	1.2613	1.7844	0.707
g-SpMM	1	city-roads-L	bwd	mul/max	128	1.1369	1.1956	0.951
g-SpMM	1	city-roads-L	bwd	mul/min	128	1.1377	1.1945	0.952
g-SpMM	1	city-roads-L	bwd	mul/sum	128	1.1251	1.5146	0.743
g-SpMM	1	city-roads-L	bwd	sub/max	128	0.9341	1.0053	0.929
g-SpMM	1	city-roads-L	bwd	sub/min	128	0.9343	1.0051	0.930
g-SpMM	1	city-roads-L	bwd	sub/sum	128	0.6970	0.8713	0.800
g-SpMM	1	city-roads-L	fb	add/max	128	1.4494	1.8988	0.763
g-SpMM	1	city-roads-L	fb	add/min	128	1.4535	1.9001	0.765
g-SpMM	1	city-roads-L	fb	add/sum	128	1.2440	1.5744	0.790
g-SpMM	1	city-roads-L	fb	copy_e/max	128	1.0642	1.2917	0.824
g-SpMM	1	city-roads-L	fb	copy_e/min	128	1.0629	1.2903	0.824
g-SpMM	1	city-roads-L	fb	copy_e/sum	128	0.6621	0.6678	0.991
g-SpMM	1	city-roads-L	fb	copy_u/max	128	0.7662	1.0253	0.747
g-SpMM	1	city-roads-L	fb	copy_u/min	128	0.7669	1.0241	0.749
g-SpMM	1	city-roads-L	fb	copy_u/sum	128	0.8045	1.1600	0.694
g-SpMM	1	city-roads-L	fb	div/max	128	1.6728	2.0916	0.800
g-SpMM	1	city-roads-L	fb	div/min	128	1.6729	2.0893	0.801
g-SpMM	1	city-roads-L	fb	div/sum	128	1.8122	2.4859	0.729
g-SpMM	1	city-roads-L	fb	mul/max	128	1.6651	2.0875	0.798
g-SpMM	1	city-roads-L	fb	mul/min	128	1.6603	2.0917	0.794
g-SpMM	1	city-roads-L	fb	mul/sum	128	1.6682	2.1953	0.760
g-SpMM	1	city-roads-L	fb	sub/max	128	1.4581	1.9021	0.767
g-SpMM	1	city-roads-L	fb	sub/min	128	1.4585	1.9002	0.768
g-SpMM	1	city-roads-L	fb	sub/sum	128	1.2436	1.5748	0.790
g-SpMM	1	city-roads-L	fwd	add/max	128	0.5637	0.9158	0.616
g-SpMM	1	city-roads-L	fwd	add/min	128	0.5633	0.9115	0.618
g-SpMM	1	city-roads-L	fwd	add/sum	128	0.5625	0.7220	0.779
g-SpMM	1	city-roads-L	fwd	copy_e/max	128	0.5121	0.5586	0.917
g-SpMM	1	city-roads-L	fwd	copy_e/min	128	0.4332	0.4321	1.003
g-SpMM	1	city-roads-L	fwd	copy_e/sum	128	0.3840	0.3777	1.017
g-SpMM	1	city-roads-L	fwd	copy_u/max	128	0.4756	0.7350	0.647
g-SpMM	1	city-roads-L	fwd	copy_u/min	128	0.4753	0.7312	0.650
g-SpMM	1	city-roads-L	fwd	copy_u/sum	128	0.3978	0.5769	0.690
g-SpMM	1	city-roads-L	fwd	div/max	128	0.5461	0.9157	0.596
g-SpMM	1	city-roads-L	fwd	div/min	128	0.5338	0.9153	0.583
g-SpMM	1	city-roads-L	fwd	div/sum	128	0.5686	0.7177	0.792
g-SpMM	1	city-roads-L	fwd	mul/max	128	0.8107	0.9155	0.886
g-SpMM	1	city-roads-L	fwd	mul/min	128	0.5311	0.9137	0.581
g-SpMM	1	city-roads-L	fwd	mul/sum	128	0.5624	0.7026	0.801
g-SpMM	1	city-roads-L	fwd	sub/max	128	0.7930	0.9143	0.867
g-SpMM	1	city-roads-L	fwd	sub/min	128	0.5448	0.9010	0.605
g-SpMM	1	city-roads-L	fwd	sub/sum	128	0.5636	0.7233	0.779
g-SpMM	1	city-roads-L	bwd	add/max	256	1.7280	1.8441	0.937
g-SpMM	1	city-roads-L	bwd	add/min	256	1.7269	1.8436	0.937
g-SpMM	1	city-roads-L	bwd	add/sum	256	1.2609	1.5901	0.793
g-SpMM	1	city-roads-L	bwd	copy_e/max	256	1.1720	1.5711	0.746
g-SpMM	1	city-roads-L	bwd	copy_e/min	256	1.1760	1.5679	0.750
g-SpMM	1	city-roads-L	bwd	copy_e/sum	256	0.5235	0.5288	0.990
g-SpMM	1	city-roads-L	bwd	copy_u/max	256	0.5743	0.5718	1.004
g-SpMM	1	city-roads-L	bwd	copy_u/min	256	0.5716	0.5713	1.001
g-SpMM	1	city-roads-L	bwd	copy_u/sum	256	0.7386	1.0661	0.693
g-SpMM	1	city-roads-L	bwd	div/max	256	2.1691	2.2177	0.978
g-SpMM	1	city-roads-L	bwd	div/min	256	2.1682	2.2177	0.978
g-SpMM	1	city-roads-L	bwd	div/sum	256	2.3077	3.3052	0.698
g-SpMM	1	city-roads-L	bwd	mul/max	256	2.1600	2.2156	0.975
g-SpMM	1	city-roads-L	bwd	mul/min	256	2.1498	2.2139	0.971
g-SpMM	1	city-roads-L	bwd	mul/sum	256	2.0351	2.7758	0.733

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-roads-L	bwd	sub/max	256	1.7431	1.8510	0.942
g-SpMM	1	city-roads-L	bwd	sub/min	256	1.7464	1.8516	0.943
g-SpMM	1	city-roads-L	bwd	sub/sum	256	1.2634	1.5926	0.793
g-SpMM	1	city-roads-L	fb	add/max	256	2.7029	3.5502	0.761
g-SpMM	1	city-roads-L	fb	add/min	256	2.7039	3.5483	0.762
g-SpMM	1	city-roads-L	fb	add/sum	256	2.2640	2.9172	0.776
g-SpMM	1	city-roads-L	fb	copy_e/max	256	1.9778	2.3736	0.833
g-SpMM	1	city-roads-L	fb	copy_e/min	256	1.9909	2.3713	0.840
g-SpMM	1	city-roads-L	fb	copy_e/sum	256	1.2042	1.2044	1.000
g-SpMM	1	city-roads-L	fb	copy_u/max	256	1.4469	1.9306	0.749
g-SpMM	1	city-roads-L	fb	copy_u/min	256	1.4460	1.9310	0.749
g-SpMM	1	city-roads-L	fb	copy_u/sum	256	1.4737	2.1467	0.686
g-SpMM	1	city-roads-L	fb	div/max	256	3.1511	3.9264	0.803
g-SpMM	1	city-roads-L	fb	div/min	256	3.1483	3.9294	0.801
g-SpMM	1	city-roads-L	fb	div/sum	256	3.3195	4.6224	0.718
g-SpMM	1	city-roads-L	fb	mul/max	256	3.1280	3.9186	0.798
g-SpMM	1	city-roads-L	fb	mul/min	256	3.1348	3.9216	0.799
g-SpMM	1	city-roads-L	fb	mul/sum	256	3.0359	4.0689	0.746
g-SpMM	1	city-roads-L	fb	sub/max	256	2.7333	3.5606	0.768
g-SpMM	1	city-roads-L	fb	sub/min	256	2.7240	3.5571	0.766
g-SpMM	1	city-roads-L	fb	sub/sum	256	2.2661	2.9277	0.774
g-SpMM	1	city-roads-L	fwd	add/max	256	1.0863	1.7355	0.626
g-SpMM	1	city-roads-L	fwd	add/min	256	1.1115	1.7336	0.641
g-SpMM	1	city-roads-L	fwd	add/sum	256	1.0269	1.3599	0.755
g-SpMM	1	city-roads-L	fwd	copy_e/max	256	1.0287	0.9897	1.039
g-SpMM	1	city-roads-L	fwd	copy_e/min	256	0.9719	0.9045	1.075
g-SpMM	1	city-roads-L	fwd	copy_e/sum	256	0.9472	0.6944	1.364
g-SpMM	1	city-roads-L	fwd	copy_u/max	256	0.8844	1.3664	0.647
g-SpMM	1	city-roads-L	fwd	copy_u/min	256	0.8797	1.3682	0.643
g-SpMM	1	city-roads-L	fwd	copy_u/sum	256	0.7394	1.0838	0.682
g-SpMM	1	city-roads-L	fwd	div/max	256	1.0817	1.7381	0.622
g-SpMM	1	city-roads-L	fwd	div/min	256	0.9818	1.7617	0.557
g-SpMM	1	city-roads-L	fwd	div/sum	256	1.0355	1.3460	0.769
g-SpMM	1	city-roads-L	fwd	mul/max	256	1.2435	1.7461	0.712
g-SpMM	1	city-roads-L	fwd	mul/min	256	1.0179	1.7350	0.587
g-SpMM	1	city-roads-L	fwd	mul/sum	256	1.0245	1.3246	0.773
g-SpMM	1	city-roads-L	fwd	sub/max	256	2.1698	1.7375	1.249
g-SpMM	1	city-roads-L	fwd	sub/min	256	1.4285	1.7348	0.823
g-SpMM	1	city-roads-L	fwd	sub/sum	256	1.0276	1.3634	0.754
g-SpMM	1	city-roads-L	bwd	add/max	512	3.0203	3.2492	0.930
g-SpMM	1	city-roads-L	bwd	add/min	512	3.0256	3.2563	0.929
g-SpMM	1	city-roads-L	bwd	add/sum	512	2.0423	2.6759	0.763
g-SpMM	1	city-roads-L	bwd	copy_e/max	512	2.0261	2.6599	0.762
g-SpMM	1	city-roads-L	bwd	copy_e/min	512	2.0244	2.6643	0.760
g-SpMM	1	city-roads-L	bwd	copy_e/sum	512	0.8338	0.8348	0.999
g-SpMM	1	city-roads-L	bwd	copy_u/max	512	1.1147	1.1151	1.000
g-SpMM	1	city-roads-L	bwd	copy_u/min	512	1.1149	1.1148	1.000
g-SpMM	1	city-roads-L	bwd	copy_u/sum	512	1.2110	1.8411	0.658
g-SpMM	1	city-roads-L	bwd	div/max	512	4.0207	3.9637	1.014
g-SpMM	1	city-roads-L	bwd	div/min	512	4.0167	3.9682	1.012
g-SpMM	1	city-roads-L	bwd	div/sum	512	4.0104	5.8595	0.684
g-SpMM	1	city-roads-L	bwd	mul/max	512	3.9738	3.9607	1.003
g-SpMM	1	city-roads-L	bwd	mul/min	512	3.9717	3.9540	1.004
g-SpMM	1	city-roads-L	bwd	mul/sum	512	3.4104	4.8827	0.698
g-SpMM	1	city-roads-L	bwd	sub/max	512	3.0509	3.2503	0.939
g-SpMM	1	city-roads-L	bwd	sub/min	512	3.0502	3.2389	0.942
g-SpMM	1	city-roads-L	bwd	sub/sum	512	2.0477	2.6786	0.764
g-SpMM	1	city-roads-L	fb	add/max	512	4.7223	6.3554	0.743
g-SpMM	1	city-roads-L	fb	add/min	512	4.7241	6.3566	0.743
g-SpMM	1	city-roads-L	fb	add/sum	512	3.8601	5.0941	0.758
g-SpMM	1	city-roads-L	fb	copy_e/max	512	3.4769	4.1102	0.846
g-SpMM	1	city-roads-L	fb	copy_e/min	512	3.4749	4.1063	0.846
g-SpMM	1	city-roads-L	fb	copy_e/sum	512	2.0343	2.0428	0.996
g-SpMM	1	city-roads-L	fb	copy_u/max	512	2.5725	3.5254	0.730
g-SpMM	1	city-roads-L	fb	copy_u/min	512	2.5757	3.5327	0.729
g-SpMM	1	city-roads-L	fb	copy_u/sum	512	2.4228	3.7254	0.650
g-SpMM	1	city-roads-L	fb	div/max	512	5.7079	7.0773	0.807
g-SpMM	1	city-roads-L	fb	div/min	512	5.7139	7.0883	0.806
g-SpMM	1	city-roads-L	fb	div/sum	512	5.7660	8.2416	0.700
g-SpMM	1	city-roads-L	fb	mul/max	512	5.6592	7.0705	0.800
g-SpMM	1	city-roads-L	fb	mul/min	512	5.6816	7.0701	0.804
g-SpMM	1	city-roads-L	fb	mul/sum	512	5.1569	7.2302	0.713
g-SpMM	1	city-roads-L	fb	sub/max	512	4.7454	6.3641	0.746
g-SpMM	1	city-roads-L	fb	sub/min	512	4.7522	6.3599	0.747
g-SpMM	1	city-roads-L	fb	sub/sum	512	3.7972	5.0990	0.745
g-SpMM	1	city-roads-L	fwd	add/max	512	2.1069	3.1766	0.663
g-SpMM	1	city-roads-L	fwd	add/min	512	2.0626	3.1793	0.649
g-SpMM	1	city-roads-L	fwd	add/sum	512	1.8349	2.4808	0.740

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-roads-L	fwd	copy_e/max	512	2.3231	1.9082	1.217
g-SpMM	1	city-roads-L	fwd	copy_e/min	512	1.7135	1.8950	0.904
g-SpMM	1	city-roads-L	fwd	copy_e/sum	512	1.2179	1.2177	1.000
g-SpMM	1	city-roads-L	fwd	copy_u/max	512	1.7151	2.4363	0.704
g-SpMM	1	city-roads-L	fwd	copy_u/min	512	1.4691	2.4273	0.605
g-SpMM	1	city-roads-L	fwd	copy_u/sum	512	1.2130	1.8936	0.641
g-SpMM	1	city-roads-L	fwd	div/max	512	2.5395	3.1798	0.799
g-SpMM	1	city-roads-L	fwd	div/min	512	2.0052	3.1313	0.640
g-SpMM	1	city-roads-L	fwd	div/sum	512	1.8013	2.4440	0.737
g-SpMM	1	city-roads-L	fwd	mul/max	512	2.0427	3.1753	0.643
g-SpMM	1	city-roads-L	fwd	mul/min	512	2.0617	3.1743	0.650
g-SpMM	1	city-roads-L	fwd	mul/sum	512	1.7833	2.4129	0.739
g-SpMM	1	city-roads-L	fwd	sub/max	512	2.0417	3.1784	0.642
g-SpMM	1	city-roads-L	fwd	sub/min	512	2.3094	3.1755	0.727
g-SpMM	1	city-roads-L	fwd	sub/sum	512	1.7910	2.4791	0.722
g-SpMM	1	city-roads-M	bwd	add/max	64	0.2239	0.2396	0.934
g-SpMM	1	city-roads-M	bwd	add/min	64	0.2287	0.2470	0.926
g-SpMM	1	city-roads-M	bwd	add/sum	64	0.2937	0.3035	0.968
g-SpMM	1	city-roads-M	bwd	copy_e/max	64	0.1967	0.2011	0.978
g-SpMM	1	city-roads-M	bwd	copy_e/min	64	0.1946	0.2086	0.933
g-SpMM	1	city-roads-M	bwd	copy_e/sum	64	0.1893	0.1835	1.032
g-SpMM	1	city-roads-M	bwd	copy_u/max	64	0.1935	0.1998	0.969
g-SpMM	1	city-roads-M	bwd	copy_u/min	64	0.1871	0.1978	0.946
g-SpMM	1	city-roads-M	bwd	copy_u/sum	64	0.2310	0.2337	0.988
g-SpMM	1	city-roads-M	bwd	div/max	64	0.2324	0.2517	0.923
g-SpMM	1	city-roads-M	bwd	div/min	64	0.2279	0.2514	0.907
g-SpMM	1	city-roads-M	bwd	div/sum	64	0.2605	0.3668	0.710
g-SpMM	1	city-roads-M	bwd	mul/max	64	0.2247	0.2521	0.891
g-SpMM	1	city-roads-M	bwd	mul/min	64	0.2469	0.2521	0.980
g-SpMM	1	city-roads-M	bwd	mul/sum	64	0.2880	0.3024	0.953
g-SpMM	1	city-roads-M	bwd	sub/max	64	0.2437	0.2095	1.163
g-SpMM	1	city-roads-M	bwd	sub/min	64	0.2295	0.2311	0.993
g-SpMM	1	city-roads-M	bwd	sub/sum	64	0.2948	0.3066	0.962
g-SpMM	1	city-roads-M	fb	add/max	64	0.4464	0.4898	0.911
g-SpMM	1	city-roads-M	fb	add/min	64	0.4521	0.5071	0.892
g-SpMM	1	city-roads-M	fb	add/sum	64	0.5102	0.4825	1.057
g-SpMM	1	city-roads-M	fb	copy_e/max	64	0.4179	0.4112	1.016
g-SpMM	1	city-roads-M	fb	copy_e/min	64	0.4159	0.4005	1.039
g-SpMM	1	city-roads-M	fb	copy_e/sum	64	0.3866	0.3677	1.051
g-SpMM	1	city-roads-M	fb	copy_u/max	64	0.4102	0.4753	0.863
g-SpMM	1	city-roads-M	fb	copy_u/min	64	0.4172	0.4724	0.883
g-SpMM	1	city-roads-M	fb	copy_u/sum	64	0.4308	0.4618	0.933
g-SpMM	1	city-roads-M	fb	div/max	64	0.4852	0.4343	1.117
g-SpMM	1	city-roads-M	fb	div/min	64	0.4833	0.4418	1.094
g-SpMM	1	city-roads-M	fb	div/sum	64	0.4981	0.4902	1.016
g-SpMM	1	city-roads-M	fb	mul/max	64	0.4411	0.4230	1.043
g-SpMM	1	city-roads-M	fb	mul/min	64	0.5353	0.4278	1.251
g-SpMM	1	city-roads-M	fb	mul/sum	64	0.5386	0.4569	1.179
g-SpMM	1	city-roads-M	fb	sub/max	64	0.4975	0.4735	1.051
g-SpMM	1	city-roads-M	fb	sub/min	64	0.4420	0.4839	0.913
g-SpMM	1	city-roads-M	fb	sub/sum	64	0.4968	0.5303	0.937
g-SpMM	1	city-roads-M	fwd	add/max	64	0.1003	0.2676	0.375
g-SpMM	1	city-roads-M	fwd	add/min	64	0.1028	0.1650	0.623
g-SpMM	1	city-roads-M	fwd	add/sum	64	0.1064	0.1369	0.777
g-SpMM	1	city-roads-M	fwd	copy_e/max	64	0.0882	0.0902	0.978
g-SpMM	1	city-roads-M	fwd	copy_e/min	64	0.0886	0.1004	0.883
g-SpMM	1	city-roads-M	fwd	copy_e/sum	64	0.0799	0.0867	0.922
g-SpMM	1	city-roads-M	fwd	copy_u/max	64	0.0866	0.1245	0.696
g-SpMM	1	city-roads-M	fwd	copy_u/min	64	0.0917	0.1237	0.742
g-SpMM	1	city-roads-M	fwd	copy_u/sum	64	0.0788	0.0823	0.958
g-SpMM	1	city-roads-M	fwd	div/max	64	0.0995	0.1664	0.598
g-SpMM	1	city-roads-M	fwd	div/min	64	0.1000	0.1658	0.603
g-SpMM	1	city-roads-M	fwd	div/sum	64	0.1071	0.1350	0.793
g-SpMM	1	city-roads-M	fwd	mul/max	64	0.1027	0.1645	0.624
g-SpMM	1	city-roads-M	fwd	mul/min	64	0.0998	0.1655	0.603
g-SpMM	1	city-roads-M	fwd	mul/sum	64	0.1064	0.1311	0.812
g-SpMM	1	city-roads-M	fwd	sub/max	64	0.1038	0.1654	0.627
g-SpMM	1	city-roads-M	fwd	sub/min	64	0.0975	0.1652	0.590
g-SpMM	1	city-roads-M	fwd	sub/sum	64	0.1064	0.1367	0.778
g-SpMM	1	city-roads-M	bwd	add/max	128	0.3276	0.3748	0.874
g-SpMM	1	city-roads-M	bwd	add/min	128	0.3273	0.3737	0.876
g-SpMM	1	city-roads-M	bwd	add/sum	128	0.3060	0.3089	0.991
g-SpMM	1	city-roads-M	bwd	copy_e/max	128	0.2423	0.3363	0.720
g-SpMM	1	city-roads-M	bwd	copy_e/min	128	0.2920	0.3376	0.865
g-SpMM	1	city-roads-M	bwd	copy_e/sum	128	0.2100	0.1703	1.233
g-SpMM	1	city-roads-M	bwd	copy_u/max	128	0.1907	0.1783	1.070
g-SpMM	1	city-roads-M	bwd	copy_u/min	128	0.1876	0.1803	1.040
g-SpMM	1	city-roads-M	bwd	copy_u/sum	128	0.2242	0.2106	1.064

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-roads-M	bwd	div/max	128	0.4317	0.4664	0.926
g-SpMM	1	city-roads-M	bwd	div/min	128	0.4303	0.4655	0.924
g-SpMM	1	city-roads-M	bwd	div/sum	128	0.4626	0.6602	0.701
g-SpMM	1	city-roads-M	bwd	mul/max	128	0.4258	0.4677	0.910
g-SpMM	1	city-roads-M	bwd	mul/min	128	0.4255	0.4667	0.912
g-SpMM	1	city-roads-M	bwd	mul/sum	128	0.3965	0.5505	0.720
g-SpMM	1	city-roads-M	bwd	sub/max	128	0.3314	0.3766	0.880
g-SpMM	1	city-roads-M	bwd	sub/min	128	0.3316	0.3760	0.882
g-SpMM	1	city-roads-M	bwd	sub/sum	128	0.2948	0.3085	0.956
g-SpMM	1	city-roads-M	fb	add/max	128	0.5052	0.6865	0.736
g-SpMM	1	city-roads-M	fb	add/min	128	0.5041	0.6866	0.734
g-SpMM	1	city-roads-M	fb	add/sum	128	0.5094	0.5725	0.890
g-SpMM	1	city-roads-M	fb	copy_e/max	128	0.4404	0.4798	0.918
g-SpMM	1	city-roads-M	fb	copy_e/min	128	0.4414	0.4822	0.915
g-SpMM	1	city-roads-M	fb	copy_e/sum	128	0.3977	0.3619	1.099
g-SpMM	1	city-roads-M	fb	copy_u/max	128	0.4265	0.4079	1.046
g-SpMM	1	city-roads-M	fb	copy_u/min	128	0.4142	0.4099	1.010
g-SpMM	1	city-roads-M	fb	copy_u/sum	128	0.4310	0.4272	1.009
g-SpMM	1	city-roads-M	fb	div/max	128	0.6043	0.7763	0.778
g-SpMM	1	city-roads-M	fb	div/min	128	0.6066	0.7735	0.784
g-SpMM	1	city-roads-M	fb	div/sum	128	0.6512	0.9007	0.723
g-SpMM	1	city-roads-M	fb	mul/max	128	0.6008	0.7787	0.772
g-SpMM	1	city-roads-M	fb	mul/min	128	0.6029	0.7746	0.778
g-SpMM	1	city-roads-M	fb	mul/sum	128	0.5830	0.7857	0.742
g-SpMM	1	city-roads-M	fb	sub/max	128	0.5092	0.6870	0.741
g-SpMM	1	city-roads-M	fb	sub/min	128	1.3003	0.6884	1.889
g-SpMM	1	city-roads-M	fb	sub/sum	128	0.5260	0.5645	0.932
g-SpMM	1	city-roads-M	fwd	add/max	128	0.3839	0.3084	1.245
g-SpMM	1	city-roads-M	fwd	add/min	128	0.1767	0.3086	0.573
g-SpMM	1	city-roads-M	fwd	add/sum	128	0.1907	0.2548	0.749
g-SpMM	1	city-roads-M	fwd	copy_e/max	128	0.1399	0.1414	0.990
g-SpMM	1	city-roads-M	fwd	copy_e/min	128	0.1396	0.1409	0.991
g-SpMM	1	city-roads-M	fwd	copy_e/sum	128	0.1255	0.1272	0.987
g-SpMM	1	city-roads-M	fwd	copy_u/max	128	0.1534	0.2387	0.643
g-SpMM	1	city-roads-M	fwd	copy_u/min	128	0.1538	0.2372	0.649
g-SpMM	1	city-roads-M	fwd	copy_u/sum	128	0.1323	0.1983	0.667
g-SpMM	1	city-roads-M	fwd	div/max	128	0.1769	0.3094	0.572
g-SpMM	1	city-roads-M	fwd	div/min	128	0.2047	0.3099	0.660
g-SpMM	1	city-roads-M	fwd	div/sum	128	0.1952	0.2529	0.772
g-SpMM	1	city-roads-M	fwd	mul/max	128	0.1801	0.3077	0.585
g-SpMM	1	city-roads-M	fwd	mul/min	128	0.1772	0.3110	0.570
g-SpMM	1	city-roads-M	fwd	mul/sum	128	0.1912	0.2501	0.765
g-SpMM	1	city-roads-M	fwd	sub/max	128	0.1767	0.3609	0.490
g-SpMM	1	city-roads-M	fwd	sub/min	128	0.1764	0.3069	0.575
g-SpMM	1	city-roads-M	fwd	sub/sum	128	0.1908	0.2608	0.732
g-SpMM	1	city-roads-M	bwd	add/max	256	0.6211	0.6994	0.888
g-SpMM	1	city-roads-M	bwd	add/min	256	0.6269	0.6990	0.897
g-SpMM	1	city-roads-M	bwd	add/sum	256	0.4461	0.5712	0.781
g-SpMM	1	city-roads-M	bwd	copy_e/max	256	0.4631	0.6267	0.739
g-SpMM	1	city-roads-M	bwd	copy_e/min	256	0.4682	0.6330	0.740
g-SpMM	1	city-roads-M	bwd	copy_e/sum	256	0.1930	0.2111	0.914
g-SpMM	1	city-roads-M	bwd	copy_u/max	256	0.2533	0.2452	1.033
g-SpMM	1	city-roads-M	bwd	copy_u/min	256	0.2457	0.2451	1.002
g-SpMM	1	city-roads-M	bwd	copy_u/sum	256	0.2512	0.3734	0.673
g-SpMM	1	city-roads-M	bwd	div/max	256	0.8176	0.8647	0.945
g-SpMM	1	city-roads-M	bwd	div/min	256	0.8181	0.8661	0.945
g-SpMM	1	city-roads-M	bwd	div/sum	256	0.8596	1.2292	0.699
g-SpMM	1	city-roads-M	bwd	mul/max	256	0.8077	0.8653	0.933
g-SpMM	1	city-roads-M	bwd	mul/min	256	0.8107	0.8670	0.935
g-SpMM	1	city-roads-M	bwd	mul/sum	256	0.7358	1.0140	0.726
g-SpMM	1	city-roads-M	bwd	sub/max	256	0.6354	0.7066	0.899
g-SpMM	1	city-roads-M	bwd	sub/min	256	0.6405	0.7022	0.912
g-SpMM	1	city-roads-M	bwd	sub/sum	256	0.4457	0.5728	0.778
g-SpMM	1	city-roads-M	fb	add/max	256	0.9526	1.2884	0.739
g-SpMM	1	city-roads-M	fb	add/min	256	0.9473	1.2885	0.735
g-SpMM	1	city-roads-M	fb	add/sum	256	0.7954	1.0534	0.755
g-SpMM	1	city-roads-M	fb	copy_e/max	256	0.7217	0.8885	0.812
g-SpMM	1	city-roads-M	fb	copy_e/min	256	0.7224	0.8889	0.813
g-SpMM	1	city-roads-M	fb	copy_e/sum	256	0.4266	0.4206	1.014
g-SpMM	1	city-roads-M	fb	copy_u/max	256	0.5293	0.6916	0.765
g-SpMM	1	city-roads-M	fb	copy_u/min	256	0.5343	0.6983	0.765
g-SpMM	1	city-roads-M	fb	copy_u/sum	256	0.5010	0.7574	0.662
g-SpMM	1	city-roads-M	fb	div/max	256	1.1426	1.4551	0.785
g-SpMM	1	city-roads-M	fb	div/min	256	1.1448	1.4559	0.786
g-SpMM	1	city-roads-M	fb	div/sum	256	1.2073	1.6855	0.716
g-SpMM	1	city-roads-M	fb	mul/max	256	1.1318	1.4559	0.777
g-SpMM	1	city-roads-M	fb	mul/min	256	1.1329	1.4507	0.781
g-SpMM	1	city-roads-M	fb	mul/sum	256	1.0793	1.4646	0.737

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	city-roads-M	fb	sub/max	256	0.9553	1.2931	0.739
g-SpMM	1	city-roads-M	fb	sub/min	256	0.9558	1.2914	0.740
g-SpMM	1	city-roads-M	fb	sub/sum	256	0.7953	1.0567	0.753
g-SpMM	1	city-roads-M	fwd	add/max	256	0.3573	0.6008	0.595
g-SpMM	1	city-roads-M	fwd	add/min	256	0.4632	0.5890	0.786
g-SpMM	1	city-roads-M	fwd	add/sum	256	0.3570	0.4971	0.718
g-SpMM	1	city-roads-M	fwd	copy_e/max	256	0.2999	0.3081	0.973
g-SpMM	1	city-roads-M	fwd	copy_e/min	256	0.3872	0.2630	1.472
g-SpMM	1	city-roads-M	fwd	copy_e/sum	256	0.2489	0.2313	1.076
g-SpMM	1	city-roads-M	fwd	copy_u/max	256	0.2878	0.4500	0.639
g-SpMM	1	city-roads-M	fwd	copy_u/min	256	0.7273	0.4434	1.640
g-SpMM	1	city-roads-M	fwd	copy_u/sum	256	0.2489	0.3794	0.656
g-SpMM	1	city-roads-M	fwd	div/max	256	0.5287	0.6005	0.881
g-SpMM	1	city-roads-M	fwd	div/min	256	0.3870	0.5994	0.646
g-SpMM	1	city-roads-M	fwd	div/sum	256	0.3653	0.4776	0.765
g-SpMM	1	city-roads-M	fwd	mul/max	256	0.3916	0.6018	0.651
g-SpMM	1	city-roads-M	fwd	mul/min	256	0.3781	0.5983	0.632
g-SpMM	1	city-roads-M	fwd	mul/sum	256	0.3541	0.4664	0.759
g-SpMM	1	city-roads-M	fwd	sub/max	256	0.3531	0.6245	0.565
g-SpMM	1	city-roads-M	fwd	sub/min	256	0.3284	0.5897	0.557
g-SpMM	1	city-roads-M	fwd	sub/sum	256	0.3572	0.4930	0.725
g-SpMM	1	city-roads-M	bwd	add/max	512	1.0694	1.2057	0.887
g-SpMM	1	city-roads-M	bwd	add/min	512	1.0697	1.2056	0.887
g-SpMM	1	city-roads-M	bwd	add/sum	512	0.6981	0.9436	0.740
g-SpMM	1	city-roads-M	bwd	copy_e/max	512	0.8022	1.0726	0.748
g-SpMM	1	city-roads-M	bwd	copy_e/min	512	0.8075	1.0733	0.752
g-SpMM	1	city-roads-M	bwd	copy_e/sum	512	0.3066	0.3050	1.005
g-SpMM	1	city-roads-M	bwd	copy_u/max	512	0.4786	0.4787	1.000
g-SpMM	1	city-roads-M	bwd	copy_u/min	512	0.4790	0.4801	0.998
g-SpMM	1	city-roads-M	bwd	copy_u/sum	512	0.3928	0.6321	0.622
g-SpMM	1	city-roads-M	bwd	div/max	512	1.4911	1.5307	0.974
g-SpMM	1	city-roads-M	bwd	div/min	512	1.4928	1.5307	0.975
g-SpMM	1	city-roads-M	bwd	div/sum	512	1.4740	2.1516	0.685
g-SpMM	1	city-roads-M	bwd	mul/max	512	1.4740	1.5273	0.965
g-SpMM	1	city-roads-M	bwd	mul/min	512	1.4770	1.5259	0.968
g-SpMM	1	city-roads-M	bwd	mul/sum	512	1.2003	1.7602	0.682
g-SpMM	1	city-roads-M	bwd	sub/max	512	1.0811	1.2122	0.892
g-SpMM	1	city-roads-M	bwd	sub/min	512	1.0818	1.2107	0.894
g-SpMM	1	city-roads-M	bwd	sub/sum	512	0.6998	0.9428	0.742
g-SpMM	1	city-roads-M	fb	add/max	512	1.6148	2.2647	0.713
g-SpMM	1	city-roads-M	fb	add/min	512	1.6165	2.2664	0.713
g-SpMM	1	city-roads-M	fb	add/sum	512	1.2986	1.8171	0.715
g-SpMM	1	city-roads-M	fb	copy_e/max	512	1.2629	1.5266	0.827
g-SpMM	1	city-roads-M	fb	copy_e/min	512	1.2622	1.5293	0.825
g-SpMM	1	city-roads-M	fb	copy_e/sum	512	0.7194	0.6991	1.029
g-SpMM	1	city-roads-M	fb	copy_u/max	512	0.9348	1.2536	0.746
g-SpMM	1	city-roads-M	fb	copy_u/min	512	0.9350	1.2541	0.746
g-SpMM	1	city-roads-M	fb	copy_u/sum	512	0.7846	1.2899	0.608
g-SpMM	1	city-roads-M	fb	div/max	512	2.0406	2.5860	0.789
g-SpMM	1	city-roads-M	fb	div/min	512	2.0398	2.5868	0.789
g-SpMM	1	city-roads-M	fb	div/sum	512	2.0806	2.9934	0.695
g-SpMM	1	city-roads-M	fb	mul/max	512	2.0223	2.5886	0.781
g-SpMM	1	city-roads-M	fb	mul/min	512	2.0219	2.5894	0.781
g-SpMM	1	city-roads-M	fb	mul/sum	512	1.7994	2.5805	0.697
g-SpMM	1	city-roads-M	fb	sub/max	512	1.6261	2.2751	0.715
g-SpMM	1	city-roads-M	fb	sub/min	512	1.6279	2.2738	0.716
g-SpMM	1	city-roads-M	fb	sub/sum	512	1.3026	1.8140	0.718
g-SpMM	1	city-roads-M	fwd	add/max	512	0.7871	1.0779	0.730
g-SpMM	1	city-roads-M	fwd	add/min	512	0.7957	1.0832	0.735
g-SpMM	1	city-roads-M	fwd	add/sum	512	0.6144	0.8912	0.689
g-SpMM	1	city-roads-M	fwd	copy_e/max	512	0.6451	0.7528	0.857
g-SpMM	1	city-roads-M	fwd	copy_e/min	512	0.7195	0.8107	0.887
g-SpMM	1	city-roads-M	fwd	copy_e/sum	512	0.4073	0.3999	1.018
g-SpMM	1	city-roads-M	fwd	copy_u/max	512	0.4620	0.7769	0.595
g-SpMM	1	city-roads-M	fwd	copy_u/min	512	0.5247	0.7750	0.677
g-SpMM	1	city-roads-M	fwd	copy_u/sum	512	0.3908	0.6472	0.604
g-SpMM	1	city-roads-M	fwd	div/max	512	0.7283	1.0841	0.672
g-SpMM	1	city-roads-M	fwd	div/min	512	0.7608	1.0786	0.705
g-SpMM	1	city-roads-M	fwd	div/sum	512	0.6206	0.8552	0.726
g-SpMM	1	city-roads-M	fwd	mul/max	512	0.7415	1.0804	0.686
g-SpMM	1	city-roads-M	fwd	mul/min	512	0.5545	1.2157	0.456
g-SpMM	1	city-roads-M	fwd	mul/sum	512	0.6144	0.8445	0.727
g-SpMM	1	city-roads-M	fwd	sub/max	512	0.7708	1.0795	0.714
g-SpMM	1	city-roads-M	fwd	sub/min	512	0.7796	1.2614	0.618
g-SpMM	1	city-roads-M	fwd	sub/sum	512	0.6264	0.8947	0.700
g-SpMM	1	cora	bwd	add/max	64	0.2107	0.2151	0.980
g-SpMM	1	cora	bwd	add/min	64	0.2068	0.1900	1.089
g-SpMM	1	cora	bwd	add/sum	64	0.2606	0.2895	0.900

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	cora	bwd	copy_e/max	64	0.1823	0.1789	1.019
g-SpMM	1	cora	bwd	copy_e/min	64	0.1940	0.1806	1.074
g-SpMM	1	cora	bwd	copy_e/sum	64	0.1833	0.1783	1.028
g-SpMM	1	cora	bwd	copy_u/max	64	0.1769	0.1570	1.127
g-SpMM	1	cora	bwd	copy_u/min	64	0.1827	0.1547	1.181
g-SpMM	1	cora	bwd	copy_u/sum	64	0.2075	0.1768	1.174
g-SpMM	1	cora	bwd	div/max	64	0.2159	0.1752	1.232
g-SpMM	1	cora	bwd	div/min	64	0.2057	0.1640	1.254
g-SpMM	1	cora	bwd	div/sum	64	0.2707	0.2063	1.312
g-SpMM	1	cora	bwd	mul/max	64	0.2180	0.2208	0.987
g-SpMM	1	cora	bwd	mul/min	64	0.2280	0.2276	1.002
g-SpMM	1	cora	bwd	mul/sum	64	0.2466	0.2838	0.869
g-SpMM	1	cora	bwd	sub/max	64	0.2159	0.2407	0.897
g-SpMM	1	cora	bwd	sub/min	64	0.2161	0.2299	0.940
g-SpMM	1	cora	bwd	sub/sum	64	0.2947	0.3168	0.930
g-SpMM	1	cora	fb	add/max	64	0.4254	0.4191	1.015
g-SpMM	1	cora	fb	add/min	64	0.4364	0.5076	0.860
g-SpMM	1	cora	fb	add/sum	64	0.5032	0.5240	0.960
g-SpMM	1	cora	fb	copy_e/max	64	0.4120	0.3978	1.036
g-SpMM	1	cora	fb	copy_e/min	64	0.4183	0.3876	1.079
g-SpMM	1	cora	fb	copy_e/sum	64	0.4162	0.3701	1.125
g-SpMM	1	cora	fb	copy_u/max	64	0.4104	0.3348	1.226
g-SpMM	1	cora	fb	copy_u/min	64	0.4411	0.3324	1.327
g-SpMM	1	cora	fb	copy_u/sum	64	0.4104	0.3431	1.196
g-SpMM	1	cora	fb	div/max	64	0.4196	0.3835	1.094
g-SpMM	1	cora	fb	div/min	64	0.4462	0.3445	1.295
g-SpMM	1	cora	fb	div/sum	64	0.4859	0.4851	1.002
g-SpMM	1	cora	fb	mul/max	64	0.4651	0.4833	0.962
g-SpMM	1	cora	fb	mul/min	64	0.4482	0.4698	0.954
g-SpMM	1	cora	fb	mul/sum	64	0.5049	0.4968	1.016
g-SpMM	1	cora	fb	sub/max	64	0.5294	0.4791	1.105
g-SpMM	1	cora	fb	sub/min	64	0.4468	0.4963	0.900
g-SpMM	1	cora	fb	sub/sum	64	0.4889	0.5577	0.877
g-SpMM	1	cora	fwd	add/max	64	0.0941	0.0862	1.091
g-SpMM	1	cora	fwd	add/min	64	0.0890	0.0913	0.975
g-SpMM	1	cora	fwd	add/sum	64	0.0809	0.0792	1.021
g-SpMM	1	cora	fwd	copy_e/max	64	0.0854	0.0861	0.993
g-SpMM	1	cora	fwd	copy_e/min	64	0.0861	0.0839	1.026
g-SpMM	1	cora	fwd	copy_e/sum	64	0.0799	0.0771	1.036
g-SpMM	1	cora	fwd	copy_u/max	64	0.0854	0.0835	1.023
g-SpMM	1	cora	fwd	copy_u/min	64	0.0882	0.0856	1.030
g-SpMM	1	cora	fwd	copy_u/sum	64	0.0809	0.0797	1.015
g-SpMM	1	cora	fwd	div/max	64	0.0866	0.0854	1.014
g-SpMM	1	cora	fwd	div/min	64	0.0860	0.0865	0.994
g-SpMM	1	cora	fwd	div/sum	64	0.0791	0.0799	0.990
g-SpMM	1	cora	fwd	mul/max	64	0.0881	0.0962	0.916
g-SpMM	1	cora	fwd	mul/min	64	0.0861	0.1035	0.831
g-SpMM	1	cora	fwd	mul/sum	64	0.0816	0.0791	1.032
g-SpMM	1	cora	fwd	sub/max	64	0.0875	0.0855	1.023
g-SpMM	1	cora	fwd	sub/min	64	0.0891	0.0965	0.924
g-SpMM	1	cora	fwd	sub/sum	64	0.0809	0.0802	1.008
g-SpMM	1	cora	bwd	add/max	128	0.2198	0.2420	0.908
g-SpMM	1	cora	bwd	add/min	128	0.2207	0.2785	0.792
g-SpMM	1	cora	bwd	add/sum	128	0.2813	0.2416	1.164
g-SpMM	1	cora	bwd	copy_e/max	128	0.2093	0.2081	1.006
g-SpMM	1	cora	bwd	copy_e/min	128	0.1907	0.1878	1.016
g-SpMM	1	cora	bwd	copy_e/sum	128	0.3437	0.1663	2.066
g-SpMM	1	cora	bwd	copy_u/max	128	0.2249	0.1702	1.322
g-SpMM	1	cora	bwd	copy_u/min	128	0.1980	0.1731	1.144
g-SpMM	1	cora	bwd	copy_u/sum	128	0.2240	0.1948	1.150
g-SpMM	1	cora	bwd	div/max	128	0.2237	0.1888	1.185
g-SpMM	1	cora	bwd	div/min	128	0.2218	0.1864	1.190
g-SpMM	1	cora	bwd	div/sum	128	0.2513	0.1971	1.275
g-SpMM	1	cora	bwd	mul/max	128	0.2216	0.1716	1.292
g-SpMM	1	cora	bwd	mul/min	128	0.2251	0.1988	1.132
g-SpMM	1	cora	bwd	mul/sum	128	0.2645	0.2304	1.148
g-SpMM	1	cora	bwd	sub/max	128	0.2355	0.2330	1.011
g-SpMM	1	cora	bwd	sub/min	128	0.2173	0.1991	1.092
g-SpMM	1	cora	bwd	sub/sum	128	0.2938	0.3060	0.960
g-SpMM	1	cora	fb	add/max	128	0.4517	0.5078	0.889
g-SpMM	1	cora	fb	add/min	128	0.4355	0.4679	0.931
g-SpMM	1	cora	fb	add/sum	128	0.4995	0.5043	0.991
g-SpMM	1	cora	fb	copy_e/max	128	0.4205	0.4491	0.936
g-SpMM	1	cora	fb	copy_e/min	128	0.4128	0.3925	1.052
g-SpMM	1	cora	fb	copy_e/sum	128	0.5725	0.3562	1.607
g-SpMM	1	cora	fb	copy_u/max	128	0.4254	0.4281	0.994
g-SpMM	1	cora	fb	copy_u/min	128	0.4268	0.3941	1.083
g-SpMM	1	cora	fb	copy_u/sum	128	0.4719	0.3826	1.233

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	cora	fb	div/max	128	0.4726	0.4028	1.173
g-SpMM	1	cora	fb	div/min	128	0.4588	0.4136	1.109
g-SpMM	1	cora	fb	div/sum	128	0.4865	0.4086	1.191
g-SpMM	1	cora	fb	mul/max	128	0.4739	0.3570	1.327
g-SpMM	1	cora	fb	mul/min	128	0.4600	0.4215	1.091
g-SpMM	1	cora	fb	mul/sum	128	0.5004	0.4577	1.093
g-SpMM	1	cora	fb	sub/max	128	0.4460	0.4036	1.105
g-SpMM	1	cora	fb	sub/min	128	0.4511	0.4377	1.030
g-SpMM	1	cora	fb	sub/sum	128	0.5074	0.5467	0.928
g-SpMM	1	cora	fwd	add/max	128	0.0884	0.0969	0.912
g-SpMM	1	cora	fwd	add/min	128	0.0869	0.0871	0.997
g-SpMM	1	cora	fwd	add/sum	128	0.0818	0.0849	0.964
g-SpMM	1	cora	fwd	copy_e/max	128	0.0866	0.0985	0.880
g-SpMM	1	cora	fwd	copy_e/min	128	0.0882	0.0854	1.033
g-SpMM	1	cora	fwd	copy_e/sum	128	0.0799	0.0809	0.988
g-SpMM	1	cora	fwd	copy_u/max	128	0.0882	0.0859	1.027
g-SpMM	1	cora	fwd	copy_u/min	128	0.0867	0.0857	1.012
g-SpMM	1	cora	fwd	copy_u/sum	128	0.0781	0.0879	0.889
g-SpMM	1	cora	fwd	div/max	128	0.0910	0.0859	1.060
g-SpMM	1	cora	fwd	div/min	128	0.0899	0.0943	0.953
g-SpMM	1	cora	fwd	div/sum	128	0.0801	0.0859	0.933
g-SpMM	1	cora	fwd	mul/max	128	0.0908	0.0922	0.985
g-SpMM	1	cora	fwd	mul/min	128	0.0875	0.0934	0.937
g-SpMM	1	cora	fwd	mul/sum	128	0.0847	0.0863	0.981
g-SpMM	1	cora	fwd	sub/max	128	0.0874	0.0945	0.925
g-SpMM	1	cora	fwd	sub/min	128	0.0873	0.0955	0.914
g-SpMM	1	cora	fwd	sub/sum	128	0.0807	0.0801	1.007
g-SpMM	1	cora	bwd	add/max	256	0.2217	0.2257	0.982
g-SpMM	1	cora	bwd	add/min	256	0.2264	0.2222	1.019
g-SpMM	1	cora	bwd	add/sum	256	0.2910	0.3127	0.931
g-SpMM	1	cora	bwd	copy_e/max	256	0.2016	0.1956	1.031
g-SpMM	1	cora	bwd	copy_e/min	256	0.1993	0.2037	0.978
g-SpMM	1	cora	bwd	copy_e/sum	256	0.2152	0.2031	1.060
g-SpMM	1	cora	bwd	copy_u/max	256	0.1963	0.1912	1.027
g-SpMM	1	cora	bwd	copy_u/min	256	0.1971	0.1988	0.992
g-SpMM	1	cora	bwd	copy_u/sum	256	0.2272	0.2188	1.038
g-SpMM	1	cora	bwd	div/max	256	0.2193	0.2199	0.997
g-SpMM	1	cora	bwd	div/min	256	0.2249	0.2015	1.116
g-SpMM	1	cora	bwd	div/sum	256	0.2566	0.2278	1.127
g-SpMM	1	cora	bwd	mul/max	256	0.2286	0.2232	1.024
g-SpMM	1	cora	bwd	mul/min	256	0.2206	0.2334	0.945
g-SpMM	1	cora	bwd	mul/sum	256	0.2779	0.2454	1.133
g-SpMM	1	cora	bwd	sub/max	256	0.2276	0.2039	1.116
g-SpMM	1	cora	bwd	sub/min	256	0.2213	0.2314	0.956
g-SpMM	1	cora	bwd	sub/sum	256	0.2890	0.2554	1.132
g-SpMM	1	cora	fb	add/max	256	0.4894	0.4290	1.141
g-SpMM	1	cora	fb	add/min	256	0.4617	0.4399	1.049
g-SpMM	1	cora	fb	add/sum	256	0.5123	0.5093	1.006
g-SpMM	1	cora	fb	copy_e/max	256	0.4271	0.4555	0.938
g-SpMM	1	cora	fb	copy_e/min	256	0.4259	0.4557	0.935
g-SpMM	1	cora	fb	copy_e/sum	256	0.4154	0.4216	0.985
g-SpMM	1	cora	fb	copy_u/max	256	0.4228	0.4561	0.927
g-SpMM	1	cora	fb	copy_u/min	256	0.5021	0.4447	1.129
g-SpMM	1	cora	fb	copy_u/sum	256	0.4524	0.5200	0.870
g-SpMM	1	cora	fb	div/max	256	0.4534	0.4620	0.981
g-SpMM	1	cora	fb	div/min	256	0.4649	0.4420	1.052
g-SpMM	1	cora	fb	div/sum	256	0.4893	0.4573	1.070
g-SpMM	1	cora	fb	mul/max	256	0.4675	0.4671	1.001
g-SpMM	1	cora	fb	mul/min	256	0.4555	0.4379	1.040
g-SpMM	1	cora	fb	mul/sum	256	0.4944	0.4638	1.066
g-SpMM	1	cora	fb	sub/max	256	0.4521	0.4691	0.964
g-SpMM	1	cora	fb	sub/min	256	0.4671	0.4679	0.998
g-SpMM	1	cora	fb	sub/sum	256	0.5104	0.4991	1.023
g-SpMM	1	cora	fwd	add/max	256	0.0968	0.0907	1.067
g-SpMM	1	cora	fwd	add/min	256	0.0882	0.0910	0.970
g-SpMM	1	cora	fwd	add/sum	256	0.0887	0.0844	1.051
g-SpMM	1	cora	fwd	copy_e/max	256	0.0877	0.0873	1.004
g-SpMM	1	cora	fwd	copy_e/min	256	0.0874	0.0865	1.010
g-SpMM	1	cora	fwd	copy_e/sum	256	0.0788	0.0805	0.980
g-SpMM	1	cora	fwd	copy_u/max	256	0.0833	0.0890	0.935
g-SpMM	1	cora	fwd	copy_u/min	256	0.0842	0.0904	0.932
g-SpMM	1	cora	fwd	copy_u/sum	256	0.0811	0.0819	0.990
g-SpMM	1	cora	fwd	div/max	256	0.0926	0.0887	1.043
g-SpMM	1	cora	fwd	div/min	256	0.0865	0.0891	0.971
g-SpMM	1	cora	fwd	div/sum	256	0.0797	0.0852	0.935
g-SpMM	1	cora	fwd	mul/max	256	0.0850	0.0981	0.866
g-SpMM	1	cora	fwd	mul/min	256	0.0868	0.0970	0.894
g-SpMM	1	cora	fwd	mul/sum	256	0.0807	0.0824	0.978

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	cora	fwd	sub/max	256	0.0851	0.0907	0.938
g-SpMM	1	cora	fwd	sub/min	256	0.0871	0.0891	0.977
g-SpMM	1	cora	fwd	sub/sum	256	0.0824	0.0837	0.985
g-SpMM	1	cora	bwd	add/max	512	0.2398	0.2477	0.968
g-SpMM	1	cora	bwd	add/min	512	0.2310	0.2520	0.916
g-SpMM	1	cora	bwd	add/sum	512	0.3007	0.2923	1.029
g-SpMM	1	cora	bwd	copy_e/max	512	0.1963	0.2053	0.956
g-SpMM	1	cora	bwd	copy_e/min	512	0.2052	0.2259	0.908
g-SpMM	1	cora	bwd	copy_e/sum	512	0.1985	0.1975	1.005
g-SpMM	1	cora	bwd	copy_u/max	512	0.1962	0.1990	0.986
g-SpMM	1	cora	bwd	copy_u/min	512	0.1907	0.1971	0.968
g-SpMM	1	cora	bwd	copy_u/sum	512	0.2165	0.2570	0.843
g-SpMM	1	cora	bwd	div/max	512	0.4314	0.4561	0.946
g-SpMM	1	cora	bwd	div/min	512	0.4316	0.4513	0.956
g-SpMM	1	cora	bwd	div/sum	512	0.3362	0.5148	0.653
g-SpMM	1	cora	bwd	mul/max	512	0.4152	0.4461	0.931
g-SpMM	1	cora	bwd	mul/min	512	0.4161	0.4477	0.929
g-SpMM	1	cora	bwd	mul/sum	512	0.2376	0.3396	0.700
g-SpMM	1	cora	bwd	sub/max	512	0.2063	0.2467	0.836
g-SpMM	1	cora	bwd	sub/min	512	0.2066	0.2564	0.806
g-SpMM	1	cora	bwd	sub/sum	512	0.3056	0.3238	0.944
g-SpMM	1	cora	fb	add/max	512	0.4781	0.5039	0.949
g-SpMM	1	cora	fb	add/min	512	0.4804	0.5077	0.946
g-SpMM	1	cora	fb	add/sum	512	0.5511	0.5264	1.047
g-SpMM	1	cora	fb	copy_e/max	512	0.4247	0.4489	0.946
g-SpMM	1	cora	fb	copy_e/min	512	0.4357	0.4598	0.948
g-SpMM	1	cora	fb	copy_e/sum	512	0.4110	0.4190	0.981
g-SpMM	1	cora	fb	copy_u/max	512	0.4347	0.4699	0.925
g-SpMM	1	cora	fb	copy_u/min	512	0.4162	0.4578	0.909
g-SpMM	1	cora	fb	copy_u/sum	512	0.4472	0.4296	1.041
g-SpMM	1	cora	fb	div/max	512	0.6031	0.7164	0.842
g-SpMM	1	cora	fb	div/min	512	0.6110	0.7113	0.859
g-SpMM	1	cora	fb	div/sum	512	0.5285	0.7656	0.690
g-SpMM	1	cora	fb	mul/max	512	0.5912	0.7083	0.835
g-SpMM	1	cora	fb	mul/min	512	0.5896	0.6900	0.854
g-SpMM	1	cora	fb	mul/sum	512	0.3811	0.5687	0.670
g-SpMM	1	cora	fb	sub/max	512	0.3851	0.5128	0.751
g-SpMM	1	cora	fb	sub/min	512	0.4734	0.5112	0.926
g-SpMM	1	cora	fb	sub/sum	512	0.5079	0.5312	0.956
g-SpMM	1	cora	fwd	add/max	512	0.1555	0.2172	0.716
g-SpMM	1	cora	fwd	add/min	512	0.1558	0.2212	0.704
g-SpMM	1	cora	fwd	add/sum	512	0.1158	0.1643	0.705
g-SpMM	1	cora	fwd	copy_e/max	512	0.0929	0.0917	1.013
g-SpMM	1	cora	fwd	copy_e/min	512	0.0914	0.0923	0.991
g-SpMM	1	cora	fwd	copy_e/sum	512	0.0934	0.0900	1.038
g-SpMM	1	cora	fwd	copy_u/max	512	0.0895	0.1209	0.740
g-SpMM	1	cora	fwd	copy_u/min	512	0.0902	0.1224	0.738
g-SpMM	1	cora	fwd	copy_u/sum	512	0.0866	0.0885	0.978
g-SpMM	1	cora	fwd	div/max	512	0.1557	0.2248	0.693
g-SpMM	1	cora	fwd	div/min	512	0.1573	0.2266	0.694
g-SpMM	1	cora	fwd	div/sum	512	0.1227	0.1739	0.706
g-SpMM	1	cora	fwd	mul/max	512	0.1546	0.2232	0.693
g-SpMM	1	cora	fwd	mul/min	512	0.1541	0.2184	0.706
g-SpMM	1	cora	fwd	mul/sum	512	0.1012	0.1564	0.647
g-SpMM	1	cora	fwd	sub/max	512	0.1587	0.2253	0.704
g-SpMM	1	cora	fwd	sub/min	512	0.1548	0.2182	0.709
g-SpMM	1	cora	fwd	sub/sum	512	0.1154	0.1727	0.669
g-SpMM	1	hm-categories	bwd	copy_u/max	64	0.1891	0.1954	0.968
g-SpMM	1	hm-categories	bwd	copy_u/min	64	0.1840	0.2124	0.866
g-SpMM	1	hm-categories	bwd	copy_u/sum	64	2.2221	4.4527	0.499
g-SpMM	1	hm-categories	fb	copy_u/max	64	2.1660	5.3704	0.403
g-SpMM	1	hm-categories	fb	copy_u/min	64	2.1381	5.2086	0.410
g-SpMM	1	hm-categories	fb	copy_u/sum	64	4.5294	9.0413	0.501
g-SpMM	1	hm-categories	fwd	copy_u/max	64	1.9096	5.1072	0.374
g-SpMM	1	hm-categories	fwd	copy_u/min	64	1.9039	5.0408	0.378
g-SpMM	1	hm-categories	fwd	copy_u/sum	64	2.2186	4.3686	0.508
g-SpMM	1	hm-categories	bwd	copy_u/max	128	0.2520	0.2522	0.999
g-SpMM	1	hm-categories	bwd	copy_u/min	128	0.2481	0.2480	1.001
g-SpMM	1	hm-categories	bwd	copy_u/sum	128	4.2229	8.1963	0.515
g-SpMM	1	hm-categories	fb	copy_u/max	128	3.7514	9.7620	0.384
g-SpMM	1	hm-categories	fb	copy_u/min	128	3.8477	9.6616	0.398
g-SpMM	1	hm-categories	fb	copy_u/sum	128	8.5041	16.6525	0.511
g-SpMM	1	hm-categories	fwd	copy_u/max	128	3.6437	9.6298	0.378
g-SpMM	1	hm-categories	fwd	copy_u/min	128	3.6275	9.5008	0.382
g-SpMM	1	hm-categories	fwd	copy_u/sum	128	4.1597	8.0109	0.519
g-SpMM	1	hm-categories	bwd	copy_u/max	256	0.4226	0.4187	1.009
g-SpMM	1	hm-categories	bwd	copy_u/min	256	0.4555	0.4504	1.011
g-SpMM	1	hm-categories	bwd	copy_u/sum	256	8.7640	16.9249	0.518

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	hm-categories	fb	copy_u/max	256	7.4696	20.1255	0.371
g-SpMM	1	hm-categories	fb	copy_u/min	256	7.6801	20.2563	0.379
g-SpMM	1	hm-categories	fb	copy_u/sum	256	17.9019	34.1904	0.524
g-SpMM	1	hm-categories	fwd	copy_u/max	256	7.2628	19.8893	0.365
g-SpMM	1	hm-categories	fwd	copy_u/min	256	7.3107	20.1333	0.363
g-SpMM	1	hm-categories	fwd	copy_u/sum	256	8.8532	16.8757	0.525
g-SpMM	1	hm-categories	bwd	copy_u/max	512	0.7180	0.7089	1.013
g-SpMM	1	hm-categories	bwd	copy_u/min	512	0.7583	0.7222	1.050
g-SpMM	1	hm-categories	bwd	copy_u/sum	512	19.0305	37.4683	0.508
g-SpMM	1	hm-categories	fb	copy_u/max	512	16.1316	44.8664	0.360
g-SpMM	1	hm-categories	fb	copy_u/min	512	15.9780	45.2840	0.353
g-SpMM	1	hm-categories	fb	copy_u/sum	512	39.3782	75.7315	0.520
g-SpMM	1	hm-categories	fwd	copy_u/max	512	15.5890	43.8421	0.356
g-SpMM	1	hm-categories	fwd	copy_u/min	512	15.6775	44.1030	0.355
g-SpMM	1	hm-categories	fwd	copy_u/sum	512	19.5086	37.4556	0.521
g-SpMM	1	ogbn-arxiv	bwd	add/max	64	0.9456	1.0452	0.905
g-SpMM	1	ogbn-arxiv	bwd	add/min	64	0.9459	1.0311	0.917
g-SpMM	1	ogbn-arxiv	bwd	add/sum	64	0.5812	0.8159	0.712
g-SpMM	1	ogbn-arxiv	bwd	copy_e/max	64	0.6667	0.9758	0.683
g-SpMM	1	ogbn-arxiv	bwd	copy_e/min	64	0.6673	0.9698	0.688
g-SpMM	1	ogbn-arxiv	bwd	copy_e/sum	64	0.4247	0.4138	1.026
g-SpMM	1	ogbn-arxiv	bwd	copy_u/max	64	0.2280	0.2305	0.989
g-SpMM	1	ogbn-arxiv	bwd	copy_u/min	64	0.2264	0.2312	0.979
g-SpMM	1	ogbn-arxiv	bwd	copy_u/sum	64	0.2649	0.4712	0.562
g-SpMM	1	ogbn-arxiv	bwd	div/max	64	1.1226	1.2291	0.913
g-SpMM	1	ogbn-arxiv	bwd	div/min	64	1.1192	1.2230	0.915
g-SpMM	1	ogbn-arxiv	bwd	div/sum	64	1.2971	2.1495	0.603
g-SpMM	1	ogbn-arxiv	bwd	mul/max	64	1.1025	1.2232	0.901
g-SpMM	1	ogbn-arxiv	bwd	mul/min	64	1.1039	1.2233	0.902
g-SpMM	1	ogbn-arxiv	bwd	mul/sum	64	1.0688	1.5960	0.670
g-SpMM	1	ogbn-arxiv	bwd	sub/max	64	0.9575	1.0417	0.919
g-SpMM	1	ogbn-arxiv	bwd	sub/min	64	0.9570	1.0368	0.923
g-SpMM	1	ogbn-arxiv	bwd	sub/sum	64	0.5805	0.8158	0.712
g-SpMM	1	ogbn-arxiv	fb	add/max	64	2.5991	3.8632	0.673
g-SpMM	1	ogbn-arxiv	fb	add/min	64	2.5856	3.8520	0.671
g-SpMM	1	ogbn-arxiv	fb	add/sum	64	2.5467	3.9682	0.642
g-SpMM	1	ogbn-arxiv	fb	copy_e/max	64	1.2854	1.5925	0.807
g-SpMM	1	ogbn-arxiv	fb	copy_e/min	64	1.2845	1.5951	0.805
g-SpMM	1	ogbn-arxiv	fb	copy_e/sum	64	1.9990	2.0046	0.997
g-SpMM	1	ogbn-arxiv	fb	copy_u/max	64	0.8940	2.0045	0.446
g-SpMM	1	ogbn-arxiv	fb	copy_u/min	64	0.8947	2.0119	0.445
g-SpMM	1	ogbn-arxiv	fb	copy_u/sum	64	1.0832	1.8583	0.583
g-SpMM	1	ogbn-arxiv	fb	div/max	64	2.7760	4.0809	0.680
g-SpMM	1	ogbn-arxiv	fb	div/min	64	2.7910	4.0892	0.683
g-SpMM	1	ogbn-arxiv	fb	div/sum	64	3.2960	5.4057	0.610
g-SpMM	1	ogbn-arxiv	fb	mul/max	64	2.7396	4.0549	0.676
g-SpMM	1	ogbn-arxiv	fb	mul/min	64	2.7445	4.0743	0.674
g-SpMM	1	ogbn-arxiv	fb	mul/sum	64	2.6955	4.6654	0.578
g-SpMM	1	ogbn-arxiv	fb	sub/max	64	2.5852	3.8782	0.667
g-SpMM	1	ogbn-arxiv	fb	sub/min	64	2.5883	3.8646	0.670
g-SpMM	1	ogbn-arxiv	fb	sub/sum	64	2.5599	3.9628	0.646
g-SpMM	1	ogbn-arxiv	fwd	add/max	64	1.6874	2.8061	0.601
g-SpMM	1	ogbn-arxiv	fwd	add/min	64	1.6450	2.7746	0.593
g-SpMM	1	ogbn-arxiv	fwd	add/sum	64	1.9632	3.1412	0.625
g-SpMM	1	ogbn-arxiv	fwd	copy_e/max	64	0.6195	0.6448	0.961
g-SpMM	1	ogbn-arxiv	fwd	copy_e/min	64	0.6410	0.6285	1.020
g-SpMM	1	ogbn-arxiv	fwd	copy_e/sum	64	1.6642	1.6882	0.986
g-SpMM	1	ogbn-arxiv	fwd	copy_u/max	64	0.6641	1.7417	0.381
g-SpMM	1	ogbn-arxiv	fwd	copy_u/min	64	0.6596	1.7114	0.385
g-SpMM	1	ogbn-arxiv	fwd	copy_u/sum	64	0.7919	1.3641	0.581
g-SpMM	1	ogbn-arxiv	fwd	div/max	64	1.6944	2.8528	0.594
g-SpMM	1	ogbn-arxiv	fwd	div/min	64	1.6967	2.8469	0.596
g-SpMM	1	ogbn-arxiv	fwd	div/sum	64	1.9678	3.2642	0.603
g-SpMM	1	ogbn-arxiv	fwd	mul/max	64	1.6933	2.8555	0.593
g-SpMM	1	ogbn-arxiv	fwd	mul/min	64	1.6341	2.8239	0.579
g-SpMM	1	ogbn-arxiv	fwd	mul/sum	64	1.6680	3.0004	0.556
g-SpMM	1	ogbn-arxiv	fwd	sub/max	64	1.6771	2.8212	0.594
g-SpMM	1	ogbn-arxiv	fwd	sub/min	64	1.6608	2.8418	0.584
g-SpMM	1	ogbn-arxiv	fwd	sub/sum	64	1.9980	3.1300	0.638
g-SpMM	1	ogbn-arxiv	bwd	add/max	128	1.7240	1.9275	0.894
g-SpMM	1	ogbn-arxiv	bwd	add/min	128	1.7189	1.8976	0.906
g-SpMM	1	ogbn-arxiv	bwd	add/sum	128	0.9683	1.3703	0.707
g-SpMM	1	ogbn-arxiv	bwd	copy_e/max	128	1.2372	1.7796	0.695
g-SpMM	1	ogbn-arxiv	bwd	copy_e/min	128	1.2405	1.7732	0.700
g-SpMM	1	ogbn-arxiv	bwd	copy_e/sum	128	0.4564	0.4753	0.960
g-SpMM	1	ogbn-arxiv	bwd	copy_u/max	128	0.5141	0.5155	0.997
g-SpMM	1	ogbn-arxiv	bwd	copy_u/min	128	0.5217	0.5172	1.009
g-SpMM	1	ogbn-arxiv	bwd	copy_u/sum	128	0.4895	0.8638	0.567

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	ogbn-arxiv	bwd	div/max	128	2.0532	2.2344	0.919
g-SpMM	1	ogbn-arxiv	bwd	div/min	128	2.0507	2.2325	0.919
g-SpMM	1	ogbn-arxiv	bwd	div/sum	128	2.3194	3.6909	0.628
g-SpMM	1	ogbn-arxiv	bwd	mul/max	128	2.0312	2.2306	0.911
g-SpMM	1	ogbn-arxiv	bwd	mul/min	128	2.0315	2.2233	0.914
g-SpMM	1	ogbn-arxiv	bwd	mul/sum	128	1.8695	2.8608	0.653
g-SpMM	1	ogbn-arxiv	bwd	sub/max	128	1.7425	1.9140	0.910
g-SpMM	1	ogbn-arxiv	bwd	sub/min	128	1.7383	1.8975	0.916
g-SpMM	1	ogbn-arxiv	bwd	sub/sum	128	0.9697	1.3710	0.707
g-SpMM	1	ogbn-arxiv	fb	add/max	128	5.0470	7.5955	0.664
g-SpMM	1	ogbn-arxiv	fb	add/min	128	5.0310	7.5784	0.664
g-SpMM	1	ogbn-arxiv	fb	add/sum	128	4.8919	7.7826	0.629
g-SpMM	1	ogbn-arxiv	fb	copy_e/max	128	2.4760	3.0325	0.816
g-SpMM	1	ogbn-arxiv	fb	copy_e/min	128	2.4768	3.0224	0.819
g-SpMM	1	ogbn-arxiv	fb	copy_e/sum	128	3.7835	3.8107	0.993
g-SpMM	1	ogbn-arxiv	fb	copy_u/max	128	1.9023	4.2164	0.451
g-SpMM	1	ogbn-arxiv	fb	copy_u/min	128	1.8961	4.2311	0.448
g-SpMM	1	ogbn-arxiv	fb	copy_u/sum	128	2.2655	3.8112	0.594
g-SpMM	1	ogbn-arxiv	fb	div/max	128	5.4006	7.9585	0.679
g-SpMM	1	ogbn-arxiv	fb	div/min	128	5.4378	7.9399	0.685
g-SpMM	1	ogbn-arxiv	fb	div/sum	128	6.3285	10.3660	0.611
g-SpMM	1	ogbn-arxiv	fb	mul/max	128	5.3497	7.9222	0.675
g-SpMM	1	ogbn-arxiv	fb	mul/min	128	5.3610	7.9103	0.678
g-SpMM	1	ogbn-arxiv	fb	mul/sum	128	5.1149	8.9470	0.572
g-SpMM	1	ogbn-arxiv	fb	sub/max	128	5.0330	7.6045	0.662
g-SpMM	1	ogbn-arxiv	fb	sub/min	128	5.0914	7.5378	0.675
g-SpMM	1	ogbn-arxiv	fb	sub/sum	128	4.9152	7.7902	0.631
g-SpMM	1	ogbn-arxiv	fwd	add/max	128	3.3659	5.7086	0.590
g-SpMM	1	ogbn-arxiv	fwd	add/min	128	3.3448	5.6177	0.595
g-SpMM	1	ogbn-arxiv	fwd	add/sum	128	3.9308	6.3003	0.624
g-SpMM	1	ogbn-arxiv	fwd	copy_e/max	128	1.2822	1.2951	0.990
g-SpMM	1	ogbn-arxiv	fwd	copy_e/min	128	1.2645	1.2946	0.977
g-SpMM	1	ogbn-arxiv	fwd	copy_e/sum	128	3.3058	3.3325	0.992
g-SpMM	1	ogbn-arxiv	fwd	copy_u/max	128	1.3941	3.6406	0.383
g-SpMM	1	ogbn-arxiv	fwd	copy_u/min	128	1.3951	3.6804	0.379
g-SpMM	1	ogbn-arxiv	fwd	copy_u/sum	128	1.7787	2.9361	0.606
g-SpMM	1	ogbn-arxiv	fwd	div/max	128	3.4148	5.7517	0.594
g-SpMM	1	ogbn-arxiv	fwd	div/min	128	3.4164	5.6877	0.601
g-SpMM	1	ogbn-arxiv	fwd	div/sum	128	4.0336	6.6751	0.604
g-SpMM	1	ogbn-arxiv	fwd	mul/max	128	3.3867	5.7426	0.590
g-SpMM	1	ogbn-arxiv	fwd	mul/min	128	3.3477	5.6615	0.591
g-SpMM	1	ogbn-arxiv	fwd	mul/sum	128	3.3512	6.0882	0.550
g-SpMM	1	ogbn-arxiv	fwd	sub/max	128	3.4631	5.6717	0.611
g-SpMM	1	ogbn-arxiv	fwd	sub/min	128	3.3440	5.6976	0.587
g-SpMM	1	ogbn-arxiv	fwd	sub/sum	128	3.9948	6.3541	0.629
g-SpMM	1	ogbn-arxiv	bwd	add/max	256	3.2709	3.6420	0.898
g-SpMM	1	ogbn-arxiv	bwd	add/min	256	3.2813	3.6442	0.900
g-SpMM	1	ogbn-arxiv	bwd	add/sum	256	1.8017	2.5520	0.706
g-SpMM	1	ogbn-arxiv	bwd	copy_e/max	256	2.4019	3.3798	0.711
g-SpMM	1	ogbn-arxiv	bwd	copy_e/min	256	2.4076	3.3665	0.715
g-SpMM	1	ogbn-arxiv	bwd	copy_e/sum	256	0.8437	0.8588	0.982
g-SpMM	1	ogbn-arxiv	bwd	copy_u/max	256	1.1058	1.1117	0.995
g-SpMM	1	ogbn-arxiv	bwd	copy_u/min	256	1.1059	1.1112	0.995
g-SpMM	1	ogbn-arxiv	bwd	copy_u/sum	256	0.9396	1.6513	0.569
g-SpMM	1	ogbn-arxiv	bwd	div/max	256	3.9687	4.2584	0.932
g-SpMM	1	ogbn-arxiv	bwd	div/min	256	3.9628	4.2529	0.932
g-SpMM	1	ogbn-arxiv	bwd	div/sum	256	4.3375	6.9984	0.620
g-SpMM	1	ogbn-arxiv	bwd	mul/max	256	3.9212	4.2232	0.928
g-SpMM	1	ogbn-arxiv	bwd	mul/min	256	3.9253	4.2395	0.926
g-SpMM	1	ogbn-arxiv	bwd	mul/sum	256	3.4578	5.3027	0.652
g-SpMM	1	ogbn-arxiv	bwd	sub/max	256	3.3259	3.6351	0.915
g-SpMM	1	ogbn-arxiv	bwd	sub/min	256	3.3188	3.6469	0.910
g-SpMM	1	ogbn-arxiv	bwd	sub/sum	256	1.7901	2.5468	0.703
g-SpMM	1	ogbn-arxiv	fb	add/max	256	9.9519	15.1051	0.659
g-SpMM	1	ogbn-arxiv	fb	add/min	256	9.9587	15.0689	0.661
g-SpMM	1	ogbn-arxiv	fb	add/sum	256	9.7537	15.5103	0.629
g-SpMM	1	ogbn-arxiv	fb	copy_e/max	256	4.8729	5.8118	0.838
g-SpMM	1	ogbn-arxiv	fb	copy_e/min	256	4.8248	5.8526	0.824
g-SpMM	1	ogbn-arxiv	fb	copy_e/sum	256	7.3806	7.4118	0.996
g-SpMM	1	ogbn-arxiv	fb	copy_u/max	256	4.0360	9.0932	0.444
g-SpMM	1	ogbn-arxiv	fb	copy_u/min	256	4.0530	9.1145	0.445
g-SpMM	1	ogbn-arxiv	fb	copy_u/sum	256	4.9199	8.1767	0.602
g-SpMM	1	ogbn-arxiv	fb	div/max	256	10.7123	15.6674	0.684
g-SpMM	1	ogbn-arxiv	fb	div/min	256	10.7335	15.7850	0.680
g-SpMM	1	ogbn-arxiv	fb	div/sum	256	12.3551	20.5605	0.601
g-SpMM	1	ogbn-arxiv	fb	mul/max	256	10.5515	15.6058	0.676
g-SpMM	1	ogbn-arxiv	fb	mul/min	256	10.6142	15.7626	0.673
g-SpMM	1	ogbn-arxiv	fb	mul/sum	256	10.1125	17.7353	0.570

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	ogbn-arxiv	fb	sub/max	256	9.9968	15.0685	0.663
g-SpMM	1	ogbn-arxiv	fb	sub/min	256	10.0364	15.0963	0.665
g-SpMM	1	ogbn-arxiv	fb	sub/sum	256	9.7548	15.5675	0.627
g-SpMM	1	ogbn-arxiv	fwd	add/max	256	6.8843	11.3712	0.605
g-SpMM	1	ogbn-arxiv	fwd	add/min	256	6.9045	11.3565	0.608
g-SpMM	1	ogbn-arxiv	fwd	add/sum	256	8.0230	12.9218	0.621
g-SpMM	1	ogbn-arxiv	fwd	copy_e/max	256	2.5132	2.5586	0.982
g-SpMM	1	ogbn-arxiv	fwd	copy_e/min	256	2.4973	2.5463	0.981
g-SpMM	1	ogbn-arxiv	fwd	copy_e/sum	256	6.4325	6.5256	0.986
g-SpMM	1	ogbn-arxiv	fwd	copy_u/max	256	2.9820	8.0391	0.371
g-SpMM	1	ogbn-arxiv	fwd	copy_u/min	256	2.9909	7.9637	0.376
g-SpMM	1	ogbn-arxiv	fwd	copy_u/sum	256	3.9717	6.5191	0.609
g-SpMM	1	ogbn-arxiv	fwd	div/max	256	7.0291	11.4835	0.612
g-SpMM	1	ogbn-arxiv	fwd	div/min	256	6.9703	11.3333	0.615
g-SpMM	1	ogbn-arxiv	fwd	div/sum	256	8.1353	13.5315	0.601
g-SpMM	1	ogbn-arxiv	fwd	mul/max	256	6.9037	11.3823	0.607
g-SpMM	1	ogbn-arxiv	fwd	mul/min	256	6.8764	11.3802	0.604
g-SpMM	1	ogbn-arxiv	fwd	mul/sum	256	6.7623	12.2421	0.552
g-SpMM	1	ogbn-arxiv	fwd	sub/max	256	6.9181	11.3532	0.609
g-SpMM	1	ogbn-arxiv	fwd	sub/min	256	6.7608	11.4152	0.592
g-SpMM	1	ogbn-arxiv	fwd	sub/sum	256	8.1937	12.9763	0.631
g-SpMM	1	ogbn-arxiv	bwd	add/max	512	6.0940	6.7393	0.904
g-SpMM	1	ogbn-arxiv	bwd	add/min	512	6.1023	6.7057	0.910
g-SpMM	1	ogbn-arxiv	bwd	add/sum	512	3.1461	4.7469	0.663
g-SpMM	1	ogbn-arxiv	bwd	copy_e/max	512	4.5920	6.2873	0.730
g-SpMM	1	ogbn-arxiv	bwd	copy_e/min	512	4.6135	6.2588	0.737
g-SpMM	1	ogbn-arxiv	bwd	copy_e/sum	512	1.5267	1.5341	0.995
g-SpMM	1	ogbn-arxiv	bwd	copy_u/max	512	2.2650	2.2660	1.000
g-SpMM	1	ogbn-arxiv	bwd	copy_u/min	512	2.2647	2.2662	0.999
g-SpMM	1	ogbn-arxiv	bwd	copy_u/sum	512	1.6186	3.1555	0.513
g-SpMM	1	ogbn-arxiv	bwd	div/max	512	7.5105	7.8944	0.951
g-SpMM	1	ogbn-arxiv	bwd	div/min	512	7.5535	7.8844	0.958
g-SpMM	1	ogbn-arxiv	bwd	div/sum	512	8.1347	13.4145	0.606
g-SpMM	1	ogbn-arxiv	bwd	mul/max	512	7.5075	7.9363	0.946
g-SpMM	1	ogbn-arxiv	bwd	mul/min	512	7.5019	7.8904	0.951
g-SpMM	1	ogbn-arxiv	bwd	mul/sum	512	6.2707	9.9726	0.629
g-SpMM	1	ogbn-arxiv	bwd	sub/max	512	6.1502	6.7440	0.912
g-SpMM	1	ogbn-arxiv	bwd	sub/min	512	6.1501	6.7552	0.910
g-SpMM	1	ogbn-arxiv	bwd	sub/sum	512	3.1591	4.7460	0.666
g-SpMM	1	ogbn-arxiv	fb	add/max	512	19.6261	29.7407	0.660
g-SpMM	1	ogbn-arxiv	fb	add/min	512	19.4889	29.9191	0.651
g-SpMM	1	ogbn-arxiv	fb	add/sum	512	18.9156	31.3170	0.604
g-SpMM	1	ogbn-arxiv	fb	copy_e/max	512	9.6217	11.2358	0.856
g-SpMM	1	ogbn-arxiv	fb	copy_e/min	512	9.6936	11.2225	0.864
g-SpMM	1	ogbn-arxiv	fb	copy_e/sum	512	14.4278	14.4132	1.001
g-SpMM	1	ogbn-arxiv	fb	copy_u/max	512	8.3144	19.0066	0.437
g-SpMM	1	ogbn-arxiv	fb	copy_u/min	512	8.3529	19.1173	0.437
g-SpMM	1	ogbn-arxiv	fb	copy_u/sum	512	10.1110	17.0216	0.594
g-SpMM	1	ogbn-arxiv	fb	div/max	512	21.2377	30.9716	0.686
g-SpMM	1	ogbn-arxiv	fb	div/min	512	21.2331	31.0925	0.683
g-SpMM	1	ogbn-arxiv	fb	div/sum	512	24.2653	40.8420	0.594
g-SpMM	1	ogbn-arxiv	fb	mul/max	512	20.9334	30.8984	0.677
g-SpMM	1	ogbn-arxiv	fb	mul/min	512	21.0824	30.9994	0.680
g-SpMM	1	ogbn-arxiv	fb	mul/sum	512	19.3992	35.1585	0.552
g-SpMM	1	ogbn-arxiv	fb	sub/max	512	19.6816	29.7519	0.662
g-SpMM	1	ogbn-arxiv	fb	sub/min	512	19.6196	29.6603	0.661
g-SpMM	1	ogbn-arxiv	fb	sub/sum	512	19.1975	31.2399	0.615
g-SpMM	1	ogbn-arxiv	fwd	add/max	512	14.0076	22.8990	0.612
g-SpMM	1	ogbn-arxiv	fwd	add/min	512	13.6259	22.9388	0.594
g-SpMM	1	ogbn-arxiv	fwd	add/sum	512	16.0676	26.3479	0.610
g-SpMM	1	ogbn-arxiv	fwd	copy_e/max	512	5.1131	5.2222	0.979
g-SpMM	1	ogbn-arxiv	fwd	copy_e/min	512	5.1870	5.2273	0.992
g-SpMM	1	ogbn-arxiv	fwd	copy_e/sum	512	12.8759	12.9392	0.995
g-SpMM	1	ogbn-arxiv	fwd	copy_u/max	512	6.1267	16.7516	0.366
g-SpMM	1	ogbn-arxiv	fwd	copy_u/min	512	6.1151	16.8274	0.363
g-SpMM	1	ogbn-arxiv	fwd	copy_u/sum	512	8.4831	13.8464	0.613
g-SpMM	1	ogbn-arxiv	fwd	div/max	512	14.0726	22.9666	0.613
g-SpMM	1	ogbn-arxiv	fwd	div/min	512	13.8942	22.9013	0.607
g-SpMM	1	ogbn-arxiv	fwd	div/sum	512	16.5794	27.3728	0.606
g-SpMM	1	ogbn-arxiv	fwd	mul/max	512	13.8496	22.9501	0.603
g-SpMM	1	ogbn-arxiv	fwd	mul/min	512	13.7838	22.8163	0.604
g-SpMM	1	ogbn-arxiv	fwd	mul/sum	512	13.5287	24.8971	0.543
g-SpMM	1	ogbn-arxiv	fwd	sub/max	512	13.9384	23.1889	0.601
g-SpMM	1	ogbn-arxiv	fwd	sub/min	512	13.8048	22.8101	0.605
g-SpMM	1	ogbn-arxiv	fwd	sub/sum	512	16.4284	26.4829	0.620
g-SpMM	1	ogbn-products	bwd	copy_u/max	64	13.7501	13.7544	1.000
g-SpMM	1	ogbn-products	bwd	copy_u/min	64	13.7391	13.7339	1.000
g-SpMM	1	ogbn-products	bwd	copy_u/sum	64	16.5686	36.5688	0.453

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	ogbn-products	fb	copy_u/max	64	30.7156	55.1390	0.557
g-SpMM	1	ogbn-products	fb	copy_u/min	64	30.7266	55.1315	0.557
g-SpMM	1	ogbn-products	fb	copy_u/sum	64	33.1601	73.1809	0.453
g-SpMM	1	ogbn-products	fwd	copy_u/max	64	17.0203	41.3959	0.411
g-SpMM	1	ogbn-products	fwd	copy_u/min	64	16.9978	41.3894	0.411
g-SpMM	1	ogbn-products	fwd	copy_u/sum	64	16.5551	36.5728	0.453
g-SpMM	1	ogbn-products	bwd	copy_u/max	128	29.6977	29.7007	1.000
g-SpMM	1	ogbn-products	bwd	copy_u/min	128	29.6818	29.6916	1.000
g-SpMM	1	ogbn-products	bwd	copy_u/sum	128	30.8622	66.3652	0.465
g-SpMM	1	ogbn-products	fb	copy_u/max	128	61.2342	105.8780	0.578
g-SpMM	1	ogbn-products	fb	copy_u/min	128	61.2311	105.8914	0.578
g-SpMM	1	ogbn-products	fb	copy_u/sum	128	61.8012	132.9101	0.465
g-SpMM	1	ogbn-products	fwd	copy_u/max	128	31.5998	76.1419	0.415
g-SpMM	1	ogbn-products	fwd	copy_u/min	128	31.5408	76.1436	0.414
g-SpMM	1	ogbn-products	fwd	copy_u/sum	128	30.8180	66.3949	0.464
g-SpMM	1	ogbn-products	bwd	copy_u/max	256	58.9270	59.1104	0.997
g-SpMM	1	ogbn-products	bwd	copy_u/min	256	58.9533	58.9552	1.000
g-SpMM	1	ogbn-products	bwd	copy_u/sum	256	61.2247	126.8847	0.483
g-SpMM	1	ogbn-products	fb	copy_u/max	256	149.2710	207.4682	0.719
g-SpMM	1	ogbn-products	fb	copy_u/min	256	153.2847	236.2007	0.649
g-SpMM	1	ogbn-products	fb	copy_u/sum	256	122.5419	253.7651	0.483
g-SpMM	1	ogbn-products	fwd	copy_u/max	256	90.4307	175.5823	0.515
g-SpMM	1	ogbn-products	fwd	copy_u/min	256	63.1958	182.9688	0.345
g-SpMM	1	ogbn-products	fwd	copy_u/sum	256	61.1012	126.5478	0.483
g-SpMM	1	ogbn-products	bwd	copy_u/max	512	123.1265	122.9985	1.001
g-SpMM	1	ogbn-products	bwd	copy_u/min	512	123.1409	123.0278	1.001
g-SpMM	1	ogbn-products	bwd	copy_u/sum	512	123.7424	276.4297	0.448
g-SpMM	1	ogbn-products	fb	copy_u/max	512	304.3282	479.5316	0.635
g-SpMM	1	ogbn-products	fb	copy_u/min	512	303.6015	472.9709	0.642
g-SpMM	1	ogbn-products	fb	copy_u/sum	512	269.3409	532.2282	0.506
g-SpMM	1	ogbn-products	fwd	copy_u/max	512	171.5782	371.9501	0.461
g-SpMM	1	ogbn-products	fwd	copy_u/min	512	158.8181	367.7416	0.432
g-SpMM	1	ogbn-products	fwd	copy_u/sum	512	120.6923	252.1072	0.479
g-SpMM	1	ogbn-proteins	bwd	copy_u/max	64	0.3365	0.3436	0.979
g-SpMM	1	ogbn-proteins	bwd	copy_u/min	64	0.3369	0.3552	0.948
g-SpMM	1	ogbn-proteins	bwd	copy_u/sum	64	5.2808	13.2842	0.398
g-SpMM	1	ogbn-proteins	fb	copy_u/max	64	6.4688	14.4639	0.447
g-SpMM	1	ogbn-proteins	fb	copy_u/min	64	6.4630	14.4730	0.447
g-SpMM	1	ogbn-proteins	fb	copy_u/sum	64	10.4929	26.5340	0.395
g-SpMM	1	ogbn-proteins	fwd	copy_u/max	64	6.1327	14.1288	0.434
g-SpMM	1	ogbn-proteins	fwd	copy_u/min	64	6.1331	14.1250	0.434
g-SpMM	1	ogbn-proteins	fwd	copy_u/sum	64	5.2516	13.2855	0.395
g-SpMM	1	ogbn-proteins	bwd	copy_u/max	128	0.5705	0.5757	0.991
g-SpMM	1	ogbn-proteins	bwd	copy_u/min	128	0.5705	0.5735	0.995
g-SpMM	1	ogbn-proteins	bwd	copy_u/sum	128	9.6071	22.2609	0.432
g-SpMM	1	ogbn-proteins	fb	copy_u/max	128	12.0288	24.7886	0.485
g-SpMM	1	ogbn-proteins	fb	copy_u/min	128	12.0092	24.7920	0.484
g-SpMM	1	ogbn-proteins	fb	copy_u/sum	128	19.1858	44.5159	0.431
g-SpMM	1	ogbn-proteins	fwd	copy_u/max	128	11.4427	24.1903	0.473
g-SpMM	1	ogbn-proteins	fwd	copy_u/min	128	11.4472	24.1905	0.473
g-SpMM	1	ogbn-proteins	fwd	copy_u/sum	128	9.5946	22.2560	0.431
g-SpMM	1	ogbn-proteins	bwd	copy_u/max	256	1.0172	1.0336	0.984
g-SpMM	1	ogbn-proteins	bwd	copy_u/min	256	1.0214	1.0269	0.995
g-SpMM	1	ogbn-proteins	bwd	copy_u/sum	256	19.2390	41.5776	0.463
g-SpMM	1	ogbn-proteins	fb	copy_u/max	256	23.5973	46.9719	0.502
g-SpMM	1	ogbn-proteins	fb	copy_u/min	256	23.6102	46.9259	0.503
g-SpMM	1	ogbn-proteins	fb	copy_u/sum	256	38.3152	83.0531	0.461
g-SpMM	1	ogbn-proteins	fwd	copy_u/max	256	22.5803	45.8692	0.492
g-SpMM	1	ogbn-proteins	fwd	copy_u/min	256	22.5778	45.8974	0.492
g-SpMM	1	ogbn-proteins	fwd	copy_u/sum	256	19.0995	41.4106	0.461
g-SpMM	1	ogbn-proteins	bwd	copy_u/max	512	2.0967	2.0771	1.009
g-SpMM	1	ogbn-proteins	bwd	copy_u/min	512	2.0749	2.0667	1.004
g-SpMM	1	ogbn-proteins	bwd	copy_u/sum	512	40.8700	97.6330	0.419
g-SpMM	1	ogbn-proteins	fb	copy_u/max	512	48.0453	108.9339	0.441
g-SpMM	1	ogbn-proteins	fb	copy_u/min	512	48.0589	109.0903	0.441
g-SpMM	1	ogbn-proteins	fb	copy_u/sum	512	81.9283	196.3298	0.417
g-SpMM	1	ogbn-proteins	fwd	copy_u/max	512	45.9952	106.9263	0.430
g-SpMM	1	ogbn-proteins	fwd	copy_u/min	512	45.9558	106.8885	0.430
g-SpMM	1	ogbn-proteins	fwd	copy_u/sum	512	40.7025	97.5979	0.417
g-SpMM	1	pokec-regions	bwd	copy_u/max	64	5.1667	5.1514	1.003
g-SpMM	1	pokec-regions	bwd	copy_u/min	64	5.1547	5.1581	0.999
g-SpMM	1	pokec-regions	bwd	copy_u/sum	64	4.7302	9.9705	0.474
g-SpMM	1	pokec-regions	fb	copy_u/max	64	10.1908	16.4908	0.618
g-SpMM	1	pokec-regions	fb	copy_u/min	64	10.1960	16.5008	0.618
g-SpMM	1	pokec-regions	fb	copy_u/sum	64	9.4634	19.9707	0.474
g-SpMM	1	pokec-regions	fwd	copy_u/max	64	5.0708	11.3502	0.447
g-SpMM	1	pokec-regions	fwd	copy_u/min	64	5.0499	11.3483	0.445
g-SpMM	1	pokec-regions	fwd	copy_u/sum	64	4.7386	10.0003	0.474

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	pokec-regions	bwd	copy_u/max	128	11.1779	11.1664	1.001
g-SpMM	1	pokec-regions	bwd	copy_u/min	128	11.1667	11.1588	1.001
g-SpMM	1	pokec-regions	bwd	copy_u/sum	128	8.7691	18.2338	0.481
g-SpMM	1	pokec-regions	fb	copy_u/max	128	20.4596	32.1302	0.637
g-SpMM	1	pokec-regions	fb	copy_u/min	128	20.4620	32.1307	0.637
g-SpMM	1	pokec-regions	fb	copy_u/sum	128	17.6538	36.6417	0.482
g-SpMM	1	pokec-regions	fwd	copy_u/max	128	9.3695	21.0101	0.446
g-SpMM	1	pokec-regions	fwd	copy_u/min	128	9.3288	20.9877	0.444
g-SpMM	1	pokec-regions	fwd	copy_u/sum	128	8.8878	18.3443	0.485
g-SpMM	1	pokec-regions	bwd	copy_u/max	256	21.8430	21.8370	1.000
g-SpMM	1	pokec-regions	bwd	copy_u/min	256	23.5766	21.8513	1.079
g-SpMM	1	pokec-regions	bwd	copy_u/sum	256	17.0448	34.6503	0.492
g-SpMM	1	pokec-regions	fb	copy_u/max	256	40.7090	62.9219	0.647
g-SpMM	1	pokec-regions	fb	copy_u/min	256	40.7338	62.9191	0.647
g-SpMM	1	pokec-regions	fb	copy_u/sum	256	34.4201	69.6961	0.494
g-SpMM	1	pokec-regions	fwd	copy_u/max	256	18.2178	40.2389	0.453
g-SpMM	1	pokec-regions	fwd	copy_u/min	256	18.0694	40.2315	0.449
g-SpMM	1	pokec-regions	fwd	copy_u/sum	256	17.4521	35.0561	0.498
g-SpMM	1	pokec-regions	bwd	copy_u/max	512	46.1982	46.1840	1.000
g-SpMM	1	pokec-regions	bwd	copy_u/min	512	46.2444	46.1655	1.002
g-SpMM	1	pokec-regions	bwd	copy_u/sum	512	31.9027	67.4190	0.473
g-SpMM	1	pokec-regions	fb	copy_u/max	512	104.5971	149.0141	0.702
g-SpMM	1	pokec-regions	fb	copy_u/min	512	104.1012	147.4727	0.706
g-SpMM	1	pokec-regions	fb	copy_u/sum	512	91.7780	160.8309	0.571
g-SpMM	1	pokec-regions	fwd	copy_u/max	512	65.2315	113.7724	0.573
g-SpMM	1	pokec-regions	fwd	copy_u/min	512	66.6299	112.5280	0.592
g-SpMM	1	pokec-regions	fwd	copy_u/sum	512	32.9303	68.0163	0.484
g-SpMM	1	pubmed	bwd	add/max	64	0.2279	0.2228	1.023
g-SpMM	1	pubmed	bwd	add/min	64	0.2148	0.2119	1.014
g-SpMM	1	pubmed	bwd	add/sum	64	0.2889	0.2877	1.004
g-SpMM	1	pubmed	bwd	copy_e/max	64	0.2116	0.1945	1.088
g-SpMM	1	pubmed	bwd	copy_e/min	64	0.2054	0.1994	1.030
g-SpMM	1	pubmed	bwd	copy_e/sum	64	0.1987	0.1882	1.056
g-SpMM	1	pubmed	bwd	copy_u/max	64	0.2008	0.1879	1.068
g-SpMM	1	pubmed	bwd	copy_u/min	64	0.1919	0.1885	1.018
g-SpMM	1	pubmed	bwd	copy_u/sum	64	0.2211	0.2204	1.003
g-SpMM	1	pubmed	bwd	div/max	64	0.2222	0.2161	1.028
g-SpMM	1	pubmed	bwd	div/min	64	0.2300	0.2135	1.077
g-SpMM	1	pubmed	bwd	div/sum	64	0.2500	0.2703	0.925
g-SpMM	1	pubmed	bwd	mul/max	64	0.2167	0.2231	0.972
g-SpMM	1	pubmed	bwd	mul/min	64	0.2275	0.2317	0.982
g-SpMM	1	pubmed	bwd	mul/sum	64	0.2482	0.2585	0.960
g-SpMM	1	pubmed	bwd	sub/max	64	0.2280	0.2406	0.947
g-SpMM	1	pubmed	bwd	sub/min	64	0.2150	0.2293	0.937
g-SpMM	1	pubmed	bwd	sub/sum	64	0.2866	0.2901	0.988
g-SpMM	1	pubmed	fb	add/max	64	0.4660	0.4465	1.044
g-SpMM	1	pubmed	fb	add/min	64	0.4615	0.4682	0.986
g-SpMM	1	pubmed	fb	add/sum	64	0.5171	0.5093	1.015
g-SpMM	1	pubmed	fb	copy_e/max	64	0.4328	0.4224	1.024
g-SpMM	1	pubmed	fb	copy_e/min	64	0.4357	0.4223	1.032
g-SpMM	1	pubmed	fb	copy_e/sum	64	0.4075	0.3956	1.030
g-SpMM	1	pubmed	fb	copy_u/max	64	0.4147	0.4140	1.002
g-SpMM	1	pubmed	fb	copy_u/min	64	0.4276	0.4162	1.027
g-SpMM	1	pubmed	fb	copy_u/sum	64	0.4354	0.4408	0.988
g-SpMM	1	pubmed	fb	div/max	64	0.4693	0.4684	1.002
g-SpMM	1	pubmed	fb	div/min	64	0.4393	0.4419	0.994
g-SpMM	1	pubmed	fb	div/sum	64	0.4918	0.5079	0.968
g-SpMM	1	pubmed	fb	mul/max	64	0.4427	0.4621	0.958
g-SpMM	1	pubmed	fb	mul/min	64	0.4428	0.4496	0.985
g-SpMM	1	pubmed	fb	mul/sum	64	0.4897	0.5091	0.962
g-SpMM	1	pubmed	fb	sub/max	64	0.4453	0.5170	0.861
g-SpMM	1	pubmed	fb	sub/min	64	0.4408	0.4522	0.975
g-SpMM	1	pubmed	fb	sub/sum	64	0.5046	0.5299	0.952
g-SpMM	1	pubmed	fwd	add/max	64	0.0868	0.0915	0.948
g-SpMM	1	pubmed	fwd	add/min	64	0.0888	0.0910	0.975
g-SpMM	1	pubmed	fwd	add/sum	64	0.0787	0.0801	0.983
g-SpMM	1	pubmed	fwd	copy_e/max	64	0.0870	0.0853	1.020
g-SpMM	1	pubmed	fwd	copy_e/min	64	0.0850	0.0851	0.999
g-SpMM	1	pubmed	fwd	copy_e/sum	64	0.0770	0.0779	0.989
g-SpMM	1	pubmed	fwd	copy_u/max	64	0.0841	0.0852	0.987
g-SpMM	1	pubmed	fwd	copy_u/min	64	0.0873	0.0865	1.010
g-SpMM	1	pubmed	fwd	copy_u/sum	64	0.0864	0.0799	1.082
g-SpMM	1	pubmed	fwd	div/max	64	0.0877	0.0935	0.938
g-SpMM	1	pubmed	fwd	div/min	64	0.0869	0.0905	0.960
g-SpMM	1	pubmed	fwd	div/sum	64	0.0784	0.0809	0.969
g-SpMM	1	pubmed	fwd	mul/max	64	0.0847	0.0893	0.948
g-SpMM	1	pubmed	fwd	mul/min	64	0.0858	0.0891	0.964
g-SpMM	1	pubmed	fwd	mul/sum	64	0.0817	0.0851	0.961

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	pubmed	fwd	sub/max	64	0.0858	0.0905	0.948
g-SpMM	1	pubmed	fwd	sub/min	64	0.0863	0.0967	0.892
g-SpMM	1	pubmed	fwd	sub/sum	64	0.0858	0.0810	1.059
g-SpMM	1	pubmed	bwd	add/max	128	0.1884	0.2046	0.921
g-SpMM	1	pubmed	bwd	add/min	128	0.2251	0.2083	1.081
g-SpMM	1	pubmed	bwd	add/sum	128	0.2956	0.2510	1.178
g-SpMM	1	pubmed	bwd	copy_e/max	128	0.2125	0.1898	1.119
g-SpMM	1	pubmed	bwd	copy_e/min	128	0.2091	0.1921	1.088
g-SpMM	1	pubmed	bwd	copy_e/sum	128	0.1969	0.1918	1.027
g-SpMM	1	pubmed	bwd	copy_u/max	128	0.2076	0.1877	1.106
g-SpMM	1	pubmed	bwd	copy_u/min	128	0.2075	0.1879	1.104
g-SpMM	1	pubmed	bwd	copy_u/sum	128	0.2489	0.2217	1.123
g-SpMM	1	pubmed	bwd	div/max	128	0.3523	0.2654	1.327
g-SpMM	1	pubmed	bwd	div/min	128	0.2568	0.2674	0.960
g-SpMM	1	pubmed	bwd	div/sum	128	0.2668	0.3585	0.744
g-SpMM	1	pubmed	bwd	mul/max	128	0.2464	0.2634	0.935
g-SpMM	1	pubmed	bwd	mul/min	128	0.2544	0.2659	0.957
g-SpMM	1	pubmed	bwd	mul/sum	128	0.2357	0.2830	0.833
g-SpMM	1	pubmed	bwd	sub/max	128	0.1925	0.2052	0.938
g-SpMM	1	pubmed	bwd	sub/min	128	0.1852	0.2084	0.889
g-SpMM	1	pubmed	bwd	sub/sum	128	0.2384	0.2497	0.955
g-SpMM	1	pubmed	fb	add/max	128	0.3901	0.4370	0.893
g-SpMM	1	pubmed	fb	add/min	128	0.4762	0.4194	1.135
g-SpMM	1	pubmed	fb	add/sum	128	0.5211	0.4835	1.078
g-SpMM	1	pubmed	fb	copy_e/max	128	0.5001	0.4270	1.171
g-SpMM	1	pubmed	fb	copy_e/min	128	0.4812	0.4158	1.157
g-SpMM	1	pubmed	fb	copy_e/sum	128	0.4425	0.4031	1.098
g-SpMM	1	pubmed	fb	copy_u/max	128	0.4613	0.4196	1.099
g-SpMM	1	pubmed	fb	copy_u/min	128	0.4641	0.4194	1.107
g-SpMM	1	pubmed	fb	copy_u/sum	128	0.4726	0.4391	1.076
g-SpMM	1	pubmed	fb	div/max	128	0.4647	0.4354	1.067
g-SpMM	1	pubmed	fb	div/min	128	0.5023	0.4338	1.158
g-SpMM	1	pubmed	fb	div/sum	128	0.5244	0.5028	1.043
g-SpMM	1	pubmed	fb	mul/max	128	0.4090	0.4339	0.943
g-SpMM	1	pubmed	fb	mul/min	128	0.3942	0.4472	0.881
g-SpMM	1	pubmed	fb	mul/sum	128	0.4210	0.4616	0.912
g-SpMM	1	pubmed	fb	sub/max	128	0.3931	0.4102	0.958
g-SpMM	1	pubmed	fb	sub/min	128	0.3810	0.4313	0.883
g-SpMM	1	pubmed	fb	sub/sum	128	0.4510	0.4818	0.936
g-SpMM	1	pubmed	fwd	add/max	128	0.1156	0.1666	0.694
g-SpMM	1	pubmed	fwd	add/min	128	0.1076	0.1665	0.646
g-SpMM	1	pubmed	fwd	add/sum	128	0.1049	0.1470	0.714
g-SpMM	1	pubmed	fwd	copy_e/max	128	0.0985	0.0959	1.026
g-SpMM	1	pubmed	fwd	copy_e/min	128	0.0961	0.0878	1.094
g-SpMM	1	pubmed	fwd	copy_e/sum	128	0.1005	0.0835	1.203
g-SpMM	1	pubmed	fwd	copy_u/max	128	0.0957	0.0887	1.079
g-SpMM	1	pubmed	fwd	copy_u/min	128	0.0964	0.0892	1.080
g-SpMM	1	pubmed	fwd	copy_u/sum	128	0.0866	0.0826	1.048
g-SpMM	1	pubmed	fwd	div/max	128	0.2470	0.1692	1.460
g-SpMM	1	pubmed	fwd	div/min	128	0.1012	0.1681	0.602
g-SpMM	1	pubmed	fwd	div/sum	128	0.1075	0.1548	0.695
g-SpMM	1	pubmed	fwd	mul/max	128	0.0994	0.1688	0.589
g-SpMM	1	pubmed	fwd	mul/min	128	0.1007	0.1677	0.600
g-SpMM	1	pubmed	fwd	mul/sum	128	0.1041	0.1459	0.714
g-SpMM	1	pubmed	fwd	sub/max	128	0.1003	0.1666	0.602
g-SpMM	1	pubmed	fwd	sub/min	128	0.1020	0.1687	0.605
g-SpMM	1	pubmed	fwd	sub/sum	128	0.1075	0.1481	0.726
g-SpMM	1	pubmed	bwd	add/max	256	0.3638	0.3925	0.927
g-SpMM	1	pubmed	bwd	add/min	256	0.3600	0.3988	0.903
g-SpMM	1	pubmed	bwd	add/sum	256	0.3170	0.2669	1.188
g-SpMM	1	pubmed	bwd	copy_e/max	256	0.2641	0.3632	0.727
g-SpMM	1	pubmed	bwd	copy_e/min	256	0.2636	0.3730	0.707
g-SpMM	1	pubmed	bwd	copy_e/sum	256	0.2003	0.1712	1.170
g-SpMM	1	pubmed	bwd	copy_u/max	256	0.2076	0.1678	1.237
g-SpMM	1	pubmed	bwd	copy_u/min	256	0.1935	0.1745	1.109
g-SpMM	1	pubmed	bwd	copy_u/sum	256	0.2279	0.1974	1.154
g-SpMM	1	pubmed	bwd	div/max	256	0.4500	0.4746	0.948
g-SpMM	1	pubmed	bwd	div/min	256	0.4514	0.4856	0.929
g-SpMM	1	pubmed	bwd	div/sum	256	0.4479	0.6697	0.669
g-SpMM	1	pubmed	bwd	mul/max	256	0.4572	0.4845	0.944
g-SpMM	1	pubmed	bwd	mul/min	256	0.4507	0.4789	0.941
g-SpMM	1	pubmed	bwd	mul/sum	256	0.3584	0.5237	0.684
g-SpMM	1	pubmed	bwd	sub/max	256	0.3640	0.3984	0.914
g-SpMM	1	pubmed	bwd	sub/min	256	0.3579	0.3923	0.912
g-SpMM	1	pubmed	bwd	sub/sum	256	0.3370	0.2771	1.216
g-SpMM	1	pubmed	fb	add/max	256	0.5485	0.7016	0.782
g-SpMM	1	pubmed	fb	add/min	256	0.5403	0.7066	0.765
g-SpMM	1	pubmed	fb	add/sum	256	0.5558	0.5350	1.039

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	pubmed	fb	copy_e/max	256	0.4746	0.4876	0.973
g-SpMM	1	pubmed	fb	copy_e/min	256	0.4569	0.4814	0.949
g-SpMM	1	pubmed	fb	copy_e/sum	256	0.4181	0.3565	1.173
g-SpMM	1	pubmed	fb	copy_u/max	256	0.4565	0.3771	1.211
g-SpMM	1	pubmed	fb	copy_u/min	256	0.4294	0.3880	1.107
g-SpMM	1	pubmed	fb	copy_u/sum	256	0.4670	0.4057	1.151
g-SpMM	1	pubmed	fb	div/max	256	0.6276	0.7954	0.789
g-SpMM	1	pubmed	fb	div/min	256	0.6396	0.7816	0.818
g-SpMM	1	pubmed	fb	div/sum	256	0.6392	0.9396	0.680
g-SpMM	1	pubmed	fb	mul/max	256	0.6440	0.7900	0.815
g-SpMM	1	pubmed	fb	mul/min	256	0.6231	0.7879	0.791
g-SpMM	1	pubmed	fb	mul/sum	256	0.5504	0.7771	0.708
g-SpMM	1	pubmed	fb	sub/max	256	0.5566	0.7005	0.795
g-SpMM	1	pubmed	fb	sub/min	256	0.5362	0.7132	0.752
g-SpMM	1	pubmed	fb	sub/sum	256	0.5855	0.5410	1.082
g-SpMM	1	pubmed	fwd	add/max	256	0.1834	0.3130	0.586
g-SpMM	1	pubmed	fwd	add/min	256	0.1825	0.3150	0.579
g-SpMM	1	pubmed	fwd	add/sum	256	0.2078	0.2830	0.734
g-SpMM	1	pubmed	fwd	copy_e/max	256	0.1220	0.1228	0.994
g-SpMM	1	pubmed	fwd	copy_e/min	256	0.1235	0.1219	1.013
g-SpMM	1	pubmed	fwd	copy_e/sum	256	0.1428	0.1456	0.981
g-SpMM	1	pubmed	fwd	copy_u/max	256	0.1178	0.2038	0.578
g-SpMM	1	pubmed	fwd	copy_u/min	256	0.1177	0.2251	0.523
g-SpMM	1	pubmed	fwd	copy_u/sum	256	0.0916	0.1207	0.759
g-SpMM	1	pubmed	fwd	div/max	256	0.1986	0.3189	0.623
g-SpMM	1	pubmed	fwd	div/min	256	0.1846	0.3235	0.571
g-SpMM	1	pubmed	fwd	div/sum	256	0.2095	0.2882	0.727
g-SpMM	1	pubmed	fwd	mul/max	256	0.1839	0.3153	0.583
g-SpMM	1	pubmed	fwd	mul/min	256	0.1798	0.3142	0.572
g-SpMM	1	pubmed	fwd	mul/sum	256	0.1862	0.2725	0.683
g-SpMM	1	pubmed	fwd	sub/max	256	0.1819	0.3199	0.568
g-SpMM	1	pubmed	fwd	sub/min	256	0.1865	0.3158	0.590
g-SpMM	1	pubmed	fwd	sub/sum	256	0.1932	0.2848	0.678
g-SpMM	1	pubmed	bwd	add/max	512	0.7140	0.7513	0.950
g-SpMM	1	pubmed	bwd	add/min	512	0.6823	0.7467	0.914
g-SpMM	1	pubmed	bwd	add/sum	512	0.3124	0.4508	0.693
g-SpMM	1	pubmed	bwd	copy_e/max	512	0.5020	0.6918	0.726
g-SpMM	1	pubmed	bwd	copy_e/min	512	0.4988	0.6693	0.745
g-SpMM	1	pubmed	bwd	copy_e/sum	512	0.2080	0.2154	0.966
g-SpMM	1	pubmed	bwd	copy_u/max	512	0.2185	0.2171	1.007
g-SpMM	1	pubmed	bwd	copy_u/min	512	0.2328	0.2101	1.108
g-SpMM	1	pubmed	bwd	copy_u/sum	512	0.2732	0.3134	0.872
g-SpMM	1	pubmed	bwd	div/max	512	0.8638	0.9009	0.959
g-SpMM	1	pubmed	bwd	div/min	512	0.8616	0.9283	0.928
g-SpMM	1	pubmed	bwd	div/sum	512	0.8007	1.2145	0.659
g-SpMM	1	pubmed	bwd	mul/max	512	0.8515	0.9121	0.934
g-SpMM	1	pubmed	bwd	mul/min	512	0.8684	0.9025	0.962
g-SpMM	1	pubmed	bwd	mul/sum	512	0.6127	0.9652	0.635
g-SpMM	1	pubmed	bwd	sub/max	512	0.6722	0.7245	0.928
g-SpMM	1	pubmed	bwd	sub/min	512	0.6844	0.7519	0.910
g-SpMM	1	pubmed	bwd	sub/sum	512	0.3180	0.4531	0.702
g-SpMM	1	pubmed	fb	add/max	512	0.9942	1.2941	0.768
g-SpMM	1	pubmed	fb	add/min	512	1.0117	1.3310	0.760
g-SpMM	1	pubmed	fb	add/sum	512	0.6821	0.9711	0.702
g-SpMM	1	pubmed	fb	copy_e/max	512	0.7095	0.8968	0.791
g-SpMM	1	pubmed	fb	copy_e/min	512	0.7233	0.9045	0.800
g-SpMM	1	pubmed	fb	copy_e/sum	512	0.4310	0.4320	0.998
g-SpMM	1	pubmed	fb	copy_u/max	512	0.4356	0.6032	0.722
g-SpMM	1	pubmed	fb	copy_u/min	512	0.4987	0.6222	0.801
g-SpMM	1	pubmed	fb	copy_u/sum	512	0.4835	0.6432	0.752
g-SpMM	1	pubmed	fb	div/max	512	1.1970	1.4966	0.800
g-SpMM	1	pubmed	fb	div/min	512	1.1626	1.4979	0.776
g-SpMM	1	pubmed	fb	div/sum	512	1.1549	1.8168	0.636
g-SpMM	1	pubmed	fb	mul/max	512	1.1788	1.4848	0.794
g-SpMM	1	pubmed	fb	mul/min	512	1.1450	1.4994	0.764
g-SpMM	1	pubmed	fb	mul/sum	512	0.9583	1.5345	0.625
g-SpMM	1	pubmed	fb	sub/max	512	1.0002	1.3117	0.763
g-SpMM	1	pubmed	fb	sub/min	512	0.9825	1.3175	0.746
g-SpMM	1	pubmed	fb	sub/sum	512	0.6790	0.9884	0.687
g-SpMM	1	pubmed	fwd	add/max	512	0.3266	0.6068	0.538
g-SpMM	1	pubmed	fwd	add/min	512	0.3327	0.5922	0.562
g-SpMM	1	pubmed	fwd	add/sum	512	0.3760	0.5661	0.664
g-SpMM	1	pubmed	fwd	copy_e/max	512	0.2214	0.2406	0.920
g-SpMM	1	pubmed	fwd	copy_e/min	512	0.2190	0.2178	1.006
g-SpMM	1	pubmed	fwd	copy_e/sum	512	0.2764	0.2729	1.013
g-SpMM	1	pubmed	fwd	copy_u/max	512	0.2050	0.3772	0.543
g-SpMM	1	pubmed	fwd	copy_u/min	512	0.2022	0.3858	0.524
g-SpMM	1	pubmed	fwd	copy_u/sum	512	0.1779	0.3029	0.587

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	pubmed	fwd	div/max	512	0.3491	0.6286	0.555
g-SpMM	1	pubmed	fwd	div/min	512	0.3216	0.6089	0.528
g-SpMM	1	pubmed	fwd	div/sum	512	0.3807	0.5830	0.653
g-SpMM	1	pubmed	fwd	mul/max	512	0.3334	0.6104	0.546
g-SpMM	1	pubmed	fwd	mul/min	512	0.3359	0.6051	0.555
g-SpMM	1	pubmed	fwd	mul/sum	512	0.3432	0.5619	0.611
g-SpMM	1	pubmed	fwd	sub/max	512	0.3427	0.5975	0.574
g-SpMM	1	pubmed	fwd	sub/min	512	0.3196	0.6043	0.529
g-SpMM	1	pubmed	fwd	sub/sum	512	0.3600	0.5522	0.652
g-SpMM	1	tolokers-2	bwd	add/max	64	0.2264	0.2283	0.992
g-SpMM	1	tolokers-2	bwd	add/min	64	0.2247	0.2113	1.064
g-SpMM	1	tolokers-2	bwd	add/sum	64	0.5024	0.5021	1.001
g-SpMM	1	tolokers-2	bwd	copy_e/max	64	0.1754	0.1739	1.008
g-SpMM	1	tolokers-2	bwd	copy_e/min	64	0.1823	0.1743	1.046
g-SpMM	1	tolokers-2	bwd	copy_e/sum	64	0.4014	0.4206	0.954
g-SpMM	1	tolokers-2	bwd	copy_u/max	64	0.1933	0.1947	0.992
g-SpMM	1	tolokers-2	bwd	copy_u/min	64	0.2011	0.1958	1.027
g-SpMM	1	tolokers-2	bwd	copy_u/sum	64	0.2216	0.2304	0.961
g-SpMM	1	tolokers-2	bwd	div/max	64	0.2030	0.2114	0.960
g-SpMM	1	tolokers-2	bwd	div/min	64	0.2159	0.2119	1.019
g-SpMM	1	tolokers-2	bwd	div/sum	64	0.8895	1.4709	0.605
g-SpMM	1	tolokers-2	bwd	mul/max	64	0.2039	0.2212	0.922
g-SpMM	1	tolokers-2	bwd	mul/min	64	0.2051	0.2170	0.945
g-SpMM	1	tolokers-2	bwd	mul/sum	64	0.6287	1.0876	0.578
g-SpMM	1	tolokers-2	bwd	sub/max	64	0.2018	0.1692	1.193
g-SpMM	1	tolokers-2	bwd	sub/min	64	0.2042	0.1882	1.085
g-SpMM	1	tolokers-2	bwd	sub/sum	64	0.5370	0.4956	1.083
g-SpMM	1	tolokers-2	fb	add/max	64	0.4946	0.8276	0.598
g-SpMM	1	tolokers-2	fb	add/min	64	0.4937	0.8329	0.593
g-SpMM	1	tolokers-2	fb	add/sum	64	0.7377	1.1021	0.669
g-SpMM	1	tolokers-2	fb	copy_e/max	64	0.4168	0.4190	0.995
g-SpMM	1	tolokers-2	fb	copy_e/min	64	0.4145	0.4044	1.025
g-SpMM	1	tolokers-2	fb	copy_e/sum	64	0.6560	0.6530	1.005
g-SpMM	1	tolokers-2	fb	copy_u/max	64	0.4289	0.4380	0.979
g-SpMM	1	tolokers-2	fb	copy_u/min	64	0.4341	0.4353	0.997
g-SpMM	1	tolokers-2	fb	copy_u/sum	64	0.4306	0.4724	0.911
g-SpMM	1	tolokers-2	fb	div/max	64	0.4978	0.8345	0.597
g-SpMM	1	tolokers-2	fb	div/min	64	0.4881	0.8407	0.581
g-SpMM	1	tolokers-2	fb	div/sum	64	1.3131	2.1446	0.612
g-SpMM	1	tolokers-2	fb	mul/max	64	0.4740	0.8459	0.560
g-SpMM	1	tolokers-2	fb	mul/min	64	0.4818	0.8440	0.571
g-SpMM	1	tolokers-2	fb	mul/sum	64	0.9970	1.7519	0.569
g-SpMM	1	tolokers-2	fb	sub/max	64	0.4634	0.8202	0.565
g-SpMM	1	tolokers-2	fb	sub/min	64	0.4613	0.8176	0.564
g-SpMM	1	tolokers-2	fb	sub/sum	64	0.7280	1.0991	0.662
g-SpMM	1	tolokers-2	fwd	add/max	64	0.3230	0.6849	0.472
g-SpMM	1	tolokers-2	fwd	add/min	64	0.3266	0.6745	0.484
g-SpMM	1	tolokers-2	fwd	add/sum	64	0.4115	0.6633	0.620
g-SpMM	1	tolokers-2	fwd	copy_e/max	64	0.1673	0.1780	0.940
g-SpMM	1	tolokers-2	fwd	copy_e/min	64	0.1685	0.1725	0.977
g-SpMM	1	tolokers-2	fwd	copy_e/sum	64	0.3229	0.3261	0.990
g-SpMM	1	tolokers-2	fwd	copy_u/max	64	0.1252	0.2450	0.511
g-SpMM	1	tolokers-2	fwd	copy_u/min	64	0.1249	0.2488	0.502
g-SpMM	1	tolokers-2	fwd	copy_u/sum	64	0.1090	0.2016	0.541
g-SpMM	1	tolokers-2	fwd	div/max	64	0.3294	0.6855	0.481
g-SpMM	1	tolokers-2	fwd	div/min	64	0.3348	0.7022	0.477
g-SpMM	1	tolokers-2	fwd	div/sum	64	0.4190	0.6513	0.643
g-SpMM	1	tolokers-2	fwd	mul/max	64	0.3284	0.6873	0.478
g-SpMM	1	tolokers-2	fwd	mul/min	64	0.3341	0.6981	0.479
g-SpMM	1	tolokers-2	fwd	mul/sum	64	0.3762	0.6196	0.607
g-SpMM	1	tolokers-2	fwd	sub/max	64	0.3180	0.6757	0.471
g-SpMM	1	tolokers-2	fwd	sub/min	64	0.3232	0.6669	0.485
g-SpMM	1	tolokers-2	fwd	sub/sum	64	0.4214	0.6576	0.641
g-SpMM	1	tolokers-2	bwd	add/max	128	0.2815	0.2829	0.995
g-SpMM	1	tolokers-2	bwd	add/min	128	0.2835	0.2827	1.003
g-SpMM	1	tolokers-2	bwd	add/sum	128	0.5012	0.7428	0.675
g-SpMM	1	tolokers-2	bwd	copy_e/max	128	0.2573	0.2619	0.983
g-SpMM	1	tolokers-2	bwd	copy_e/min	128	0.2571	0.2578	0.997
g-SpMM	1	tolokers-2	bwd	copy_e/sum	128	0.4039	0.4111	0.982
g-SpMM	1	tolokers-2	bwd	copy_u/max	128	0.2005	0.1963	1.021
g-SpMM	1	tolokers-2	bwd	copy_u/min	128	0.1956	0.1922	1.018
g-SpMM	1	tolokers-2	bwd	copy_u/sum	128	0.2403	0.3580	0.671
g-SpMM	1	tolokers-2	bwd	div/max	128	0.3227	0.3241	0.996
g-SpMM	1	tolokers-2	bwd	div/min	128	0.3223	0.3233	0.997
g-SpMM	1	tolokers-2	bwd	div/sum	128	1.4321	2.4505	0.584
g-SpMM	1	tolokers-2	bwd	mul/max	128	0.3225	0.3219	1.002
g-SpMM	1	tolokers-2	bwd	mul/min	128	0.3218	0.3217	1.000
g-SpMM	1	tolokers-2	bwd	mul/sum	128	1.0929	1.8840	0.580

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	tolokers-2	bwd	sub/max	128	0.2817	0.2850	0.989
g-SpMM	1	tolokers-2	bwd	sub/min	128	0.2823	0.2823	1.000
g-SpMM	1	tolokers-2	bwd	sub/sum	128	0.4928	0.7315	0.674
g-SpMM	1	tolokers-2	fb	add/max	128	0.9082	1.4537	0.625
g-SpMM	1	tolokers-2	fb	add/min	128	0.9044	1.4156	0.639
g-SpMM	1	tolokers-2	fb	add/sum	128	1.2803	2.0150	0.635
g-SpMM	1	tolokers-2	fb	copy_e/max	128	0.5596	0.5648	0.991
g-SpMM	1	tolokers-2	fb	copy_e/min	128	0.5480	0.5591	0.980
g-SpMM	1	tolokers-2	fb	copy_e/sum	128	0.9069	0.9137	0.992
g-SpMM	1	tolokers-2	fb	copy_u/max	128	0.4220	0.5393	0.782
g-SpMM	1	tolokers-2	fb	copy_u/min	128	0.4300	0.5297	0.812
g-SpMM	1	tolokers-2	fb	copy_u/sum	128	0.4673	0.7590	0.616
g-SpMM	1	tolokers-2	fb	div/max	128	0.9557	1.4691	0.651
g-SpMM	1	tolokers-2	fb	div/min	128	0.9541	1.4682	0.650
g-SpMM	1	tolokers-2	fb	div/sum	128	2.2397	3.7422	0.598
g-SpMM	1	tolokers-2	fb	mul/max	128	0.9425	1.4555	0.648
g-SpMM	1	tolokers-2	fb	mul/min	128	0.9568	1.5035	0.636
g-SpMM	1	tolokers-2	fb	mul/sum	128	1.7077	3.0659	0.557
g-SpMM	1	tolokers-2	fb	sub/max	128	0.9046	1.4106	0.641
g-SpMM	1	tolokers-2	fb	sub/min	128	0.9114	1.4391	0.633
g-SpMM	1	tolokers-2	fb	sub/sum	128	1.2889	1.9920	0.647
g-SpMM	1	tolokers-2	fwd	add/max	128	0.6289	1.1739	0.536
g-SpMM	1	tolokers-2	fwd	add/min	128	0.6327	1.1749	0.539
g-SpMM	1	tolokers-2	fwd	add/sum	128	0.7711	1.2294	0.627
g-SpMM	1	tolokers-2	fwd	copy_e/max	128	0.3201	0.3100	1.033
g-SpMM	1	tolokers-2	fwd	copy_e/min	128	0.3179	0.3197	0.994
g-SpMM	1	tolokers-2	fwd	copy_e/sum	128	0.6348	0.6320	1.004
g-SpMM	1	tolokers-2	fwd	copy_u/max	128	0.2164	0.4687	0.462
g-SpMM	1	tolokers-2	fwd	copy_u/min	128	0.2123	0.4614	0.460
g-SpMM	1	tolokers-2	fwd	copy_u/sum	128	0.1960	0.3605	0.544
g-SpMM	1	tolokers-2	fwd	div/max	128	0.6362	1.1876	0.536
g-SpMM	1	tolokers-2	fwd	div/min	128	0.6778	1.2468	0.544
g-SpMM	1	tolokers-2	fwd	div/sum	128	0.7636	1.2412	0.615
g-SpMM	1	tolokers-2	fwd	mul/max	128	0.6232	1.2237	0.509
g-SpMM	1	tolokers-2	fwd	mul/min	128	0.6519	1.1988	0.544
g-SpMM	1	tolokers-2	fwd	mul/sum	128	0.6604	1.2030	0.549
g-SpMM	1	tolokers-2	fwd	sub/max	128	0.6377	1.1702	0.545
g-SpMM	1	tolokers-2	fwd	sub/min	128	0.6321	1.2326	0.513
g-SpMM	1	tolokers-2	fwd	sub/sum	128	0.7493	1.2644	0.593
g-SpMM	1	tolokers-2	bwd	add/max	256	0.5429	0.5445	0.997
g-SpMM	1	tolokers-2	bwd	add/min	256	0.5427	0.5431	0.999
g-SpMM	1	tolokers-2	bwd	add/sum	256	0.8961	1.2615	0.710
g-SpMM	1	tolokers-2	bwd	copy_e/max	256	0.4938	0.4980	0.992
g-SpMM	1	tolokers-2	bwd	copy_e/min	256	0.4995	0.4984	1.002
g-SpMM	1	tolokers-2	bwd	copy_e/sum	256	0.4570	0.4526	1.010
g-SpMM	1	tolokers-2	bwd	copy_u/max	256	0.2207	0.2013	1.096
g-SpMM	1	tolokers-2	bwd	copy_u/min	256	0.2074	0.1989	1.043
g-SpMM	1	tolokers-2	bwd	copy_u/sum	256	0.3743	0.7059	0.530
g-SpMM	1	tolokers-2	bwd	div/max	256	0.6359	0.6453	0.986
g-SpMM	1	tolokers-2	bwd	div/min	256	0.6458	0.6391	1.011
g-SpMM	1	tolokers-2	bwd	div/sum	256	2.6638	4.5746	0.582
g-SpMM	1	tolokers-2	bwd	mul/max	256	0.6344	0.6386	0.993
g-SpMM	1	tolokers-2	bwd	mul/min	256	0.6357	0.6375	0.997
g-SpMM	1	tolokers-2	bwd	mul/sum	256	1.9952	3.6063	0.553
g-SpMM	1	tolokers-2	bwd	sub/max	256	0.5453	0.5443	1.002
g-SpMM	1	tolokers-2	bwd	sub/min	256	0.5468	0.5454	1.003
g-SpMM	1	tolokers-2	bwd	sub/sum	256	0.8955	1.2996	0.689
g-SpMM	1	tolokers-2	fb	add/max	256	1.7738	2.8262	0.628
g-SpMM	1	tolokers-2	fb	add/min	256	1.7639	2.8398	0.621
g-SpMM	1	tolokers-2	fb	add/sum	256	2.3937	3.7802	0.633
g-SpMM	1	tolokers-2	fb	copy_e/max	256	1.0869	1.0671	1.019
g-SpMM	1	tolokers-2	fb	copy_e/min	256	1.0868	1.0738	1.012
g-SpMM	1	tolokers-2	fb	copy_e/sum	256	1.7149	1.7339	0.989
g-SpMM	1	tolokers-2	fb	copy_u/max	256	0.5172	1.0961	0.472
g-SpMM	1	tolokers-2	fb	copy_u/min	256	0.5017	1.0799	0.465
g-SpMM	1	tolokers-2	fb	copy_u/sum	256	0.8388	1.6124	0.520
g-SpMM	1	tolokers-2	fb	div/max	256	1.9000	2.9526	0.643
g-SpMM	1	tolokers-2	fb	div/min	256	1.9071	2.9572	0.645
g-SpMM	1	tolokers-2	fb	div/sum	256	4.1856	7.0767	0.591
g-SpMM	1	tolokers-2	fb	mul/max	256	1.8797	2.9268	0.642
g-SpMM	1	tolokers-2	fb	mul/min	256	1.9137	2.9019	0.659
g-SpMM	1	tolokers-2	fb	mul/sum	256	3.3428	5.9341	0.563
g-SpMM	1	tolokers-2	fb	sub/max	256	1.7963	2.8713	0.626
g-SpMM	1	tolokers-2	fb	sub/min	256	1.7877	2.8300	0.632
g-SpMM	1	tolokers-2	fb	sub/sum	256	2.4232	3.7763	0.642
g-SpMM	1	tolokers-2	fwd	add/max	256	1.2258	2.2894	0.535
g-SpMM	1	tolokers-2	fwd	add/min	256	1.2963	2.4130	0.537
g-SpMM	1	tolokers-2	fwd	add/sum	256	1.4908	2.4195	0.616

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	tolokers-2	fwd	copy_e/max	256	0.5853	0.6045	0.968
g-SpMM	1	tolokers-2	fwd	copy_e/min	256	0.6127	0.6097	1.005
g-SpMM	1	tolokers-2	fwd	copy_e/sum	256	1.2606	1.2525	1.006
g-SpMM	1	tolokers-2	fwd	copy_u/max	256	0.4245	0.9731	0.436
g-SpMM	1	tolokers-2	fwd	copy_u/min	256	0.4096	0.9360	0.438
g-SpMM	1	tolokers-2	fwd	copy_u/sum	256	0.3720	0.6923	0.537
g-SpMM	1	tolokers-2	fwd	div/max	256	1.2754	2.2799	0.559
g-SpMM	1	tolokers-2	fwd	div/min	256	1.2993	2.4006	0.541
g-SpMM	1	tolokers-2	fwd	div/sum	256	1.4938	2.4474	0.610
g-SpMM	1	tolokers-2	fwd	mul/max	256	1.2387	2.3258	0.533
g-SpMM	1	tolokers-2	fwd	mul/min	256	1.2913	2.3356	0.553
g-SpMM	1	tolokers-2	fwd	mul/sum	256	1.2765	2.3839	0.535
g-SpMM	1	tolokers-2	fwd	sub/max	256	1.2383	2.2821	0.543
g-SpMM	1	tolokers-2	fwd	sub/min	256	1.2964	2.3254	0.557
g-SpMM	1	tolokers-2	fwd	sub/sum	256	1.4471	2.4844	0.582
g-SpMM	1	tolokers-2	bwd	add/max	512	1.1677	1.1684	0.999
g-SpMM	1	tolokers-2	bwd	add/min	512	1.1728	1.1723	1.000
g-SpMM	1	tolokers-2	bwd	add/sum	512	1.8691	2.5624	0.729
g-SpMM	1	tolokers-2	bwd	copy_e/max	512	1.0095	1.0088	1.001
g-SpMM	1	tolokers-2	bwd	copy_e/min	512	1.0115	1.0199	0.992
g-SpMM	1	tolokers-2	bwd	copy_e/sum	512	1.0489	1.0373	1.011
g-SpMM	1	tolokers-2	bwd	copy_u/max	512	0.3788	0.1859	2.038
g-SpMM	1	tolokers-2	bwd	copy_u/min	512	0.3411	0.1799	1.896
g-SpMM	1	tolokers-2	bwd	copy_u/sum	512	0.7808	1.4697	0.531
g-SpMM	1	tolokers-2	bwd	div/max	512	1.4310	1.4357	0.997
g-SpMM	1	tolokers-2	bwd	div/min	512	1.4290	1.4320	0.998
g-SpMM	1	tolokers-2	bwd	div/sum	512	5.5165	9.2525	0.596
g-SpMM	1	tolokers-2	bwd	mul/max	512	1.4257	1.4209	1.003
g-SpMM	1	tolokers-2	bwd	mul/min	512	1.4292	1.4259	1.002
g-SpMM	1	tolokers-2	bwd	mul/sum	512	4.1841	7.3304	0.571
g-SpMM	1	tolokers-2	bwd	sub/max	512	1.1717	1.1746	0.998
g-SpMM	1	tolokers-2	bwd	sub/min	512	1.1719	1.1693	1.002
g-SpMM	1	tolokers-2	bwd	sub/sum	512	1.8538	2.5974	0.714
g-SpMM	1	tolokers-2	fb	add/max	512	3.7250	5.7928	0.643
g-SpMM	1	tolokers-2	fb	add/min	512	3.7341	5.8100	0.643
g-SpMM	1	tolokers-2	fb	add/sum	512	4.8762	7.7541	0.629
g-SpMM	1	tolokers-2	fb	copy_e/max	512	2.2922	2.2882	1.002
g-SpMM	1	tolokers-2	fb	copy_e/min	512	2.3017	2.2912	1.005
g-SpMM	1	tolokers-2	fb	copy_e/sum	512	3.5529	3.5400	1.004
g-SpMM	1	tolokers-2	fb	copy_u/max	512	0.9828	2.0710	0.475
g-SpMM	1	tolokers-2	fb	copy_u/min	512	0.9654	2.0768	0.465
g-SpMM	1	tolokers-2	fb	copy_u/sum	512	1.6124	3.1142	0.518
g-SpMM	1	tolokers-2	fb	div/max	512	3.9723	6.2282	0.638
g-SpMM	1	tolokers-2	fb	div/min	512	4.0569	6.1185	0.663
g-SpMM	1	tolokers-2	fb	div/sum	512	8.7206	14.3103	0.609
g-SpMM	1	tolokers-2	fb	mul/max	512	3.9626	6.0943	0.650
g-SpMM	1	tolokers-2	fb	mul/min	512	3.9854	6.0114	0.663
g-SpMM	1	tolokers-2	fb	mul/sum	512	6.7903	12.0588	0.563
g-SpMM	1	tolokers-2	fb	sub/max	512	3.6813	5.9475	0.619
g-SpMM	1	tolokers-2	fb	sub/min	512	3.7149	5.7927	0.641
g-SpMM	1	tolokers-2	fb	sub/sum	512	4.9470	7.7792	0.636
g-SpMM	1	tolokers-2	fwd	add/max	512	2.5364	4.7637	0.532
g-SpMM	1	tolokers-2	fwd	add/min	512	2.6799	4.6990	0.570
g-SpMM	1	tolokers-2	fwd	add/sum	512	3.0445	5.0098	0.608
g-SpMM	1	tolokers-2	fwd	copy_e/max	512	1.2708	1.3010	0.977
g-SpMM	1	tolokers-2	fwd	copy_e/min	512	1.3470	1.3399	1.005
g-SpMM	1	tolokers-2	fwd	copy_e/sum	512	2.5364	2.5082	1.011
g-SpMM	1	tolokers-2	fwd	copy_u/max	512	0.8223	1.8810	0.437
g-SpMM	1	tolokers-2	fwd	copy_u/min	512	0.8392	1.8686	0.449
g-SpMM	1	tolokers-2	fwd	copy_u/sum	512	0.7729	1.4438	0.535
g-SpMM	1	tolokers-2	fwd	div/max	512	2.6065	4.5918	0.568
g-SpMM	1	tolokers-2	fwd	div/min	512	2.7021	4.7280	0.572
g-SpMM	1	tolokers-2	fwd	div/sum	512	3.0601	4.8736	0.628
g-SpMM	1	tolokers-2	fwd	mul/max	512	2.5060	4.6165	0.543
g-SpMM	1	tolokers-2	fwd	mul/min	512	2.6662	4.8517	0.550
g-SpMM	1	tolokers-2	fwd	mul/sum	512	2.5715	4.7520	0.541
g-SpMM	1	tolokers-2	fwd	sub/max	512	2.5367	4.5470	0.558
g-SpMM	1	tolokers-2	fwd	sub/min	512	2.7148	4.9505	0.548
g-SpMM	1	tolokers-2	fwd	sub/sum	512	3.0496	5.0372	0.605
g-SpMM	1	twitch-views	bwd	copy_u/max	64	0.3624	0.3648	0.994
g-SpMM	1	twitch-views	bwd	copy_u/min	64	0.3692	0.3667	1.007
g-SpMM	1	twitch-views	bwd	copy_u/sum	64	2.5204	4.7811	0.527
g-SpMM	1	twitch-views	fb	copy_u/max	64	2.4715	6.0942	0.406
g-SpMM	1	twitch-views	fb	copy_u/min	64	2.4543	6.1371	0.400
g-SpMM	1	twitch-views	fb	copy_u/sum	64	5.0314	9.8475	0.511
g-SpMM	1	twitch-views	fwd	copy_u/max	64	2.0971	5.7376	0.366
g-SpMM	1	twitch-views	fwd	copy_u/min	64	2.1017	5.6793	0.370
g-SpMM	1	twitch-views	fwd	copy_u/sum	64	2.5053	4.7771	0.524

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	1	twitch-views	bwd	copy_u/max	128	0.7855	0.7847	1.001
g-SpMM	1	twitch-views	bwd	copy_u/min	128	0.7921	0.7928	0.999
g-SpMM	1	twitch-views	bwd	copy_u/sum	128	5.7285	10.8597	0.527
g-SpMM	1	twitch-views	fb	copy_u/max	128	5.2889	13.6575	0.387
g-SpMM	1	twitch-views	fb	copy_u/min	128	5.2459	13.4981	0.389
g-SpMM	1	twitch-views	fb	copy_u/sum	128	11.5131	21.9516	0.524
g-SpMM	1	twitch-views	fwd	copy_u/max	128	4.4401	12.7014	0.350
g-SpMM	1	twitch-views	fwd	copy_u/min	128	4.4394	12.8497	0.345
g-SpMM	1	twitch-views	fwd	copy_u/sum	128	5.7618	10.8629	0.530
g-SpMM	1	twitch-views	bwd	copy_u/max	256	2.1162	2.1083	1.004
g-SpMM	1	twitch-views	bwd	copy_u/min	256	2.1203	2.1105	1.005
g-SpMM	1	twitch-views	bwd	copy_u/sum	256	12.7565	23.4251	0.545
g-SpMM	1	twitch-views	fb	copy_u/max	256	11.7507	30.2069	0.389
g-SpMM	1	twitch-views	fb	copy_u/min	256	11.7189	30.2235	0.388
g-SpMM	1	twitch-views	fb	copy_u/sum	256	25.5881	48.2224	0.531
g-SpMM	1	twitch-views	fwd	copy_u/max	256	9.6130	27.8480	0.345
g-SpMM	1	twitch-views	fwd	copy_u/min	256	9.5850	28.2330	0.339
g-SpMM	1	twitch-views	fwd	copy_u/sum	256	12.5033	23.6062	0.530
g-SpMM	1	twitch-views	bwd	copy_u/max	512	5.4141	5.4140	1.000
g-SpMM	1	twitch-views	bwd	copy_u/min	512	5.4572	5.4531	1.001
g-SpMM	1	twitch-views	bwd	copy_u/sum	512	26.6411	50.9066	0.523
g-SpMM	1	twitch-views	fb	copy_u/max	512	25.4791	65.2883	0.390
g-SpMM	1	twitch-views	fb	copy_u/min	512	25.3114	64.8095	0.391
g-SpMM	1	twitch-views	fb	copy_u/sum	512	53.9893	101.3114	0.533
g-SpMM	1	twitch-views	fwd	copy_u/max	512	20.4989	59.8341	0.343
g-SpMM	1	twitch-views	fwd	copy_u/min	512	20.1041	59.2369	0.339
g-SpMM	1	twitch-views	fwd	copy_u/sum	512	26.5513	49.4110	0.537
g-SpMM	1	web-fraud	bwd	copy_u/max	64	12.6533	12.6591	1.000
g-SpMM	1	web-fraud	bwd	copy_u/min	64	12.7784	12.7874	0.999
g-SpMM	1	web-fraud	bwd	copy_u/sum	64	74.5888	131.8341	0.566
g-SpMM	1	web-fraud	fb	copy_u/max	64	26.2978	49.7960	0.528
g-SpMM	1	web-fraud	fb	copy_u/min	64	26.3815	50.2930	0.525
g-SpMM	1	web-fraud	fb	copy_u/sum	64	92.8230	160.8778	0.577
g-SpMM	1	web-fraud	fwd	copy_u/max	64	13.6663	37.1699	0.368
g-SpMM	1	web-fraud	fwd	copy_u/min	64	13.5791	37.1210	0.366
g-SpMM	1	web-fraud	fwd	copy_u/sum	64	17.5692	28.2448	0.622
g-SpMM	1	web-fraud	bwd	copy_u/max	128	16.2701	16.1249	1.009
g-SpMM	1	web-fraud	bwd	copy_u/min	128	16.6026	16.1940	1.025
g-SpMM	1	web-fraud	bwd	copy_u/sum	128	149.9857	253.2603	0.592
g-SpMM	1	web-fraud	fb	copy_u/max	128	42.7517	90.3472	0.473
g-SpMM	1	web-fraud	fb	copy_u/min	128	43.3043	90.4930	0.479
g-SpMM	1	web-fraud	fb	copy_u/sum	128	185.2705	311.0450	0.596
g-SpMM	1	web-fraud	fwd	copy_u/max	128	27.1672	74.3019	0.366
g-SpMM	1	web-fraud	fwd	copy_u/min	128	27.0870	73.9580	0.366
g-SpMM	1	web-fraud	fwd	copy_u/sum	128	35.7578	56.2936	0.635
g-SpMM	1	web-fraud	bwd	copy_u/max	256	32.3781	32.0104	1.011
g-SpMM	1	web-fraud	bwd	copy_u/min	256	31.9456	32.3430	0.988
g-SpMM	1	web-fraud	bwd	copy_u/sum	256	301.7913	519.1350	0.581
g-SpMM	1	web-fraud	fb	copy_u/max	256	103.8889	205.4770	0.506
g-SpMM	1	web-fraud	fb	copy_u/min	256	104.8676	198.0646	0.529
g-SpMM	1	web-fraud	fb	copy_u/sum	256	400.3877	660.5566	0.606
g-SpMM	1	web-fraud	fwd	copy_u/max	256	55.7480	183.1946	0.304
g-SpMM	1	web-fraud	fwd	copy_u/min	256	88.1386	189.9727	0.464
g-SpMM	1	web-fraud	fwd	copy_u/sum	256	70.1338	112.7211	0.622
g-SpMM	1	web-fraud	bwd	copy_u/max	512	45.5700	45.3002	1.006
g-SpMM	1	web-fraud	bwd	copy_u/min	512	44.8344	45.9623	0.975
g-SpMM	1	web-fraud	bwd	copy_u/sum	512	623.9840	1046.7178	0.596
g-SpMM	1	web-fraud	fb	copy_u/max	512	226.4346	439.2579	0.515
g-SpMM	1	web-fraud	fb	copy_u/min	512	219.5975	441.9542	0.497
g-SpMM	1	web-fraud	fb	copy_u/sum	512	792.9253	1302.9754	0.609
g-SpMM	1	web-fraud	fwd	copy_u/max	512	188.2454	381.9290	0.493
g-SpMM	1	web-fraud	fwd	copy_u/min	512	190.1446	373.3379	0.509
g-SpMM	1	web-fraud	fwd	copy_u/sum	512	166.4348	249.4754	0.667
g-SpMM	2	artnet-exp	bwd	add/max	64	0.1916	0.2017	0.950
g-SpMM	2	artnet-exp	bwd	add/min	64	0.2348	0.1954	1.202
g-SpMM	2	artnet-exp	bwd	add/sum	64	0.3018	0.2752	1.097
g-SpMM	2	artnet-exp	bwd	copy_e/max	64	0.1869	0.1773	1.054
g-SpMM	2	artnet-exp	bwd	copy_e/min	64	0.1819	0.1737	1.048
g-SpMM	2	artnet-exp	bwd	copy_e/sum	64	0.2062	0.1954	1.055
g-SpMM	2	artnet-exp	bwd	copy_u/max	64	0.2039	0.1969	1.035
g-SpMM	2	artnet-exp	bwd	copy_u/min	64	0.2034	0.2026	1.004
g-SpMM	2	artnet-exp	bwd	copy_u/sum	64	0.2448	0.2367	1.034
g-SpMM	2	artnet-exp	bwd	div/max	64	0.2148	0.2133	1.007
g-SpMM	2	artnet-exp	bwd	div/min	64	0.2274	0.2156	1.055
g-SpMM	2	artnet-exp	bwd	div/sum	64	0.4886	0.9554	0.511
g-SpMM	2	artnet-exp	bwd	mul/max	64	0.2148	0.2134	1.007
g-SpMM	2	artnet-exp	bwd	mul/min	64	0.2146	0.2144	1.001
g-SpMM	2	artnet-exp	bwd	mul/sum	64	0.3649	0.6693	0.545

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	artnet-exp	bwd	sub/max	64	0.2015	0.2119	0.951
g-SpMM	2	artnet-exp	bwd	sub/min	64	0.2005	0.2023	0.991
g-SpMM	2	artnet-exp	bwd	sub/sum	64	0.2572	0.2641	0.974
g-SpMM	2	artnet-exp	fb	add/max	64	0.5123	0.5665	0.904
g-SpMM	2	artnet-exp	fb	add/min	64	0.4940	0.5661	0.873
g-SpMM	2	artnet-exp	fb	add/sum	64	0.5275	0.6380	0.827
g-SpMM	2	artnet-exp	fb	copy_e/max	64	0.4805	0.4262	1.128
g-SpMM	2	artnet-exp	fb	copy_e/min	64	0.4351	0.4104	1.060
g-SpMM	2	artnet-exp	fb	copy_e/sum	64	0.4287	0.4092	1.048
g-SpMM	2	artnet-exp	fb	copy_u/max	64	0.4471	0.4348	1.028
g-SpMM	2	artnet-exp	fb	copy_u/min	64	0.4626	0.4323	1.070
g-SpMM	2	artnet-exp	fb	copy_u/sum	64	0.4854	0.4544	1.068
g-SpMM	2	artnet-exp	fb	div/max	64	0.4204	0.6025	0.698
g-SpMM	2	artnet-exp	fb	div/min	64	0.4234	0.6018	0.703
g-SpMM	2	artnet-exp	fb	div/sum	64	0.6981	1.3132	0.532
g-SpMM	2	artnet-exp	fb	mul/max	64	0.4234	0.6007	0.705
g-SpMM	2	artnet-exp	fb	mul/min	64	0.4122	0.6001	0.687
g-SpMM	2	artnet-exp	fb	mul/sum	64	0.5592	1.0211	0.548
g-SpMM	2	artnet-exp	fb	sub/max	64	0.4087	0.5665	0.721
g-SpMM	2	artnet-exp	fb	sub/min	64	0.4004	0.5668	0.706
g-SpMM	2	artnet-exp	fb	sub/sum	64	0.4861	0.6402	0.759
g-SpMM	2	artnet-exp	fwd	add/max	64	0.1729	0.3957	0.437
g-SpMM	2	artnet-exp	fwd	add/min	64	0.1770	0.4005	0.442
g-SpMM	2	artnet-exp	fwd	add/sum	64	0.2135	0.3757	0.568
g-SpMM	2	artnet-exp	fwd	copy_e/max	64	0.1145	0.1148	0.997
g-SpMM	2	artnet-exp	fwd	copy_e/min	64	0.1139	0.1144	0.996
g-SpMM	2	artnet-exp	fwd	copy_e/sum	64	0.1420	0.1385	1.026
g-SpMM	2	artnet-exp	fwd	copy_u/max	64	0.1014	0.1884	0.539
g-SpMM	2	artnet-exp	fwd	copy_u/min	64	0.1022	0.1880	0.543
g-SpMM	2	artnet-exp	fwd	copy_u/sum	64	0.0898	0.1393	0.644
g-SpMM	2	artnet-exp	fwd	div/max	64	0.1739	0.3971	0.438
g-SpMM	2	artnet-exp	fwd	div/min	64	0.1784	0.4072	0.438
g-SpMM	2	artnet-exp	fwd	div/sum	64	0.2160	0.3620	0.597
g-SpMM	2	artnet-exp	fwd	mul/max	64	0.1736	0.3949	0.439
g-SpMM	2	artnet-exp	fwd	mul/min	64	0.1806	0.4059	0.445
g-SpMM	2	artnet-exp	fwd	mul/sum	64	0.2022	0.3557	0.568
g-SpMM	2	artnet-exp	fwd	sub/max	64	0.1740	0.3968	0.439
g-SpMM	2	artnet-exp	fwd	sub/min	64	0.1739	0.3984	0.437
g-SpMM	2	artnet-exp	fwd	sub/sum	64	0.2148	0.3762	0.571
g-SpMM	2	artnet-exp	bwd	add/max	128	0.3427	0.3430	0.999
g-SpMM	2	artnet-exp	bwd	add/min	128	0.3432	0.3429	1.001
g-SpMM	2	artnet-exp	bwd	add/sum	128	0.3233	0.9107	0.355
g-SpMM	2	artnet-exp	bwd	copy_e/max	128	0.2444	0.2447	0.998
g-SpMM	2	artnet-exp	bwd	copy_e/min	128	0.2437	0.2456	0.992
g-SpMM	2	artnet-exp	bwd	copy_e/sum	128	0.2010	0.2216	0.907
g-SpMM	2	artnet-exp	bwd	copy_u/max	128	0.1978	0.1979	0.999
g-SpMM	2	artnet-exp	bwd	copy_u/min	128	0.2296	0.2082	1.102
g-SpMM	2	artnet-exp	bwd	copy_u/sum	128	0.2664	0.3138	0.849
g-SpMM	2	artnet-exp	bwd	div/max	128	0.4240	0.4239	1.000
g-SpMM	2	artnet-exp	bwd	div/min	128	0.4237	0.4229	1.002
g-SpMM	2	artnet-exp	bwd	div/sum	128	0.8772	1.7137	0.512
g-SpMM	2	artnet-exp	bwd	mul/max	128	0.4244	0.4241	1.001
g-SpMM	2	artnet-exp	bwd	mul/min	128	0.4241	0.4234	1.002
g-SpMM	2	artnet-exp	bwd	mul/sum	128	0.6538	1.2089	0.541
g-SpMM	2	artnet-exp	bwd	sub/max	128	0.3451	0.3422	1.009
g-SpMM	2	artnet-exp	bwd	sub/min	128	0.3436	0.3429	1.002
g-SpMM	2	artnet-exp	bwd	sub/sum	128	0.3267	0.4821	0.678
g-SpMM	2	artnet-exp	fb	add/max	128	0.6605	1.0482	0.630
g-SpMM	2	artnet-exp	fb	add/min	128	0.6572	1.0481	0.627
g-SpMM	2	artnet-exp	fb	add/sum	128	0.7052	1.4690	0.480
g-SpMM	2	artnet-exp	fb	copy_e/max	128	0.4434	0.4455	0.995
g-SpMM	2	artnet-exp	fb	copy_e/min	128	0.4446	0.4431	1.003
g-SpMM	2	artnet-exp	fb	copy_e/sum	128	0.4066	0.4216	0.964
g-SpMM	2	artnet-exp	fb	copy_u/max	128	0.4769	0.4924	0.969
g-SpMM	2	artnet-exp	fb	copy_u/min	128	0.4919	0.4922	0.999
g-SpMM	2	artnet-exp	fb	copy_u/sum	128	0.5100	0.6713	0.760
g-SpMM	2	artnet-exp	fb	div/max	128	0.7434	1.1300	0.658
g-SpMM	2	artnet-exp	fb	div/min	128	0.7451	1.1287	0.660
g-SpMM	2	artnet-exp	fb	div/sum	128	1.2630	2.3568	0.536
g-SpMM	2	artnet-exp	fb	mul/max	128	0.7406	1.1242	0.659
g-SpMM	2	artnet-exp	fb	mul/min	128	0.7436	1.1260	0.660
g-SpMM	2	artnet-exp	fb	mul/sum	128	1.0152	1.8393	0.552
g-SpMM	2	artnet-exp	fb	sub/max	128	0.6582	1.0517	0.626
g-SpMM	2	artnet-exp	fb	sub/min	128	0.6597	1.0477	0.630
g-SpMM	2	artnet-exp	fb	sub/sum	128	0.8401	1.3572	0.619
g-SpMM	2	artnet-exp	fwd	add/max	128	0.3280	0.7132	0.460
g-SpMM	2	artnet-exp	fwd	add/min	128	0.3231	0.7146	0.452
g-SpMM	2	artnet-exp	fwd	add/sum	128	0.3957	0.6769	0.585

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	artnet-exp	fwd	copy_e/max	128	0.2144	0.3648	0.588
g-SpMM	2	artnet-exp	fwd	copy_e/min	128	0.2132	0.2311	0.922
g-SpMM	2	artnet-exp	fwd	copy_e/sum	128	0.2533	0.2578	0.982
g-SpMM	2	artnet-exp	fwd	copy_u/max	128	0.1960	0.3593	0.546
g-SpMM	2	artnet-exp	fwd	copy_u/min	128	0.1951	0.3603	0.541
g-SpMM	2	artnet-exp	fwd	copy_u/sum	128	0.1643	0.3104	0.529
g-SpMM	2	artnet-exp	fwd	div/max	128	0.3262	0.7142	0.457
g-SpMM	2	artnet-exp	fwd	div/min	128	0.3296	0.7350	0.448
g-SpMM	2	artnet-exp	fwd	div/sum	128	0.3879	0.6454	0.601
g-SpMM	2	artnet-exp	fwd	mul/max	128	0.3923	0.7139	0.549
g-SpMM	2	artnet-exp	fwd	mul/min	128	0.3311	0.7340	0.451
g-SpMM	2	artnet-exp	fwd	mul/sum	128	0.3647	0.6397	0.570
g-SpMM	2	artnet-exp	fwd	sub/max	128	0.3213	0.7130	0.451
g-SpMM	2	artnet-exp	fwd	sub/min	128	0.3228	0.7116	0.454
g-SpMM	2	artnet-exp	fwd	sub/sum	128	0.3851	0.6785	0.568
g-SpMM	2	artnet-exp	bwd	add/max	256	0.7015	0.7213	0.973
g-SpMM	2	artnet-exp	bwd	add/min	256	0.7018	0.7050	0.995
g-SpMM	2	artnet-exp	bwd	add/sum	256	0.6362	0.9515	0.669
g-SpMM	2	artnet-exp	bwd	copy_e/max	256	0.4684	0.4711	0.994
g-SpMM	2	artnet-exp	bwd	copy_e/min	256	0.4692	0.4727	0.993
g-SpMM	2	artnet-exp	bwd	copy_e/sum	256	0.2924	0.3239	0.903
g-SpMM	2	artnet-exp	bwd	copy_u/max	256	0.2644	0.3157	0.838
g-SpMM	2	artnet-exp	bwd	copy_u/min	256	0.2647	0.3297	0.803
g-SpMM	2	artnet-exp	bwd	copy_u/sum	256	0.3375	0.6498	0.519
g-SpMM	2	artnet-exp	bwd	div/max	256	0.8784	0.8796	0.999
g-SpMM	2	artnet-exp	bwd	div/min	256	0.8751	0.8771	0.998
g-SpMM	2	artnet-exp	bwd	div/sum	256	1.6723	3.2457	0.515
g-SpMM	2	artnet-exp	bwd	mul/max	256	0.8727	0.8748	0.998
g-SpMM	2	artnet-exp	bwd	mul/min	256	0.8800	0.8766	1.004
g-SpMM	2	artnet-exp	bwd	mul/sum	256	1.2434	2.3007	0.540
g-SpMM	2	artnet-exp	bwd	sub/max	256	0.7010	0.7032	0.997
g-SpMM	2	artnet-exp	bwd	sub/min	256	0.7028	0.7053	0.997
g-SpMM	2	artnet-exp	bwd	sub/sum	256	0.6373	0.9483	0.672
g-SpMM	2	artnet-exp	fb	add/max	256	1.3061	2.0512	0.637
g-SpMM	2	artnet-exp	fb	add/min	256	1.3071	2.0509	0.637
g-SpMM	2	artnet-exp	fb	add/sum	256	1.3606	2.8636	0.475
g-SpMM	2	artnet-exp	fb	copy_e/max	256	0.8528	0.8554	0.997
g-SpMM	2	artnet-exp	fb	copy_e/min	256	0.8552	0.8775	0.975
g-SpMM	2	artnet-exp	fb	copy_e/sum	256	0.7609	0.8501	0.895
g-SpMM	2	artnet-exp	fb	copy_u/max	256	0.6381	1.0051	0.635
g-SpMM	2	artnet-exp	fb	copy_u/min	256	0.6384	0.9941	0.642
g-SpMM	2	artnet-exp	fb	copy_u/sum	256	0.6830	1.3184	0.518
g-SpMM	2	artnet-exp	fb	div/max	256	1.4940	2.2360	0.668
g-SpMM	2	artnet-exp	fb	div/min	256	1.5028	2.2368	0.672
g-SpMM	2	artnet-exp	fb	div/sum	256	2.4097	4.4696	0.539
g-SpMM	2	artnet-exp	fb	mul/max	256	1.4859	2.2459	0.662
g-SpMM	2	artnet-exp	fb	mul/min	256	1.4975	2.2344	0.670
g-SpMM	2	artnet-exp	fb	mul/sum	256	1.9188	3.5163	0.546
g-SpMM	2	artnet-exp	fb	sub/max	256	1.2952	2.0477	0.633
g-SpMM	2	artnet-exp	fb	sub/min	256	1.3043	2.0527	0.635
g-SpMM	2	artnet-exp	fb	sub/sum	256	1.3578	3.7478	0.362
g-SpMM	2	artnet-exp	fwd	add/max	256	0.6153	1.3672	0.450
g-SpMM	2	artnet-exp	fwd	add/min	256	0.6306	1.3720	0.460
g-SpMM	2	artnet-exp	fwd	add/sum	256	0.7361	1.3033	0.565
g-SpMM	2	artnet-exp	fwd	copy_e/max	256	0.3955	0.4029	0.982
g-SpMM	2	artnet-exp	fwd	copy_e/min	256	0.4247	0.4050	1.049
g-SpMM	2	artnet-exp	fwd	copy_e/sum	256	0.4897	0.5105	0.959
g-SpMM	2	artnet-exp	fwd	copy_u/max	256	0.3791	0.7154	0.530
g-SpMM	2	artnet-exp	fwd	copy_u/min	256	0.3741	0.7178	0.521
g-SpMM	2	artnet-exp	fwd	copy_u/sum	256	0.3337	0.6396	0.522
g-SpMM	2	artnet-exp	fwd	div/max	256	0.6253	1.3666	0.458
g-SpMM	2	artnet-exp	fwd	div/min	256	0.6341	1.4063	0.451
g-SpMM	2	artnet-exp	fwd	div/sum	256	0.7436	1.2364	0.601
g-SpMM	2	artnet-exp	fwd	mul/max	256	0.6182	1.3660	0.453
g-SpMM	2	artnet-exp	fwd	mul/min	256	0.8611	1.3614	0.633
g-SpMM	2	artnet-exp	fwd	mul/sum	256	0.6778	1.2257	0.553
g-SpMM	2	artnet-exp	fwd	sub/max	256	0.6140	1.4220	0.432
g-SpMM	2	artnet-exp	fwd	sub/min	256	0.6345	1.3928	0.456
g-SpMM	2	artnet-exp	fwd	sub/sum	256	0.7318	1.3141	0.557
g-SpMM	2	artnet-exp	bwd	add/max	512	1.5567	1.5617	0.997
g-SpMM	2	artnet-exp	bwd	add/min	512	1.5636	1.5654	0.999
g-SpMM	2	artnet-exp	bwd	add/sum	512	1.2048	1.8740	0.643
g-SpMM	2	artnet-exp	bwd	copy_e/max	512	0.9502	0.9490	1.001
g-SpMM	2	artnet-exp	bwd	copy_e/min	512	0.9494	0.9461	1.003
g-SpMM	2	artnet-exp	bwd	copy_e/sum	512	0.6041	0.5875	1.028
g-SpMM	2	artnet-exp	bwd	copy_u/max	512	0.5815	0.5810	1.001
g-SpMM	2	artnet-exp	bwd	copy_u/min	512	0.5817	0.5811	1.001
g-SpMM	2	artnet-exp	bwd	copy_u/sum	512	0.6122	1.2879	0.475

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	artnet-exp	bwd	div/max	512	1.9724	1.9558	1.008
g-SpMM	2	artnet-exp	bwd	div/min	512	1.9644	1.9641	1.000
g-SpMM	2	artnet-exp	bwd	div/sum	512	3.2054	6.2706	0.511
g-SpMM	2	artnet-exp	bwd	mul/max	512	1.9565	1.9532	1.002
g-SpMM	2	artnet-exp	bwd	mul/min	512	1.9542	1.9544	1.000
g-SpMM	2	artnet-exp	bwd	mul/sum	512	2.3023	4.3948	0.524
g-SpMM	2	artnet-exp	bwd	sub/max	512	1.5597	1.5619	0.999
g-SpMM	2	artnet-exp	bwd	sub/min	512	1.5665	1.5699	0.998
g-SpMM	2	artnet-exp	bwd	sub/sum	512	1.1972	1.8829	0.636
g-SpMM	2	artnet-exp	fb	add/max	512	2.7451	4.2428	0.647
g-SpMM	2	artnet-exp	fb	add/min	512	2.7415	4.2220	0.649
g-SpMM	2	artnet-exp	fb	add/sum	512	2.9775	4.4637	0.667
g-SpMM	2	artnet-exp	fb	copy_e/max	512	1.7314	1.7183	1.008
g-SpMM	2	artnet-exp	fb	copy_e/min	512	1.7141	1.7191	0.997
g-SpMM	2	artnet-exp	fb	copy_e/sum	512	1.5090	1.6109	0.937
g-SpMM	2	artnet-exp	fb	copy_u/max	512	1.2421	1.9887	0.625
g-SpMM	2	artnet-exp	fb	copy_u/min	512	1.2369	1.9811	0.624
g-SpMM	2	artnet-exp	fb	copy_u/sum	512	1.2209	2.5742	0.474
g-SpMM	2	artnet-exp	fb	div/max	512	3.1317	4.6252	0.677
g-SpMM	2	artnet-exp	fb	div/min	512	3.1822	4.6232	0.688
g-SpMM	2	artnet-exp	fb	div/sum	512	4.6294	8.6810	0.533
g-SpMM	2	artnet-exp	fb	mul/max	512	3.1133	4.6018	0.677
g-SpMM	2	artnet-exp	fb	mul/min	512	3.1267	4.6045	0.679
g-SpMM	2	artnet-exp	fb	mul/sum	512	3.6147	6.7854	0.533
g-SpMM	2	artnet-exp	fb	sub/max	512	2.7428	4.2210	0.650
g-SpMM	2	artnet-exp	fb	sub/min	512	2.7351	4.2105	0.650
g-SpMM	2	artnet-exp	fb	sub/sum	512	2.6000	4.4526	0.584
g-SpMM	2	artnet-exp	fwd	add/max	512	1.1827	2.6655	0.444
g-SpMM	2	artnet-exp	fwd	add/min	512	1.2087	2.7546	0.439
g-SpMM	2	artnet-exp	fwd	add/sum	512	1.4036	2.5702	0.546
g-SpMM	2	artnet-exp	fwd	copy_e/max	512	0.7763	0.7775	0.998
g-SpMM	2	artnet-exp	fwd	copy_e/min	512	0.7986	0.7991	0.999
g-SpMM	2	artnet-exp	fwd	copy_e/sum	512	0.9142	0.9273	0.986
g-SpMM	2	artnet-exp	fwd	copy_u/max	512	0.7532	1.4009	0.538
g-SpMM	2	artnet-exp	fwd	copy_u/min	512	0.6610	1.4007	0.472
g-SpMM	2	artnet-exp	fwd	copy_u/sum	512	0.6109	1.2809	0.477
g-SpMM	2	artnet-exp	fwd	div/max	512	1.1865	2.6593	0.446
g-SpMM	2	artnet-exp	fwd	div/min	512	1.2283	2.7680	0.444
g-SpMM	2	artnet-exp	fwd	div/sum	512	1.4184	2.3987	0.591
g-SpMM	2	artnet-exp	fwd	mul/max	512	1.1690	2.6663	0.438
g-SpMM	2	artnet-exp	fwd	mul/min	512	1.2192	2.7521	0.443
g-SpMM	2	artnet-exp	fwd	mul/sum	512	1.3106	2.4057	0.545
g-SpMM	2	artnet-exp	fwd	sub/max	512	1.1846	2.6617	0.445
g-SpMM	2	artnet-exp	fwd	sub/min	512	1.2636	2.7532	0.459
g-SpMM	2	artnet-exp	fwd	sub/sum	512	1.4055	2.5554	0.550
g-SpMM	2	avazu-ctr	bwd	copy_u/max	64	0.2630	0.2657	0.990
g-SpMM	2	avazu-ctr	bwd	copy_u/min	64	0.2812	0.2826	0.995
g-SpMM	2	avazu-ctr	bwd	copy_u/sum	64	3.6112	6.5366	0.552
g-SpMM	2	avazu-ctr	fb	copy_u/max	64	2.9174	7.0645	0.413
g-SpMM	2	avazu-ctr	fb	copy_u/min	64	2.9609	6.9975	0.423
g-SpMM	2	avazu-ctr	fb	copy_u/sum	64	7.2759	13.6955	0.531
g-SpMM	2	avazu-ctr	fwd	copy_u/max	64	2.5988	6.8684	0.378
g-SpMM	2	avazu-ctr	fwd	copy_u/min	64	2.5724	6.8665	0.375
g-SpMM	2	avazu-ctr	fwd	copy_u/sum	64	3.5313	6.7923	0.520
g-SpMM	2	avazu-ctr	bwd	copy_u/max	128	0.4053	0.4045	1.002
g-SpMM	2	avazu-ctr	bwd	copy_u/min	128	0.4146	0.4120	1.006
g-SpMM	2	avazu-ctr	bwd	copy_u/sum	128	7.2122	13.5049	0.534
g-SpMM	2	avazu-ctr	fb	copy_u/max	128	5.5951	14.1634	0.395
g-SpMM	2	avazu-ctr	fb	copy_u/min	128	5.5243	14.2021	0.389
g-SpMM	2	avazu-ctr	fb	copy_u/sum	128	14.5191	27.2930	0.532
g-SpMM	2	avazu-ctr	fwd	copy_u/max	128	5.2039	13.9744	0.372
g-SpMM	2	avazu-ctr	fwd	copy_u/min	128	5.2965	14.0121	0.378
g-SpMM	2	avazu-ctr	fwd	copy_u/sum	128	7.2027	13.2361	0.544
g-SpMM	2	avazu-ctr	bwd	copy_u/max	256	0.7147	0.7148	1.000
g-SpMM	2	avazu-ctr	bwd	copy_u/min	256	0.7269	0.7285	0.998
g-SpMM	2	avazu-ctr	bwd	copy_u/sum	256	14.8422	27.0094	0.550
g-SpMM	2	avazu-ctr	fb	copy_u/max	256	11.2733	29.4576	0.383
g-SpMM	2	avazu-ctr	fb	copy_u/min	256	11.2188	28.5367	0.393
g-SpMM	2	avazu-ctr	fb	copy_u/sum	256	30.1132	56.3593	0.534
g-SpMM	2	avazu-ctr	fwd	copy_u/max	256	10.3586	28.2334	0.367
g-SpMM	2	avazu-ctr	fwd	copy_u/min	256	10.2659	27.9928	0.367
g-SpMM	2	avazu-ctr	fwd	copy_u/sum	256	14.9378	27.5909	0.541
g-SpMM	2	avazu-ctr	bwd	copy_u/max	512	1.2005	1.2029	0.998
g-SpMM	2	avazu-ctr	bwd	copy_u/min	512	1.2457	1.2456	1.000
g-SpMM	2	avazu-ctr	bwd	copy_u/sum	512	30.4540	55.2314	0.551
g-SpMM	2	avazu-ctr	fb	copy_u/max	512	22.6107	58.1767	0.389
g-SpMM	2	avazu-ctr	fb	copy_u/min	512	21.9430	57.5186	0.381
g-SpMM	2	avazu-ctr	fb	copy_u/sum	512	60.6918	114.5649	0.530

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	avazu-ctr	fwd	copy_u/max	512	21.4633	57.5748	0.373
g-SpMM	2	avazu-ctr	fwd	copy_u/min	512	21.4109	57.8807	0.370
g-SpMM	2	avazu-ctr	fwd	copy_u/sum	512	29.8641	55.9265	0.534
g-SpMM	2	citeseer	bwd	add/max	64	0.2281	0.2209	1.033
g-SpMM	2	citeseer	bwd	add/min	64	0.2218	0.2266	0.979
g-SpMM	2	citeseer	bwd	add/sum	64	0.3161	0.3140	1.007
g-SpMM	2	citeseer	bwd	copy_e/max	64	0.2036	0.1971	1.033
g-SpMM	2	citeseer	bwd	copy_e/min	64	0.2023	0.1957	1.034
g-SpMM	2	citeseer	bwd	copy_e/sum	64	0.2040	0.2239	0.911
g-SpMM	2	citeseer	bwd	copy_u/max	64	0.2082	0.1985	1.049
g-SpMM	2	citeseer	bwd	copy_u/min	64	0.2053	0.2286	0.898
g-SpMM	2	citeseer	bwd	copy_u/sum	64	0.2270	0.3270	0.694
g-SpMM	2	citeseer	bwd	div/max	64	0.2383	0.2146	1.110
g-SpMM	2	citeseer	bwd	div/min	64	0.2261	0.2244	1.008
g-SpMM	2	citeseer	bwd	div/sum	64	0.2686	0.2818	0.953
g-SpMM	2	citeseer	bwd	mul/max	64	0.2469	0.2187	1.129
g-SpMM	2	citeseer	bwd	mul/min	64	0.2250	0.2209	1.019
g-SpMM	2	citeseer	bwd	mul/sum	64	0.2598	0.2457	1.057
g-SpMM	2	citeseer	bwd	sub/max	64	0.2391	0.2237	1.069
g-SpMM	2	citeseer	bwd	sub/min	64	0.2250	0.2234	1.007
g-SpMM	2	citeseer	bwd	sub/sum	64	0.3182	0.3487	0.912
g-SpMM	2	citeseer	fb	add/max	64	0.4873	0.5497	0.886
g-SpMM	2	citeseer	fb	add/min	64	0.4679	0.5405	0.866
g-SpMM	2	citeseer	fb	add/sum	64	0.6091	0.5311	1.147
g-SpMM	2	citeseer	fb	copy_e/max	64	0.4485	0.4284	1.047
g-SpMM	2	citeseer	fb	copy_e/min	64	0.4399	0.4448	0.989
g-SpMM	2	citeseer	fb	copy_e/sum	64	0.4450	0.4429	1.005
g-SpMM	2	citeseer	fb	copy_u/max	64	0.4446	0.4493	0.990
g-SpMM	2	citeseer	fb	copy_u/min	64	0.4765	1.1482	0.415
g-SpMM	2	citeseer	fb	copy_u/sum	64	0.5366	1.5517	0.346
g-SpMM	2	citeseer	fb	div/max	64	0.4933	0.4635	1.064
g-SpMM	2	citeseer	fb	div/min	64	0.4671	0.4647	1.005
g-SpMM	2	citeseer	fb	div/sum	64	0.5263	0.4910	1.072
g-SpMM	2	citeseer	fb	mul/max	64	0.4976	0.4650	1.070
g-SpMM	2	citeseer	fb	mul/min	64	0.5012	0.4635	1.082
g-SpMM	2	citeseer	fb	mul/sum	64	0.5194	0.4816	1.079
g-SpMM	2	citeseer	fb	sub/max	64	0.5078	0.4606	1.103
g-SpMM	2	citeseer	fb	sub/min	64	0.4855	0.4767	1.018
g-SpMM	2	citeseer	fb	sub/sum	64	0.5313	0.5151	1.031
g-SpMM	2	citeseer	fwd	add/max	64	0.0890	0.1027	0.866
g-SpMM	2	citeseer	fwd	add/min	64	0.0985	0.1314	0.750
g-SpMM	2	citeseer	fwd	add/sum	64	0.0813	0.0810	1.004
g-SpMM	2	citeseer	fwd	copy_e/max	64	0.0887	0.0883	1.004
g-SpMM	2	citeseer	fwd	copy_e/min	64	0.0884	0.0886	0.998
g-SpMM	2	citeseer	fwd	copy_e/sum	64	0.0818	0.0870	0.940
g-SpMM	2	citeseer	fwd	copy_u/max	64	0.0954	0.0874	1.091
g-SpMM	2	citeseer	fwd	copy_u/min	64	0.0975	0.1505	0.648
g-SpMM	2	citeseer	fwd	copy_u/sum	64	0.0920	0.1474	0.624
g-SpMM	2	citeseer	fwd	div/max	64	0.0877	0.0895	0.981
g-SpMM	2	citeseer	fwd	div/min	64	0.0897	0.0897	1.000
g-SpMM	2	citeseer	fwd	div/sum	64	0.0906	0.0822	1.102
g-SpMM	2	citeseer	fwd	mul/max	64	0.0867	0.0900	0.963
g-SpMM	2	citeseer	fwd	mul/min	64	0.0894	0.0891	1.004
g-SpMM	2	citeseer	fwd	mul/sum	64	0.0817	0.0821	0.996
g-SpMM	2	citeseer	fwd	sub/max	64	0.0880	0.0918	0.959
g-SpMM	2	citeseer	fwd	sub/min	64	0.0898	0.1557	0.577
g-SpMM	2	citeseer	fwd	sub/sum	64	0.0822	0.0843	0.975
g-SpMM	2	citeseer	bwd	add/max	128	0.1903	0.2067	0.920
g-SpMM	2	citeseer	bwd	add/min	128	0.1929	0.2142	0.900
g-SpMM	2	citeseer	bwd	add/sum	128	0.2526	0.2779	0.909
g-SpMM	2	citeseer	bwd	copy_e/max	128	0.1686	0.2943	0.573
g-SpMM	2	citeseer	bwd	copy_e/min	128	0.1728	0.2822	0.612
g-SpMM	2	citeseer	bwd	copy_e/sum	128	0.1656	0.2182	0.759
g-SpMM	2	citeseer	bwd	copy_u/max	128	0.1803	0.1837	0.981
g-SpMM	2	citeseer	bwd	copy_u/min	128	0.1675	0.1859	0.901
g-SpMM	2	citeseer	bwd	copy_u/sum	128	0.1952	0.2086	0.936
g-SpMM	2	citeseer	bwd	div/max	128	0.1989	0.2151	0.925
g-SpMM	2	citeseer	bwd	div/min	128	0.1978	0.2207	0.896
g-SpMM	2	citeseer	bwd	div/sum	128	0.2291	0.2577	0.889
g-SpMM	2	citeseer	bwd	mul/max	128	0.1894	0.2172	0.872
g-SpMM	2	citeseer	bwd	mul/min	128	0.1966	0.2173	0.905
g-SpMM	2	citeseer	bwd	mul/sum	128	0.2177	0.2569	0.848
g-SpMM	2	citeseer	bwd	sub/max	128	0.1954	0.2181	0.896
g-SpMM	2	citeseer	bwd	sub/min	128	0.1911	0.2094	0.913
g-SpMM	2	citeseer	bwd	sub/sum	128	0.2460	0.2899	0.849
g-SpMM	2	citeseer	fb	add/max	128	0.4022	0.4238	0.949
g-SpMM	2	citeseer	fb	add/min	128	0.4106	0.4208	0.976
g-SpMM	2	citeseer	fb	add/sum	128	0.4586	0.6119	0.749

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	citeseer	fb	copy_e/max	128	0.3707	0.5180	0.716
g-SpMM	2	citeseer	fb	copy_e/min	128	0.3814	0.4748	0.803
g-SpMM	2	citeseer	fb	copy_e/sum	128	0.3616	0.3956	0.914
g-SpMM	2	citeseer	fb	copy_u/max	128	0.3757	0.4045	0.929
g-SpMM	2	citeseer	fb	copy_u/min	128	0.3714	0.4083	0.910
g-SpMM	2	citeseer	fb	copy_u/sum	128	0.3886	0.4189	0.928
g-SpMM	2	citeseer	fb	div/max	128	0.4110	0.4238	0.970
g-SpMM	2	citeseer	fb	div/min	128	0.4085	0.4506	0.907
g-SpMM	2	citeseer	fb	div/sum	128	0.4303	0.4876	0.883
g-SpMM	2	citeseer	fb	mul/max	128	0.4755	0.4447	1.069
g-SpMM	2	citeseer	fb	mul/min	128	0.4116	0.4434	0.928
g-SpMM	2	citeseer	fb	mul/sum	128	0.4120	0.4801	0.858
g-SpMM	2	citeseer	fb	sub/max	128	0.3915	0.4255	0.920
g-SpMM	2	citeseer	fb	sub/min	128	0.3957	0.4612	0.858
g-SpMM	2	citeseer	fb	sub/sum	128	0.4607	0.5040	0.914
g-SpMM	2	citeseer	fwd	add/max	128	0.0911	0.0855	1.065
g-SpMM	2	citeseer	fwd	add/min	128	0.0935	0.0879	1.064
g-SpMM	2	citeseer	fwd	add/sum	128	0.0802	0.0931	0.861
g-SpMM	2	citeseer	fwd	copy_e/max	128	0.0905	0.0874	1.035
g-SpMM	2	citeseer	fwd	copy_e/min	128	0.0853	0.0867	0.984
g-SpMM	2	citeseer	fwd	copy_e/sum	128	0.0785	0.0774	1.015
g-SpMM	2	citeseer	fwd	copy_u/max	128	0.0848	0.0862	0.984
g-SpMM	2	citeseer	fwd	copy_u/min	128	0.0861	0.0837	1.029
g-SpMM	2	citeseer	fwd	copy_u/sum	128	0.0790	0.0764	1.034
g-SpMM	2	citeseer	fwd	div/max	128	0.0865	0.0880	0.983
g-SpMM	2	citeseer	fwd	div/min	128	0.0869	0.0865	1.004
g-SpMM	2	citeseer	fwd	div/sum	128	0.0807	0.0892	0.905
g-SpMM	2	citeseer	fwd	mul/max	128	0.0874	0.0862	1.014
g-SpMM	2	citeseer	fwd	mul/min	128	0.0870	0.0903	0.964
g-SpMM	2	citeseer	fwd	mul/sum	128	0.0863	0.0806	1.070
g-SpMM	2	citeseer	fwd	sub/max	128	0.0876	0.0863	1.015
g-SpMM	2	citeseer	fwd	sub/min	128	0.0921	0.0869	1.059
g-SpMM	2	citeseer	fwd	sub/sum	128	0.0861	0.0798	1.079
g-SpMM	2	citeseer	bwd	add/max	256	0.1983	0.2170	0.914
g-SpMM	2	citeseer	bwd	add/min	256	0.1880	0.2250	0.836
g-SpMM	2	citeseer	bwd	add/sum	256	0.2392	0.2862	0.836
g-SpMM	2	citeseer	bwd	copy_e/max	256	0.1779	0.2052	0.867
g-SpMM	2	citeseer	bwd	copy_e/min	256	0.1788	0.2016	0.887
g-SpMM	2	citeseer	bwd	copy_e/sum	256	0.1729	0.1917	0.902
g-SpMM	2	citeseer	bwd	copy_u/max	256	0.1730	0.2239	0.773
g-SpMM	2	citeseer	bwd	copy_u/min	256	0.1703	0.1907	0.893
g-SpMM	2	citeseer	bwd	copy_u/sum	256	0.1995	0.2188	0.912
g-SpMM	2	citeseer	bwd	div/max	256	0.1872	0.2118	0.884
g-SpMM	2	citeseer	bwd	div/min	256	0.1947	0.2200	0.885
g-SpMM	2	citeseer	bwd	div/sum	256	0.2157	0.2652	0.813
g-SpMM	2	citeseer	bwd	mul/max	256	0.1898	0.2190	0.867
g-SpMM	2	citeseer	bwd	mul/min	256	0.1865	0.2207	0.845
g-SpMM	2	citeseer	bwd	mul/sum	256	0.2325	0.3459	0.672
g-SpMM	2	citeseer	bwd	sub/max	256	0.1890	0.2155	0.877
g-SpMM	2	citeseer	bwd	sub/min	256	0.1964	0.2140	0.918
g-SpMM	2	citeseer	bwd	sub/sum	256	0.2526	0.3238	0.780
g-SpMM	2	citeseer	fb	add/max	256	0.4002	0.4468	0.896
g-SpMM	2	citeseer	fb	add/min	256	0.3893	0.4590	0.848
g-SpMM	2	citeseer	fb	add/sum	256	0.4606	0.5243	0.879
g-SpMM	2	citeseer	fb	copy_e/max	256	0.3804	0.4653	0.817
g-SpMM	2	citeseer	fb	copy_e/min	256	0.3907	0.4278	0.913
g-SpMM	2	citeseer	fb	copy_e/sum	256	0.3598	0.3940	0.913
g-SpMM	2	citeseer	fb	copy_u/max	256	0.3783	0.4343	0.871
g-SpMM	2	citeseer	fb	copy_u/min	256	0.3795	0.4285	0.886
g-SpMM	2	citeseer	fb	copy_u/sum	256	0.4042	0.4855	0.832
g-SpMM	2	citeseer	fb	div/max	256	0.3851	0.4515	0.853
g-SpMM	2	citeseer	fb	div/min	256	0.4006	0.4550	0.880
g-SpMM	2	citeseer	fb	div/sum	256	0.4023	0.4994	0.806
g-SpMM	2	citeseer	fb	mul/max	256	0.3864	0.4542	0.851
g-SpMM	2	citeseer	fb	mul/min	256	0.3829	0.4675	0.819
g-SpMM	2	citeseer	fb	mul/sum	256	0.4074	0.5384	0.757
g-SpMM	2	citeseer	fb	sub/max	256	0.4149	0.4603	0.902
g-SpMM	2	citeseer	fb	sub/min	256	0.3988	0.5131	0.777
g-SpMM	2	citeseer	fb	sub/sum	256	0.4536	0.5140	0.882
g-SpMM	2	citeseer	fwd	add/max	256	0.0856	0.0914	0.936
g-SpMM	2	citeseer	fwd	add/min	256	0.0880	0.0908	0.969
g-SpMM	2	citeseer	fwd	add/sum	256	0.0805	0.0826	0.975
g-SpMM	2	citeseer	fwd	copy_e/max	256	0.0866	0.0874	0.991
g-SpMM	2	citeseer	fwd	copy_e/min	256	0.0829	0.0856	0.969
g-SpMM	2	citeseer	fwd	copy_e/sum	256	0.0762	0.0798	0.954
g-SpMM	2	citeseer	fwd	copy_u/max	256	0.0834	0.0857	0.973
g-SpMM	2	citeseer	fwd	copy_u/min	256	0.0848	0.0859	0.988
g-SpMM	2	citeseer	fwd	copy_u/sum	256	0.0765	0.0815	0.938

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	citeseer	fwd	div/max	256	0.0849	0.0923	0.920
g-SpMM	2	citeseer	fwd	div/min	256	0.0841	0.0911	0.923
g-SpMM	2	citeseer	fwd	div/sum	256	0.0787	0.0831	0.948
g-SpMM	2	citeseer	fwd	mul/max	256	0.0837	0.0929	0.902
g-SpMM	2	citeseer	fwd	mul/min	256	0.0842	0.0912	0.924
g-SpMM	2	citeseer	fwd	mul/sum	256	0.0776	0.0838	0.925
g-SpMM	2	citeseer	fwd	sub/max	256	0.0902	0.0901	1.002
g-SpMM	2	citeseer	fwd	sub/min	256	0.0848	0.0931	0.911
g-SpMM	2	citeseer	fwd	sub/sum	256	0.0829	0.0828	1.002
g-SpMM	2	citeseer	bwd	add/max	512	0.2390	0.2171	1.101
g-SpMM	2	citeseer	bwd	add/min	512	0.2363	0.2202	1.073
g-SpMM	2	citeseer	bwd	add/sum	512	0.2995	0.2921	1.025
g-SpMM	2	citeseer	bwd	copy_e/max	512	0.1992	0.2067	0.964
g-SpMM	2	citeseer	bwd	copy_e/min	512	0.2047	0.2016	1.016
g-SpMM	2	citeseer	bwd	copy_e/sum	512	0.2004	0.1854	1.080
g-SpMM	2	citeseer	bwd	copy_u/max	512	0.1950	0.1907	1.022
g-SpMM	2	citeseer	bwd	copy_u/min	512	0.1968	0.1936	1.016
g-SpMM	2	citeseer	bwd	copy_u/sum	512	0.2242	0.2236	1.002
g-SpMM	2	citeseer	bwd	div/max	512	0.2855	0.2363	1.208
g-SpMM	2	citeseer	bwd	div/min	512	0.3075	0.2422	1.269
g-SpMM	2	citeseer	bwd	div/sum	512	0.2722	0.4642	0.586
g-SpMM	2	citeseer	bwd	mul/max	512	0.2764	0.2307	1.198
g-SpMM	2	citeseer	bwd	mul/min	512	0.2735	0.2244	1.219
g-SpMM	2	citeseer	bwd	mul/sum	512	0.2482	0.3206	0.774
g-SpMM	2	citeseer	bwd	sub/max	512	0.2258	0.2205	1.024
g-SpMM	2	citeseer	bwd	sub/min	512	0.2241	0.2241	1.000
g-SpMM	2	citeseer	bwd	sub/sum	512	0.2863	0.2902	0.987
g-SpMM	2	citeseer	fb	add/max	512	0.4757	0.4468	1.065
g-SpMM	2	citeseer	fb	add/min	512	0.4689	0.4564	1.027
g-SpMM	2	citeseer	fb	add/sum	512	0.5014	0.5091	0.985
g-SpMM	2	citeseer	fb	copy_e/max	512	0.4395	0.4226	1.040
g-SpMM	2	citeseer	fb	copy_e/min	512	0.4336	0.4308	1.006
g-SpMM	2	citeseer	fb	copy_e/sum	512	0.4139	0.3883	1.066
g-SpMM	2	citeseer	fb	copy_u/max	512	0.4393	0.4227	1.039
g-SpMM	2	citeseer	fb	copy_u/min	512	0.4438	0.4290	1.035
g-SpMM	2	citeseer	fb	copy_u/sum	512	0.4423	0.4322	1.023
g-SpMM	2	citeseer	fb	div/max	512	0.4973	0.4860	1.023
g-SpMM	2	citeseer	fb	div/min	512	0.5929	0.4832	1.227
g-SpMM	2	citeseer	fb	div/sum	512	0.5116	0.6454	0.793
g-SpMM	2	citeseer	fb	mul/max	512	0.4993	0.4469	1.117
g-SpMM	2	citeseer	fb	mul/min	512	0.4892	0.4462	1.096
g-SpMM	2	citeseer	fb	mul/sum	512	0.4751	0.5128	0.927
g-SpMM	2	citeseer	fb	sub/max	512	0.4651	0.4469	1.041
g-SpMM	2	citeseer	fb	sub/min	512	0.4634	0.4600	1.007
g-SpMM	2	citeseer	fb	sub/sum	512	0.5172	0.5757	0.898
g-SpMM	2	citeseer	fwd	add/max	512	0.1215	0.2244	0.542
g-SpMM	2	citeseer	fwd	add/min	512	0.1215	0.2220	0.547
g-SpMM	2	citeseer	fwd	add/sum	512	0.0920	0.1963	0.468
g-SpMM	2	citeseer	fwd	copy_e/max	512	0.0870	0.0903	0.964
g-SpMM	2	citeseer	fwd	copy_e/min	512	0.0915	0.0881	1.039
g-SpMM	2	citeseer	fwd	copy_e/sum	512	0.0817	0.0820	0.997
g-SpMM	2	citeseer	fwd	copy_u/max	512	0.0914	0.0922	0.991
g-SpMM	2	citeseer	fwd	copy_u/min	512	0.0861	0.0929	0.927
g-SpMM	2	citeseer	fwd	copy_u/sum	512	0.0795	0.0883	0.900
g-SpMM	2	citeseer	fwd	div/max	512	0.1230	0.2254	0.546
g-SpMM	2	citeseer	fwd	div/min	512	0.1220	0.2260	0.540
g-SpMM	2	citeseer	fwd	div/sum	512	0.0886	0.1760	0.504
g-SpMM	2	citeseer	fwd	mul/max	512	0.1208	0.2265	0.533
g-SpMM	2	citeseer	fwd	mul/min	512	0.1224	0.2213	0.553
g-SpMM	2	citeseer	fwd	mul/sum	512	0.0854	0.1878	0.455
g-SpMM	2	citeseer	fwd	sub/max	512	0.1220	0.2221	0.549
g-SpMM	2	citeseer	fwd	sub/min	512	0.1199	0.2256	0.532
g-SpMM	2	citeseer	fwd	sub/sum	512	0.0914	0.1967	0.465
g-SpMM	2	city-reviews	bwd	add/max	64	0.6338	0.6336	1.000
g-SpMM	2	city-reviews	bwd	add/min	64	0.6352	0.6357	0.999
g-SpMM	2	city-reviews	bwd	add/sum	64	0.8802	2.5154	0.350
g-SpMM	2	city-reviews	bwd	copy_e/max	64	0.4018	0.4016	1.001
g-SpMM	2	city-reviews	bwd	copy_e/min	64	0.4002	0.6962	0.575
g-SpMM	2	city-reviews	bwd	copy_e/sum	64	0.4334	1.5526	0.279
g-SpMM	2	city-reviews	bwd	copy_u/max	64	0.2142	0.2142	1.000
g-SpMM	2	city-reviews	bwd	copy_u/min	64	0.2161	0.2159	1.001
g-SpMM	2	city-reviews	bwd	copy_u/sum	64	0.5205	1.0212	0.510
g-SpMM	2	city-reviews	bwd	div/max	64	0.7908	0.7930	0.997
g-SpMM	2	city-reviews	bwd	div/min	64	0.7933	0.7919	1.002
g-SpMM	2	city-reviews	bwd	div/sum	64	2.2805	4.7918	0.476
g-SpMM	2	city-reviews	bwd	mul/max	64	0.7880	0.7946	0.992
g-SpMM	2	city-reviews	bwd	mul/min	64	0.7989	0.7899	1.011
g-SpMM	2	city-reviews	bwd	mul/sum	64	1.8219	3.5990	0.506

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-reviews	bwd	sub/max	64	0.6309	0.6310	1.000
g-SpMM	2	city-reviews	bwd	sub/min	64	0.6325	0.6340	0.998
g-SpMM	2	city-reviews	bwd	sub/sum	64	0.8932	1.3637	0.655
g-SpMM	2	city-reviews	fb	add/max	64	1.7362	2.8720	0.605
g-SpMM	2	city-reviews	fb	add/min	64	1.7458	2.8876	0.605
g-SpMM	2	city-reviews	fb	add/sum	64	2.2693	3.5616	0.637
g-SpMM	2	city-reviews	fb	copy_e/max	64	0.8627	0.8843	0.976
g-SpMM	2	city-reviews	fb	copy_e/min	64	0.8643	2.4791	0.349
g-SpMM	2	city-reviews	fb	copy_e/sum	64	1.4027	1.4204	0.988
g-SpMM	2	city-reviews	fb	copy_u/max	64	0.7016	1.3481	0.520
g-SpMM	2	city-reviews	fb	copy_u/min	64	0.7062	1.3550	0.521
g-SpMM	2	city-reviews	fb	copy_u/sum	64	1.0873	2.0749	0.524
g-SpMM	2	city-reviews	fb	div/max	64	1.9272	2.9902	0.645
g-SpMM	2	city-reviews	fb	div/min	64	1.9243	2.9969	0.642
g-SpMM	2	city-reviews	fb	div/sum	64	3.6276	6.8883	0.527
g-SpMM	2	city-reviews	fb	mul/max	64	1.8912	3.0075	0.629
g-SpMM	2	city-reviews	fb	mul/min	64	1.9022	3.0748	0.619
g-SpMM	2	city-reviews	fb	mul/sum	64	3.0020	5.7454	0.523
g-SpMM	2	city-reviews	fb	sub/max	64	1.7288	2.8966	0.597
g-SpMM	2	city-reviews	fb	sub/min	64	1.7300	2.8294	0.611
g-SpMM	2	city-reviews	fb	sub/sum	64	2.2200	3.6480	0.609
g-SpMM	2	city-reviews	fwd	add/max	64	1.1196	2.2574	0.496
g-SpMM	2	city-reviews	fwd	add/min	64	1.1359	2.2918	0.496
g-SpMM	2	city-reviews	fwd	add/sum	64	1.3162	2.2289	0.591
g-SpMM	2	city-reviews	fwd	copy_e/max	64	0.4872	0.4911	0.992
g-SpMM	2	city-reviews	fwd	copy_e/min	64	0.5359	0.4839	1.107
g-SpMM	2	city-reviews	fwd	copy_e/sum	64	1.0820	1.0795	1.002
g-SpMM	2	city-reviews	fwd	copy_u/max	64	0.4686	1.0846	0.432
g-SpMM	2	city-reviews	fwd	copy_u/min	64	0.4633	1.0952	0.423
g-SpMM	2	city-reviews	fwd	copy_u/sum	64	0.5340	0.9824	0.544
g-SpMM	2	city-reviews	fwd	div/max	64	1.1209	2.2592	0.496
g-SpMM	2	city-reviews	fwd	div/min	64	1.1687	2.3594	0.495
g-SpMM	2	city-reviews	fwd	div/sum	64	1.3190	1.9559	0.674
g-SpMM	2	city-reviews	fwd	mul/max	64	1.1109	2.2172	0.501
g-SpMM	2	city-reviews	fwd	mul/min	64	1.1231	2.3169	0.485
g-SpMM	2	city-reviews	fwd	mul/sum	64	1.1233	2.2310	0.503
g-SpMM	2	city-reviews	fwd	sub/max	64	1.1091	2.2356	0.496
g-SpMM	2	city-reviews	fwd	sub/min	64	1.1494	2.2556	0.510
g-SpMM	2	city-reviews	fwd	sub/sum	64	1.3382	2.2059	0.607
g-SpMM	2	city-reviews	bwd	add/max	128	1.3897	1.3950	0.996
g-SpMM	2	city-reviews	bwd	add/min	128	1.3912	1.3997	0.994
g-SpMM	2	city-reviews	bwd	add/sum	128	1.7032	2.7038	0.630
g-SpMM	2	city-reviews	bwd	copy_e/max	128	0.7714	0.7770	0.993
g-SpMM	2	city-reviews	bwd	copy_e/min	128	0.7733	0.7720	1.002
g-SpMM	2	city-reviews	bwd	copy_e/sum	128	0.5689	0.5726	0.994
g-SpMM	2	city-reviews	bwd	copy_u/max	128	0.5104	0.5107	0.999
g-SpMM	2	city-reviews	bwd	copy_u/min	128	0.5130	0.5120	1.002
g-SpMM	2	city-reviews	bwd	copy_u/sum	128	1.1231	2.1137	0.531
g-SpMM	2	city-reviews	bwd	div/max	128	1.6842	1.6782	1.004
g-SpMM	2	city-reviews	bwd	div/min	128	1.6763	1.6802	0.998
g-SpMM	2	city-reviews	bwd	div/sum	128	4.2206	8.8548	0.477
g-SpMM	2	city-reviews	bwd	mul/max	128	1.6662	1.6681	0.999
g-SpMM	2	city-reviews	bwd	mul/min	128	1.6762	1.6698	1.004
g-SpMM	2	city-reviews	bwd	mul/sum	128	3.4167	6.7001	0.510
g-SpMM	2	city-reviews	bwd	sub/max	128	1.3984	1.3902	1.006
g-SpMM	2	city-reviews	bwd	sub/min	128	1.3930	1.3935	1.000
g-SpMM	2	city-reviews	bwd	sub/sum	128	1.7054	2.6906	0.634
g-SpMM	2	city-reviews	fb	add/max	128	3.6067	5.7808	0.624
g-SpMM	2	city-reviews	fb	add/min	128	3.5930	5.9303	0.606
g-SpMM	2	city-reviews	fb	add/sum	128	4.3664	7.1557	0.610
g-SpMM	2	city-reviews	fb	copy_e/max	128	1.6974	1.7104	0.992
g-SpMM	2	city-reviews	fb	copy_e/min	128	1.7183	1.7139	1.003
g-SpMM	2	city-reviews	fb	copy_e/sum	128	2.6400	2.6545	0.995
g-SpMM	2	city-reviews	fb	copy_u/max	128	1.4592	2.7800	0.525
g-SpMM	2	city-reviews	fb	copy_u/min	128	1.4582	2.7789	0.525
g-SpMM	2	city-reviews	fb	copy_u/sum	128	2.2559	4.2262	0.534
g-SpMM	2	city-reviews	fb	div/max	128	3.8912	6.1181	0.636
g-SpMM	2	city-reviews	fb	div/min	128	3.8735	6.0458	0.641
g-SpMM	2	city-reviews	fb	div/sum	128	6.9209	12.8734	0.538
g-SpMM	2	city-reviews	fb	mul/max	128	3.8765	6.0183	0.644
g-SpMM	2	city-reviews	fb	mul/min	128	3.8691	6.0904	0.635
g-SpMM	2	city-reviews	fb	mul/sum	128	5.6864	11.1938	0.508
g-SpMM	2	city-reviews	fb	sub/max	128	3.5739	5.7768	0.619
g-SpMM	2	city-reviews	fb	sub/min	128	3.5874	5.7615	0.623
g-SpMM	2	city-reviews	fb	sub/sum	128	4.3783	7.0967	0.617
g-SpMM	2	city-reviews	fwd	add/max	128	2.2050	4.4087	0.500
g-SpMM	2	city-reviews	fwd	add/min	128	2.2715	4.4175	0.514
g-SpMM	2	city-reviews	fwd	add/sum	128	2.5510	4.2553	0.599

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-reviews	fwd	copy_e/max	128	0.9561	0.9652	0.991
g-SpMM	2	city-reviews	fwd	copy_e/min	128	0.9987	0.9831	1.016
g-SpMM	2	city-reviews	fwd	copy_e/sum	128	2.1098	2.1205	0.995
g-SpMM	2	city-reviews	fwd	copy_u/max	128	0.9209	2.2846	0.403
g-SpMM	2	city-reviews	fwd	copy_u/min	128	0.9327	2.2464	0.415
g-SpMM	2	city-reviews	fwd	copy_u/sum	128	1.1121	2.0819	0.534
g-SpMM	2	city-reviews	fwd	div/max	128	2.2186	4.3722	0.507
g-SpMM	2	city-reviews	fwd	div/min	128	2.3144	4.5632	0.507
g-SpMM	2	city-reviews	fwd	div/sum	128	2.6435	3.9296	0.673
g-SpMM	2	city-reviews	fwd	mul/max	128	2.2006	4.3329	0.508
g-SpMM	2	city-reviews	fwd	mul/min	128	2.2511	4.4747	0.503
g-SpMM	2	city-reviews	fwd	mul/sum	128	2.2527	4.3924	0.513
g-SpMM	2	city-reviews	fwd	sub/max	128	2.2003	4.4637	0.493
g-SpMM	2	city-reviews	fwd	sub/min	128	2.2931	4.3993	0.521
g-SpMM	2	city-reviews	fwd	sub/sum	128	2.5859	4.3250	0.598
g-SpMM	2	city-reviews	bwd	add/max	256	3.0436	3.0535	0.997
g-SpMM	2	city-reviews	bwd	add/min	256	3.0474	3.0024	1.015
g-SpMM	2	city-reviews	bwd	add/sum	256	3.4864	5.5332	0.630
g-SpMM	2	city-reviews	bwd	copy_e/max	256	1.5089	1.5086	1.000
g-SpMM	2	city-reviews	bwd	copy_e/min	256	1.5136	1.5122	1.001
g-SpMM	2	city-reviews	bwd	copy_e/sum	256	1.0621	1.0653	0.997
g-SpMM	2	city-reviews	bwd	copy_u/max	256	1.1946	1.1948	1.000
g-SpMM	2	city-reviews	bwd	copy_u/min	256	1.1576	1.1928	0.970
g-SpMM	2	city-reviews	bwd	copy_u/sum	256	2.4380	4.5788	0.532
g-SpMM	2	city-reviews	bwd	div/max	256	3.5436	3.5497	0.998
g-SpMM	2	city-reviews	bwd	div/min	256	3.4990	3.5471	0.986
g-SpMM	2	city-reviews	bwd	div/sum	256	8.2809	17.3817	0.476
g-SpMM	2	city-reviews	bwd	mul/max	256	3.5354	3.5342	1.000
g-SpMM	2	city-reviews	bwd	mul/min	256	3.5364	3.4837	1.015
g-SpMM	2	city-reviews	bwd	mul/sum	256	6.6588	13.6091	0.489
g-SpMM	2	city-reviews	bwd	sub/max	256	3.0476	3.0451	1.001
g-SpMM	2	city-reviews	bwd	sub/min	256	2.9968	3.0469	0.984
g-SpMM	2	city-reviews	bwd	sub/sum	256	3.4982	5.5324	0.632
g-SpMM	2	city-reviews	fb	add/max	256	7.4640	11.8550	0.630
g-SpMM	2	city-reviews	fb	add/min	256	7.4707	11.7457	0.636
g-SpMM	2	city-reviews	fb	add/sum	256	8.6967	14.3952	0.604
g-SpMM	2	city-reviews	fb	copy_e/max	256	3.3509	3.3754	0.993
g-SpMM	2	city-reviews	fb	copy_e/min	256	3.4096	3.6356	0.938
g-SpMM	2	city-reviews	fb	copy_e/sum	256	5.2504	5.1304	1.023
g-SpMM	2	city-reviews	fb	copy_u/max	256	3.1004	5.9031	0.525
g-SpMM	2	city-reviews	fb	copy_u/min	256	3.0771	5.9038	0.521
g-SpMM	2	city-reviews	fb	copy_u/sum	256	4.9132	9.1148	0.539
g-SpMM	2	city-reviews	fb	div/max	256	7.9632	12.1511	0.655
g-SpMM	2	city-reviews	fb	div/min	256	7.9821	12.1480	0.657
g-SpMM	2	city-reviews	fb	div/sum	256	13.6333	25.1022	0.543
g-SpMM	2	city-reviews	fb	mul/max	256	7.9078	12.1801	0.649
g-SpMM	2	city-reviews	fb	mul/min	256	7.9140	12.1608	0.651
g-SpMM	2	city-reviews	fb	mul/sum	256	11.1614	22.2295	0.502
g-SpMM	2	city-reviews	fb	sub/max	256	7.4608	11.5486	0.646
g-SpMM	2	city-reviews	fb	sub/min	256	7.4112	11.5772	0.640
g-SpMM	2	city-reviews	fb	sub/sum	256	8.7767	14.3077	0.613
g-SpMM	2	city-reviews	fwd	add/max	256	4.4090	8.6643	0.509
g-SpMM	2	city-reviews	fwd	add/min	256	4.5730	8.8491	0.517
g-SpMM	2	city-reviews	fwd	add/sum	256	5.2288	8.4834	0.616
g-SpMM	2	city-reviews	fwd	copy_e/max	256	1.8830	1.9122	0.985
g-SpMM	2	city-reviews	fwd	copy_e/min	256	1.8965	1.9698	0.963
g-SpMM	2	city-reviews	fwd	copy_e/sum	256	4.1811	4.1357	1.011
g-SpMM	2	city-reviews	fwd	copy_u/max	256	1.9304	4.7735	0.404
g-SpMM	2	city-reviews	fwd	copy_u/min	256	1.9121	4.7563	0.402
g-SpMM	2	city-reviews	fwd	copy_u/sum	256	2.4219	4.4463	0.545
g-SpMM	2	city-reviews	fwd	div/max	256	4.4818	8.6996	0.515
g-SpMM	2	city-reviews	fwd	div/min	256	4.6450	8.8832	0.523
g-SpMM	2	city-reviews	fwd	div/sum	256	5.1788	7.7662	0.667
g-SpMM	2	city-reviews	fwd	mul/max	256	4.3840	8.6877	0.505
g-SpMM	2	city-reviews	fwd	mul/min	256	4.5265	9.1511	0.495
g-SpMM	2	city-reviews	fwd	mul/sum	256	4.3449	8.6642	0.501
g-SpMM	2	city-reviews	fwd	sub/max	256	4.4158	8.7929	0.502
g-SpMM	2	city-reviews	fwd	sub/min	256	4.5561	9.0182	0.505
g-SpMM	2	city-reviews	fwd	sub/sum	256	5.2021	8.5882	0.606
g-SpMM	2	city-reviews	bwd	add/max	512	6.7927	6.7809	1.002
g-SpMM	2	city-reviews	bwd	add/min	512	6.7881	6.7835	1.001
g-SpMM	2	city-reviews	bwd	add/sum	512	7.5080	11.7965	0.636
g-SpMM	2	city-reviews	bwd	copy_e/max	512	3.1265	3.0933	1.011
g-SpMM	2	city-reviews	bwd	copy_e/min	512	3.1144	3.1144	1.000
g-SpMM	2	city-reviews	bwd	copy_e/sum	512	2.3528	2.3691	0.993
g-SpMM	2	city-reviews	bwd	copy_u/max	512	2.9253	2.9218	1.001
g-SpMM	2	city-reviews	bwd	copy_u/min	512	2.9301	2.9175	1.004
g-SpMM	2	city-reviews	bwd	copy_u/sum	512	5.1277	9.4520	0.543

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-reviews	bwd	div/max	512	7.8901	7.8981	0.999
g-SpMM	2	city-reviews	bwd	div/min	512	7.9002	7.8962	1.001
g-SpMM	2	city-reviews	bwd	div/sum	512	35.0477	33.9491	1.032
g-SpMM	2	city-reviews	bwd	mul/max	512	7.8875	7.8675	1.003
g-SpMM	2	city-reviews	bwd	mul/min	512	7.8837	7.8576	1.003
g-SpMM	2	city-reviews	bwd	mul/sum	512	39.6287	26.6709	1.486
g-SpMM	2	city-reviews	bwd	sub/max	512	6.8098	6.7209	1.013
g-SpMM	2	city-reviews	bwd	sub/min	512	6.8136	6.7964	1.003
g-SpMM	2	city-reviews	bwd	sub/sum	512	29.0129	11.9488	2.428
g-SpMM	2	city-reviews	fb	add/max	512	15.8097	24.2417	0.652
g-SpMM	2	city-reviews	fb	add/min	512	15.9319	24.2215	0.658
g-SpMM	2	city-reviews	fb	add/sum	512	18.0748	29.6640	0.609
g-SpMM	2	city-reviews	fb	copy_e/max	512	7.0893	7.0168	1.010
g-SpMM	2	city-reviews	fb	copy_e/min	512	7.0789	7.2051	0.982
g-SpMM	2	city-reviews	fb	copy_e/sum	512	10.5094	10.5493	0.996
g-SpMM	2	city-reviews	fb	copy_u/max	512	6.7766	12.7788	0.530
g-SpMM	2	city-reviews	fb	copy_u/min	512	6.6884	12.9743	0.516
g-SpMM	2	city-reviews	fb	copy_u/sum	512	10.2676	19.1028	0.537
g-SpMM	2	city-reviews	fb	div/max	512	16.9879	25.6579	0.662
g-SpMM	2	city-reviews	fb	div/min	512	16.9804	25.4168	0.668
g-SpMM	2	city-reviews	fb	div/sum	512	26.9111	51.1601	0.526
g-SpMM	2	city-reviews	fb	mul/max	512	16.8319	25.4996	0.660
g-SpMM	2	city-reviews	fb	mul/min	512	16.9212	25.1639	0.672
g-SpMM	2	city-reviews	fb	mul/sum	512	22.1662	46.3489	0.478
g-SpMM	2	city-reviews	fb	sub/max	512	15.7610	24.4882	0.644
g-SpMM	2	city-reviews	fb	sub/min	512	15.7485	24.3678	0.646
g-SpMM	2	city-reviews	fb	sub/sum	512	18.0978	29.7644	0.608
g-SpMM	2	city-reviews	fwd	add/max	512	8.9977	17.7688	0.506
g-SpMM	2	city-reviews	fwd	add/min	512	9.3003	17.8039	0.522
g-SpMM	2	city-reviews	fwd	add/sum	512	10.4733	17.3969	0.602
g-SpMM	2	city-reviews	fwd	copy_e/max	512	3.9732	3.9807	0.998
g-SpMM	2	city-reviews	fwd	copy_e/min	512	4.0946	4.0667	1.007
g-SpMM	2	city-reviews	fwd	copy_e/sum	512	8.2123	8.2662	0.993
g-SpMM	2	city-reviews	fwd	copy_u/max	512	3.8819	9.9413	0.390
g-SpMM	2	city-reviews	fwd	copy_u/min	512	3.8874	9.9697	0.390
g-SpMM	2	city-reviews	fwd	copy_u/sum	512	5.0675	9.4191	0.538
g-SpMM	2	city-reviews	fwd	div/max	512	9.1828	17.8745	0.514
g-SpMM	2	city-reviews	fwd	div/min	512	9.1031	17.6692	0.515
g-SpMM	2	city-reviews	fwd	div/sum	512	10.5206	15.7215	0.669
g-SpMM	2	city-reviews	fwd	mul/max	512	8.8606	17.6483	0.502
g-SpMM	2	city-reviews	fwd	mul/min	512	9.0958	17.7731	0.512
g-SpMM	2	city-reviews	fwd	mul/sum	512	8.8674	17.4040	0.510
g-SpMM	2	city-reviews	fwd	sub/max	512	9.0384	17.6885	0.511
g-SpMM	2	city-reviews	fwd	sub/min	512	9.0353	17.8101	0.507
g-SpMM	2	city-reviews	fwd	sub/sum	512	10.4049	17.4759	0.595
g-SpMM	2	city-roads-L	bwd	add/max	64	0.5158	0.5316	0.970
g-SpMM	2	city-roads-L	bwd	add/min	64	0.5189	0.5306	0.978
g-SpMM	2	city-roads-L	bwd	add/sum	64	0.4036	0.5256	0.768
g-SpMM	2	city-roads-L	bwd	copy_e/max	64	0.3571	0.4727	0.755
g-SpMM	2	city-roads-L	bwd	copy_e/min	64	0.3573	0.4723	0.756
g-SpMM	2	city-roads-L	bwd	copy_e/sum	64	0.2191	0.9662	0.227
g-SpMM	2	city-roads-L	bwd	copy_u/max	64	0.1952	0.3336	0.585
g-SpMM	2	city-roads-L	bwd	copy_u/min	64	0.2020	0.3135	0.644
g-SpMM	2	city-roads-L	bwd	copy_u/sum	64	0.2316	0.4050	0.572
g-SpMM	2	city-roads-L	bwd	div/max	64	0.6222	0.6109	1.018
g-SpMM	2	city-roads-L	bwd	div/min	64	0.6211	0.6110	1.017
g-SpMM	2	city-roads-L	bwd	div/sum	64	1.1240	1.1619	0.967
g-SpMM	2	city-roads-L	bwd	mul/max	64	0.6184	0.6072	1.018
g-SpMM	2	city-roads-L	bwd	mul/min	64	0.6208	0.6077	1.022
g-SpMM	2	city-roads-L	bwd	mul/sum	64	0.6476	0.9478	0.683
g-SpMM	2	city-roads-L	bwd	sub/max	64	0.5170	0.5313	0.973
g-SpMM	2	city-roads-L	bwd	sub/min	64	0.5173	0.5329	0.971
g-SpMM	2	city-roads-L	bwd	sub/sum	64	0.4038	0.5262	0.767
g-SpMM	2	city-roads-L	fb	add/max	64	0.8099	1.2593	0.643
g-SpMM	2	city-roads-L	fb	add/min	64	0.8100	1.0763	0.753
g-SpMM	2	city-roads-L	fb	add/sum	64	0.7407	1.0174	0.728
g-SpMM	2	city-roads-L	fb	copy_e/max	64	0.5945	0.7123	0.835
g-SpMM	2	city-roads-L	fb	copy_e/min	64	0.5949	0.8883	0.670
g-SpMM	2	city-roads-L	fb	copy_e/sum	64	0.4225	1.7991	0.235
g-SpMM	2	city-roads-L	fb	copy_u/max	64	0.4423	2.0334	0.217
g-SpMM	2	city-roads-L	fb	copy_u/min	64	0.4426	0.6105	0.725
g-SpMM	2	city-roads-L	fb	copy_u/sum	64	0.4623	0.7062	0.655
g-SpMM	2	city-roads-L	fb	div/max	64	0.9178	1.1537	0.795
g-SpMM	2	city-roads-L	fb	div/min	64	0.9180	1.1530	0.796
g-SpMM	2	city-roads-L	fb	div/sum	64	1.1275	1.6522	0.682
g-SpMM	2	city-roads-L	fb	mul/max	64	0.9120	1.1501	0.793
g-SpMM	2	city-roads-L	fb	mul/min	64	0.9139	1.1518	0.793
g-SpMM	2	city-roads-L	fb	mul/sum	64	0.9642	1.3972	0.690

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-L	fb	sub/max	64	0.8129	1.0724	0.758
g-SpMM	2	city-roads-L	fb	sub/min	64	1.2709	1.1259	1.129
g-SpMM	2	city-roads-L	fb	sub/sum	64	0.7182	1.0158	0.707
g-SpMM	2	city-roads-L	fwd	add/max	64	0.2996	0.8942	0.335
g-SpMM	2	city-roads-L	fwd	add/min	64	0.2999	0.5518	0.544
g-SpMM	2	city-roads-L	fwd	add/sum	64	0.3158	0.4898	0.645
g-SpMM	2	city-roads-L	fwd	copy_e/max	64	0.2416	0.2861	0.844
g-SpMM	2	city-roads-L	fwd	copy_e/min	64	0.2413	0.3076	0.784
g-SpMM	2	city-roads-L	fwd	copy_e/sum	64	0.2108	0.2126	0.991
g-SpMM	2	city-roads-L	fwd	copy_u/max	64	0.2642	0.3927	0.673
g-SpMM	2	city-roads-L	fwd	copy_u/min	64	0.2619	0.3920	0.668
g-SpMM	2	city-roads-L	fwd	copy_u/sum	64	0.2236	0.3336	0.670
g-SpMM	2	city-roads-L	fwd	div/max	64	0.3081	0.5474	0.563
g-SpMM	2	city-roads-L	fwd	div/min	64	0.3003	0.5515	0.545
g-SpMM	2	city-roads-L	fwd	div/sum	64	0.3250	0.5050	0.644
g-SpMM	2	city-roads-L	fwd	mul/max	64	0.3066	0.5495	0.558
g-SpMM	2	city-roads-L	fwd	mul/min	64	0.2999	0.5502	0.545
g-SpMM	2	city-roads-L	fwd	mul/sum	64	0.3274	0.4561	0.718
g-SpMM	2	city-roads-L	fwd	sub/max	64	0.3002	0.9943	0.302
g-SpMM	2	city-roads-L	fwd	sub/min	64	0.4181	0.5470	0.764
g-SpMM	2	city-roads-L	fwd	sub/sum	64	0.3232	0.4900	0.660
g-SpMM	2	city-roads-L	bwd	add/max	128	0.9262	0.9524	0.973
g-SpMM	2	city-roads-L	bwd	add/min	128	0.9272	0.9529	0.973
g-SpMM	2	city-roads-L	bwd	add/sum	128	0.6983	0.9291	0.752
g-SpMM	2	city-roads-L	bwd	copy_e/max	128	0.6349	1.1753	0.540
g-SpMM	2	city-roads-L	bwd	copy_e/min	128	0.6343	0.8304	0.764
g-SpMM	2	city-roads-L	bwd	copy_e/sum	128	0.2938	0.3162	0.929
g-SpMM	2	city-roads-L	bwd	copy_u/max	128	0.2987	0.3501	0.853
g-SpMM	2	city-roads-L	bwd	copy_u/min	128	0.2992	1.2651	0.237
g-SpMM	2	city-roads-L	bwd	copy_u/sum	128	0.4005	0.6308	0.635
g-SpMM	2	city-roads-L	bwd	div/max	128	1.1476	1.0971	1.046
g-SpMM	2	city-roads-L	bwd	div/min	128	1.1484	1.0976	1.046
g-SpMM	2	city-roads-L	bwd	div/sum	128	1.2613	2.0775	0.607
g-SpMM	2	city-roads-L	bwd	mul/max	128	1.1369	1.0936	1.040
g-SpMM	2	city-roads-L	bwd	mul/min	128	1.1377	1.0951	1.039
g-SpMM	2	city-roads-L	bwd	mul/sum	128	1.1251	1.6795	0.670
g-SpMM	2	city-roads-L	bwd	sub/max	128	0.9341	0.9538	0.979
g-SpMM	2	city-roads-L	bwd	sub/min	128	0.9343	0.9502	0.983
g-SpMM	2	city-roads-L	bwd	sub/sum	128	0.6970	0.9307	0.749
g-SpMM	2	city-roads-L	fb	add/max	128	1.4494	1.9454	0.745
g-SpMM	2	city-roads-L	fb	add/min	128	1.4535	1.9425	0.748
g-SpMM	2	city-roads-L	fb	add/sum	128	1.2440	1.8144	0.686
g-SpMM	2	city-roads-L	fb	copy_e/max	128	1.0642	2.2087	0.482
g-SpMM	2	city-roads-L	fb	copy_e/min	128	1.0629	1.2594	0.844
g-SpMM	2	city-roads-L	fb	copy_e/sum	128	0.6621	0.6885	0.962
g-SpMM	2	city-roads-L	fb	copy_u/max	128	0.7662	1.0149	0.755
g-SpMM	2	city-roads-L	fb	copy_u/min	128	0.7669	1.0157	0.755
g-SpMM	2	city-roads-L	fb	copy_u/sum	128	0.8045	1.2668	0.635
g-SpMM	2	city-roads-L	fb	div/max	128	1.6728	2.0899	0.800
g-SpMM	2	city-roads-L	fb	div/min	128	1.6729	2.0883	0.801
g-SpMM	2	city-roads-L	fb	div/sum	128	1.8122	2.9807	0.608
g-SpMM	2	city-roads-L	fb	mul/max	128	1.6651	2.0892	0.797
g-SpMM	2	city-roads-L	fb	mul/min	128	1.6603	2.0875	0.795
g-SpMM	2	city-roads-L	fb	mul/sum	128	1.6682	2.4952	0.669
g-SpMM	2	city-roads-L	fb	sub/max	128	1.4581	1.9437	0.750
g-SpMM	2	city-roads-L	fb	sub/min	128	1.4585	1.9430	0.751
g-SpMM	2	city-roads-L	fb	sub/sum	128	1.2436	1.8145	0.685
g-SpMM	2	city-roads-L	fwd	add/max	128	0.5637	1.0130	0.556
g-SpMM	2	city-roads-L	fwd	add/min	128	0.5633	1.0069	0.559
g-SpMM	2	city-roads-L	fwd	add/sum	128	0.5625	0.9049	0.622
g-SpMM	2	city-roads-L	fwd	copy_e/max	128	0.5121	1.0714	0.478
g-SpMM	2	city-roads-L	fwd	copy_e/min	128	0.4332	0.4376	0.990
g-SpMM	2	city-roads-L	fwd	copy_e/sum	128	0.3840	0.3782	1.015
g-SpMM	2	city-roads-L	fwd	copy_u/max	128	0.4756	0.7198	0.661
g-SpMM	2	city-roads-L	fwd	copy_u/min	128	0.4753	0.7221	0.658
g-SpMM	2	city-roads-L	fwd	copy_u/sum	128	0.3978	0.6172	0.645
g-SpMM	2	city-roads-L	fwd	div/max	128	0.5461	1.0084	0.542
g-SpMM	2	city-roads-L	fwd	div/min	128	0.5338	1.0076	0.530
g-SpMM	2	city-roads-L	fwd	div/sum	128	0.5686	0.8877	0.641
g-SpMM	2	city-roads-L	fwd	mul/max	128	0.8107	1.0144	0.799
g-SpMM	2	city-roads-L	fwd	mul/min	128	0.5311	1.0040	0.529
g-SpMM	2	city-roads-L	fwd	mul/sum	128	0.5624	0.8400	0.670
g-SpMM	2	city-roads-L	fwd	sub/max	128	0.7930	1.0109	0.784
g-SpMM	2	city-roads-L	fwd	sub/min	128	0.5448	1.0062	0.541
g-SpMM	2	city-roads-L	fwd	sub/sum	128	0.5636	0.9123	0.618
g-SpMM	2	city-roads-L	bwd	add/max	256	1.7280	1.7776	0.972
g-SpMM	2	city-roads-L	bwd	add/min	256	1.7269	1.7768	0.972
g-SpMM	2	city-roads-L	bwd	add/sum	256	1.2609	1.6883	0.747

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-L	bwd	copy_e/max	256	1.1720	1.5156	0.773
g-SpMM	2	city-roads-L	bwd	copy_e/min	256	1.1760	1.5160	0.776
g-SpMM	2	city-roads-L	bwd	copy_e/sum	256	0.5235	0.5241	0.999
g-SpMM	2	city-roads-L	bwd	copy_u/max	256	0.5743	0.5720	1.004
g-SpMM	2	city-roads-L	bwd	copy_u/min	256	0.5716	0.5720	0.999
g-SpMM	2	city-roads-L	bwd	copy_u/sum	256	0.7386	1.1646	0.634
g-SpMM	2	city-roads-L	bwd	div/max	256	2.1691	2.0495	1.058
g-SpMM	2	city-roads-L	bwd	div/min	256	2.1682	2.0514	1.057
g-SpMM	2	city-roads-L	bwd	div/sum	256	2.3077	3.8735	0.596
g-SpMM	2	city-roads-L	bwd	mul/max	256	2.1600	2.0458	1.056
g-SpMM	2	city-roads-L	bwd	mul/min	256	2.1498	2.0465	1.050
g-SpMM	2	city-roads-L	bwd	mul/sum	256	2.0351	3.0927	0.658
g-SpMM	2	city-roads-L	bwd	sub/max	256	1.7431	1.7774	0.981
g-SpMM	2	city-roads-L	bwd	sub/min	256	1.7464	1.7772	0.983
g-SpMM	2	city-roads-L	bwd	sub/sum	256	1.2634	1.6882	0.748
g-SpMM	2	city-roads-L	fb	add/max	256	2.7029	3.6617	0.738
g-SpMM	2	city-roads-L	fb	add/min	256	2.7039	3.6665	0.737
g-SpMM	2	city-roads-L	fb	add/sum	256	2.2640	3.3564	0.675
g-SpMM	2	city-roads-L	fb	copy_e/max	256	1.9778	2.3217	0.852
g-SpMM	2	city-roads-L	fb	copy_e/min	256	1.9909	2.3234	0.857
g-SpMM	2	city-roads-L	fb	copy_e/sum	256	1.2042	1.2029	1.001
g-SpMM	2	city-roads-L	fb	copy_u/max	256	1.4469	1.9064	0.759
g-SpMM	2	city-roads-L	fb	copy_u/min	256	1.4460	1.9028	0.760
g-SpMM	2	city-roads-L	fb	copy_u/sum	256	1.4737	2.3173	0.636
g-SpMM	2	city-roads-L	fb	div/max	256	3.1511	3.9319	0.801
g-SpMM	2	city-roads-L	fb	div/min	256	3.1483	3.9309	0.801
g-SpMM	2	city-roads-L	fb	div/sum	256	3.3195	5.5373	0.599
g-SpMM	2	city-roads-L	fb	mul/max	256	3.1280	3.9258	0.797
g-SpMM	2	city-roads-L	fb	mul/min	256	3.1348	3.9277	0.798
g-SpMM	2	city-roads-L	fb	mul/sum	256	3.0359	4.6306	0.656
g-SpMM	2	city-roads-L	fb	sub/max	256	2.7333	3.6597	0.747
g-SpMM	2	city-roads-L	fb	sub/min	256	2.7240	3.6613	0.744
g-SpMM	2	city-roads-L	fb	sub/sum	256	2.2661	3.3586	0.675
g-SpMM	2	city-roads-L	fwd	add/max	256	1.0863	1.9159	0.567
g-SpMM	2	city-roads-L	fwd	add/min	256	1.1115	1.9112	0.582
g-SpMM	2	city-roads-L	fwd	add/sum	256	1.0269	1.7104	0.600
g-SpMM	2	city-roads-L	fwd	copy_e/max	256	1.0287	0.9970	1.032
g-SpMM	2	city-roads-L	fwd	copy_e/min	256	0.9719	0.9044	1.075
g-SpMM	2	city-roads-L	fwd	copy_e/sum	256	0.9472	0.6945	1.364
g-SpMM	2	city-roads-L	fwd	copy_u/max	256	0.8844	1.3455	0.657
g-SpMM	2	city-roads-L	fwd	copy_u/min	256	0.8797	1.3390	0.657
g-SpMM	2	city-roads-L	fwd	copy_u/sum	256	0.7394	1.1547	0.640
g-SpMM	2	city-roads-L	fwd	div/max	256	1.0817	1.9089	0.567
g-SpMM	2	city-roads-L	fwd	div/min	256	0.9818	1.9091	0.514
g-SpMM	2	city-roads-L	fwd	div/sum	256	1.0355	1.7107	0.605
g-SpMM	2	city-roads-L	fwd	mul/max	256	1.2435	1.9147	0.649
g-SpMM	2	city-roads-L	fwd	mul/min	256	1.0179	1.9962	0.510
g-SpMM	2	city-roads-L	fwd	mul/sum	256	1.0245	1.5783	0.649
g-SpMM	2	city-roads-L	fwd	sub/max	256	2.1698	1.9144	1.133
g-SpMM	2	city-roads-L	fwd	sub/min	256	1.4285	1.9168	0.745
g-SpMM	2	city-roads-L	fwd	sub/sum	256	1.0276	1.7107	0.601
g-SpMM	2	city-roads-L	bwd	add/max	512	3.0203	3.0663	0.985
g-SpMM	2	city-roads-L	bwd	add/min	512	3.0256	3.0611	0.988
g-SpMM	2	city-roads-L	bwd	add/sum	512	2.0423	2.8685	0.712
g-SpMM	2	city-roads-L	bwd	copy_e/max	512	2.0261	2.5082	0.808
g-SpMM	2	city-roads-L	bwd	copy_e/min	512	2.0244	2.5085	0.807
g-SpMM	2	city-roads-L	bwd	copy_e/sum	512	0.8338	0.8348	0.999
g-SpMM	2	city-roads-L	bwd	copy_u/max	512	1.1147	1.1143	1.000
g-SpMM	2	city-roads-L	bwd	copy_u/min	512	1.1149	1.1183	0.997
g-SpMM	2	city-roads-L	bwd	copy_u/sum	512	1.2110	2.0395	0.594
g-SpMM	2	city-roads-L	bwd	div/max	512	4.0207	3.6160	1.112
g-SpMM	2	city-roads-L	bwd	div/min	512	4.0167	3.6243	1.108
g-SpMM	2	city-roads-L	bwd	div/sum	512	4.0104	6.8782	0.583
g-SpMM	2	city-roads-L	bwd	mul/max	512	3.9738	3.6250	1.096
g-SpMM	2	city-roads-L	bwd	mul/min	512	3.9717	3.6354	1.092
g-SpMM	2	city-roads-L	bwd	mul/sum	512	3.4104	5.3655	0.636
g-SpMM	2	city-roads-L	bwd	sub/max	512	3.0509	3.0689	0.994
g-SpMM	2	city-roads-L	bwd	sub/min	512	3.0502	3.0716	0.993
g-SpMM	2	city-roads-L	bwd	sub/sum	512	2.0477	2.8741	0.712
g-SpMM	2	city-roads-L	fb	add/max	512	4.7223	6.5357	0.723
g-SpMM	2	city-roads-L	fb	add/min	512	4.7241	6.5348	0.723
g-SpMM	2	city-roads-L	fb	add/sum	512	3.8601	5.9438	0.649
g-SpMM	2	city-roads-L	fb	copy_e/max	512	3.4769	3.9701	0.876
g-SpMM	2	city-roads-L	fb	copy_e/min	512	3.4749	3.9605	0.877
g-SpMM	2	city-roads-L	fb	copy_e/sum	512	2.0343	2.0345	1.000
g-SpMM	2	city-roads-L	fb	copy_u/max	512	2.5725	3.4816	0.739
g-SpMM	2	city-roads-L	fb	copy_u/min	512	2.5757	3.4797	0.740
g-SpMM	2	city-roads-L	fb	copy_u/sum	512	2.4228	4.0507	0.598

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-L	fb	div/max	512	5.7079	7.0727	0.807
g-SpMM	2	city-roads-L	fb	div/min	512	5.7139	7.0747	0.808
g-SpMM	2	city-roads-L	fb	div/sum	512	5.7660	9.9101	0.582
g-SpMM	2	city-roads-L	fb	mul/max	512	5.6592	7.0766	0.800
g-SpMM	2	city-roads-L	fb	mul/min	512	5.6816	7.0818	0.802
g-SpMM	2	city-roads-L	fb	mul/sum	512	5.1569	8.1665	0.631
g-SpMM	2	city-roads-L	fb	sub/max	512	4.7454	6.5401	0.726
g-SpMM	2	city-roads-L	fb	sub/min	512	4.7522	6.5434	0.726
g-SpMM	2	city-roads-L	fb	sub/sum	512	3.7972	5.9429	0.639
g-SpMM	2	city-roads-L	fwd	add/max	512	2.1069	3.5888	0.587
g-SpMM	2	city-roads-L	fwd	add/min	512	2.0626	3.5323	0.584
g-SpMM	2	city-roads-L	fwd	add/sum	512	1.8349	3.1432	0.584
g-SpMM	2	city-roads-L	fwd	copy_e/max	512	2.3231	2.1535	1.079
g-SpMM	2	city-roads-L	fwd	copy_e/min	512	1.7135	1.9476	0.880
g-SpMM	2	city-roads-L	fwd	copy_e/sum	512	1.2179	1.2271	0.992
g-SpMM	2	city-roads-L	fwd	copy_u/max	512	1.7151	2.3985	0.715
g-SpMM	2	city-roads-L	fwd	copy_u/min	512	1.4691	2.3759	0.618
g-SpMM	2	city-roads-L	fwd	copy_u/sum	512	1.2130	2.0163	0.602
g-SpMM	2	city-roads-L	fwd	div/max	512	2.5395	3.5188	0.722
g-SpMM	2	city-roads-L	fwd	div/min	512	2.0052	4.2684	0.470
g-SpMM	2	city-roads-L	fwd	div/sum	512	1.8013	3.1147	0.578
g-SpMM	2	city-roads-L	fwd	mul/max	512	2.0427	3.5310	0.579
g-SpMM	2	city-roads-L	fwd	mul/min	512	2.0617	3.5310	0.584
g-SpMM	2	city-roads-L	fwd	mul/sum	512	1.7833	2.8883	0.617
g-SpMM	2	city-roads-L	fwd	sub/max	512	2.0417	3.5384	0.577
g-SpMM	2	city-roads-L	fwd	sub/min	512	2.3094	3.5275	0.655
g-SpMM	2	city-roads-L	fwd	sub/sum	512	1.7910	3.1456	0.569
g-SpMM	2	city-roads-M	bwd	add/max	64	0.2239	0.2324	0.963
g-SpMM	2	city-roads-M	bwd	add/min	64	0.2287	0.2373	0.964
g-SpMM	2	city-roads-M	bwd	add/sum	64	0.2937	0.2529	1.161
g-SpMM	2	city-roads-M	bwd	copy_e/max	64	0.1967	0.1859	1.058
g-SpMM	2	city-roads-M	bwd	copy_e/min	64	0.1946	0.1923	1.012
g-SpMM	2	city-roads-M	bwd	copy_e/sum	64	0.1893	0.1726	1.097
g-SpMM	2	city-roads-M	bwd	copy_u/max	64	0.1935	0.1793	1.079
g-SpMM	2	city-roads-M	bwd	copy_u/min	64	0.1871	0.1887	0.991
g-SpMM	2	city-roads-M	bwd	copy_u/sum	64	0.2310	0.2309	1.000
g-SpMM	2	city-roads-M	bwd	div/max	64	0.2324	0.2261	1.028
g-SpMM	2	city-roads-M	bwd	div/min	64	0.2279	0.2350	0.970
g-SpMM	2	city-roads-M	bwd	div/sum	64	0.2605	0.4169	0.625
g-SpMM	2	city-roads-M	bwd	mul/max	64	0.2247	0.2363	0.951
g-SpMM	2	city-roads-M	bwd	mul/min	64	0.2469	0.2192	1.126
g-SpMM	2	city-roads-M	bwd	mul/sum	64	0.2880	0.3293	0.875
g-SpMM	2	city-roads-M	bwd	sub/max	64	0.2437	0.1978	1.232
g-SpMM	2	city-roads-M	bwd	sub/min	64	0.2295	0.2097	1.094
g-SpMM	2	city-roads-M	bwd	sub/sum	64	0.2948	0.3054	0.965
g-SpMM	2	city-roads-M	fb	add/max	64	0.4464	0.4688	0.952
g-SpMM	2	city-roads-M	fb	add/min	64	0.4521	0.4591	0.985
g-SpMM	2	city-roads-M	fb	add/sum	64	0.5102	0.4962	1.028
g-SpMM	2	city-roads-M	fb	copy_e/max	64	0.4179	0.4069	1.027
g-SpMM	2	city-roads-M	fb	copy_e/min	64	0.4159	0.4072	1.021
g-SpMM	2	city-roads-M	fb	copy_e/sum	64	0.3866	0.3717	1.040
g-SpMM	2	city-roads-M	fb	copy_u/max	64	0.4102	0.4109	0.998
g-SpMM	2	city-roads-M	fb	copy_u/min	64	0.4172	0.4245	0.983
g-SpMM	2	city-roads-M	fb	copy_u/sum	64	0.4308	0.4715	0.914
g-SpMM	2	city-roads-M	fb	div/max	64	0.4852	0.4736	1.025
g-SpMM	2	city-roads-M	fb	div/min	64	0.4833	0.4828	1.001
g-SpMM	2	city-roads-M	fb	div/sum	64	0.4981	0.5786	0.861
g-SpMM	2	city-roads-M	fb	mul/max	64	0.4411	0.4959	0.890
g-SpMM	2	city-roads-M	fb	mul/min	64	0.5353	0.4325	1.238
g-SpMM	2	city-roads-M	fb	mul/sum	64	0.5386	0.4797	1.123
g-SpMM	2	city-roads-M	fb	sub/max	64	0.4975	0.4304	1.156
g-SpMM	2	city-roads-M	fb	sub/min	64	0.4420	0.4933	0.896
g-SpMM	2	city-roads-M	fb	sub/sum	64	0.4968	0.5366	0.926
g-SpMM	2	city-roads-M	fwd	add/max	64	0.1003	0.2369	0.424
g-SpMM	2	city-roads-M	fwd	add/min	64	0.1028	0.1753	0.586
g-SpMM	2	city-roads-M	fwd	add/sum	64	0.1064	0.1593	0.668
g-SpMM	2	city-roads-M	fwd	copy_e/max	64	0.0882	0.0898	0.982
g-SpMM	2	city-roads-M	fwd	copy_e/min	64	0.0886	0.0926	0.957
g-SpMM	2	city-roads-M	fwd	copy_e/sum	64	0.0799	0.0884	0.904
g-SpMM	2	city-roads-M	fwd	copy_u/max	64	0.0866	0.1309	0.662
g-SpMM	2	city-roads-M	fwd	copy_u/min	64	0.0917	0.1824	0.503
g-SpMM	2	city-roads-M	fwd	copy_u/sum	64	0.0788	0.0912	0.865
g-SpMM	2	city-roads-M	fwd	div/max	64	0.0995	0.1766	0.564
g-SpMM	2	city-roads-M	fwd	div/min	64	0.1000	0.1779	0.562
g-SpMM	2	city-roads-M	fwd	div/sum	64	0.1071	0.1628	0.658
g-SpMM	2	city-roads-M	fwd	mul/max	64	0.1027	0.1776	0.578
g-SpMM	2	city-roads-M	fwd	mul/min	64	0.0998	0.1779	0.561
g-SpMM	2	city-roads-M	fwd	mul/sum	64	0.1064	0.1543	0.689

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-M	fwd	sub/max	64	0.1038	0.1776	0.584
g-SpMM	2	city-roads-M	fwd	sub/min	64	0.0975	0.1775	0.549
g-SpMM	2	city-roads-M	fwd	sub/sum	64	0.1064	0.1608	0.662
g-SpMM	2	city-roads-M	bwd	add/max	128	0.3276	0.3461	0.947
g-SpMM	2	city-roads-M	bwd	add/min	128	0.3273	0.3406	0.961
g-SpMM	2	city-roads-M	bwd	add/sum	128	0.3060	0.3190	0.959
g-SpMM	2	city-roads-M	bwd	copy_e/max	128	0.2423	0.3550	0.683
g-SpMM	2	city-roads-M	bwd	copy_e/min	128	0.2920	0.3155	0.926
g-SpMM	2	city-roads-M	bwd	copy_e/sum	128	0.2100	0.1935	1.085
g-SpMM	2	city-roads-M	bwd	copy_u/max	128	0.1907	0.1896	1.006
g-SpMM	2	city-roads-M	bwd	copy_u/min	128	0.1876	0.1838	1.020
g-SpMM	2	city-roads-M	bwd	copy_u/sum	128	0.2242	0.2206	1.017
g-SpMM	2	city-roads-M	bwd	div/max	128	0.4317	0.4084	1.057
g-SpMM	2	city-roads-M	bwd	div/min	128	0.4303	0.4316	0.997
g-SpMM	2	city-roads-M	bwd	div/sum	128	0.4626	0.7668	0.603
g-SpMM	2	city-roads-M	bwd	mul/max	128	0.4258	0.4045	1.053
g-SpMM	2	city-roads-M	bwd	mul/min	128	0.4255	0.4046	1.052
g-SpMM	2	city-roads-M	bwd	mul/sum	128	0.3965	0.6029	0.658
g-SpMM	2	city-roads-M	bwd	sub/max	128	0.3314	0.3446	0.962
g-SpMM	2	city-roads-M	bwd	sub/min	128	0.3316	0.3419	0.970
g-SpMM	2	city-roads-M	bwd	sub/sum	128	0.2948	0.3183	0.926
g-SpMM	2	city-roads-M	fb	add/max	128	0.5052	0.6767	0.747
g-SpMM	2	city-roads-M	fb	add/min	128	0.5041	0.6767	0.745
g-SpMM	2	city-roads-M	fb	add/sum	128	0.5094	0.6198	0.822
g-SpMM	2	city-roads-M	fb	copy_e/max	128	0.4404	0.4576	0.962
g-SpMM	2	city-roads-M	fb	copy_e/min	128	0.4414	0.4577	0.964
g-SpMM	2	city-roads-M	fb	copy_e/sum	128	0.3977	0.3936	1.010
g-SpMM	2	city-roads-M	fb	copy_u/max	128	0.4265	0.4107	1.039
g-SpMM	2	city-roads-M	fb	copy_u/min	128	0.4142	0.4121	1.005
g-SpMM	2	city-roads-M	fb	copy_u/sum	128	0.4310	0.4345	0.992
g-SpMM	2	city-roads-M	fb	div/max	128	0.6043	0.9312	0.649
g-SpMM	2	city-roads-M	fb	div/min	128	0.6066	0.7396	0.820
g-SpMM	2	city-roads-M	fb	div/sum	128	0.6512	1.3340	0.488
g-SpMM	2	city-roads-M	fb	mul/max	128	0.6008	0.7358	0.817
g-SpMM	2	city-roads-M	fb	mul/min	128	0.6029	1.0618	0.568
g-SpMM	2	city-roads-M	fb	mul/sum	128	0.5830	0.8922	0.653
g-SpMM	2	city-roads-M	fb	sub/max	128	0.5092	0.7916	0.643
g-SpMM	2	city-roads-M	fb	sub/min	128	1.3003	0.6755	1.925
g-SpMM	2	city-roads-M	fb	sub/sum	128	0.5260	0.6713	0.784
g-SpMM	2	city-roads-M	fwd	add/max	128	0.3839	0.3310	1.160
g-SpMM	2	city-roads-M	fwd	add/min	128	0.1767	0.3321	0.532
g-SpMM	2	city-roads-M	fwd	add/sum	128	0.1907	0.3007	0.634
g-SpMM	2	city-roads-M	fwd	copy_e/max	128	0.1399	0.1483	0.943
g-SpMM	2	city-roads-M	fwd	copy_e/min	128	0.1396	0.1830	0.763
g-SpMM	2	city-roads-M	fwd	copy_e/sum	128	0.1255	0.1263	0.994
g-SpMM	2	city-roads-M	fwd	copy_u/max	128	0.1534	0.2289	0.670
g-SpMM	2	city-roads-M	fwd	copy_u/min	128	0.1538	0.2285	0.673
g-SpMM	2	city-roads-M	fwd	copy_u/sum	128	0.1323	0.5435	0.243
g-SpMM	2	city-roads-M	fwd	div/max	128	0.1769	0.3310	0.534
g-SpMM	2	city-roads-M	fwd	div/min	128	0.2047	0.3290	0.622
g-SpMM	2	city-roads-M	fwd	div/sum	128	0.1952	0.2974	0.656
g-SpMM	2	city-roads-M	fwd	mul/max	128	0.1801	0.3289	0.547
g-SpMM	2	city-roads-M	fwd	mul/min	128	0.1772	0.3392	0.522
g-SpMM	2	city-roads-M	fwd	mul/sum	128	0.1912	0.2853	0.670
g-SpMM	2	city-roads-M	fwd	sub/max	128	0.1767	0.3297	0.536
g-SpMM	2	city-roads-M	fwd	sub/min	128	0.1764	0.3560	0.495
g-SpMM	2	city-roads-M	fwd	sub/sum	128	0.1908	0.3462	0.551
g-SpMM	2	city-roads-M	bwd	add/max	256	0.6211	0.6495	0.956
g-SpMM	2	city-roads-M	bwd	add/min	256	0.6269	0.6528	0.960
g-SpMM	2	city-roads-M	bwd	add/sum	256	0.4461	0.5943	0.751
g-SpMM	2	city-roads-M	bwd	copy_e/max	256	0.4631	0.5950	0.778
g-SpMM	2	city-roads-M	bwd	copy_e/min	256	0.4682	0.5963	0.785
g-SpMM	2	city-roads-M	bwd	copy_e/sum	256	0.1930	0.1960	0.985
g-SpMM	2	city-roads-M	bwd	copy_u/max	256	0.2533	0.2466	1.027
g-SpMM	2	city-roads-M	bwd	copy_u/min	256	0.2457	0.2470	0.995
g-SpMM	2	city-roads-M	bwd	copy_u/sum	256	0.2512	0.3883	0.647
g-SpMM	2	city-roads-M	bwd	div/max	256	0.8176	0.7708	1.061
g-SpMM	2	city-roads-M	bwd	div/min	256	0.8181	0.7754	1.055
g-SpMM	2	city-roads-M	bwd	div/sum	256	0.8596	1.4559	0.590
g-SpMM	2	city-roads-M	bwd	mul/max	256	0.8077	0.7807	1.035
g-SpMM	2	city-roads-M	bwd	mul/min	256	0.8107	0.7662	1.058
g-SpMM	2	city-roads-M	bwd	mul/sum	256	0.7358	1.1321	0.650
g-SpMM	2	city-roads-M	bwd	sub/max	256	0.6354	0.6513	0.975
g-SpMM	2	city-roads-M	bwd	sub/min	256	0.6405	0.6498	0.986
g-SpMM	2	city-roads-M	bwd	sub/sum	256	0.4457	0.5904	0.755
g-SpMM	2	city-roads-M	fb	add/max	256	0.9526	1.2838	0.742
g-SpMM	2	city-roads-M	fb	add/min	256	0.9473	1.2881	0.735
g-SpMM	2	city-roads-M	fb	add/sum	256	0.7954	1.1671	0.681

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-M	fb	copy_e/max	256	0.7217	0.8582	0.841
g-SpMM	2	city-roads-M	fb	copy_e/min	256	0.7224	0.8586	0.841
g-SpMM	2	city-roads-M	fb	copy_e/sum	256	0.4266	0.4364	0.978
g-SpMM	2	city-roads-M	fb	copy_u/max	256	0.5293	0.6799	0.778
g-SpMM	2	city-roads-M	fb	copy_u/min	256	0.5343	0.6815	0.784
g-SpMM	2	city-roads-M	fb	copy_u/sum	256	0.5010	0.7774	0.645
g-SpMM	2	city-roads-M	fb	div/max	256	1.1426	2.5836	0.442
g-SpMM	2	city-roads-M	fb	div/min	256	1.1448	1.4054	0.815
g-SpMM	2	city-roads-M	fb	div/sum	256	1.2073	2.0714	0.583
g-SpMM	2	city-roads-M	fb	mul/max	256	1.1318	1.4404	0.786
g-SpMM	2	city-roads-M	fb	mul/min	256	1.1329	1.3959	0.812
g-SpMM	2	city-roads-M	fb	mul/sum	256	1.0793	1.6732	0.645
g-SpMM	2	city-roads-M	fb	sub/max	256	0.9553	1.2816	0.745
g-SpMM	2	city-roads-M	fb	sub/min	256	0.9558	1.2828	0.745
g-SpMM	2	city-roads-M	fb	sub/sum	256	0.7953	1.1606	0.685
g-SpMM	2	city-roads-M	fwd	add/max	256	0.3573	0.6433	0.555
g-SpMM	2	city-roads-M	fwd	add/min	256	0.4632	0.6383	0.726
g-SpMM	2	city-roads-M	fwd	add/sum	256	0.3570	0.5868	0.608
g-SpMM	2	city-roads-M	fwd	copy_e/max	256	0.2999	0.3416	0.878
g-SpMM	2	city-roads-M	fwd	copy_e/min	256	0.3872	0.2633	1.471
g-SpMM	2	city-roads-M	fwd	copy_e/sum	256	0.2489	0.2455	1.014
g-SpMM	2	city-roads-M	fwd	copy_u/max	256	0.2878	0.4342	0.663
g-SpMM	2	city-roads-M	fwd	copy_u/min	256	0.7273	0.4322	1.683
g-SpMM	2	city-roads-M	fwd	copy_u/sum	256	0.2489	0.4834	0.515
g-SpMM	2	city-roads-M	fwd	div/max	256	0.5287	0.8097	0.653
g-SpMM	2	city-roads-M	fwd	div/min	256	0.3870	0.6371	0.607
g-SpMM	2	city-roads-M	fwd	div/sum	256	0.3653	0.5698	0.641
g-SpMM	2	city-roads-M	fwd	mul/max	256	0.3916	0.9253	0.423
g-SpMM	2	city-roads-M	fwd	mul/min	256	0.3781	0.6394	0.591
g-SpMM	2	city-roads-M	fwd	mul/sum	256	0.3541	0.5600	0.632
g-SpMM	2	city-roads-M	fwd	sub/max	256	0.3531	0.6756	0.523
g-SpMM	2	city-roads-M	fwd	sub/min	256	0.3284	0.6347	0.517
g-SpMM	2	city-roads-M	fwd	sub/sum	256	0.3572	0.5838	0.612
g-SpMM	2	city-roads-M	bwd	add/max	512	1.0694	1.0894	0.982
g-SpMM	2	city-roads-M	bwd	add/min	512	1.0697	1.0966	0.976
g-SpMM	2	city-roads-M	bwd	add/sum	512	0.6981	0.9792	0.713
g-SpMM	2	city-roads-M	bwd	copy_e/max	512	0.8022	0.9799	0.819
g-SpMM	2	city-roads-M	bwd	copy_e/min	512	0.8075	0.9822	0.822
g-SpMM	2	city-roads-M	bwd	copy_e/sum	512	0.3066	0.3061	1.002
g-SpMM	2	city-roads-M	bwd	copy_u/max	512	0.4786	0.4790	0.999
g-SpMM	2	city-roads-M	bwd	copy_u/min	512	0.4790	0.4789	1.000
g-SpMM	2	city-roads-M	bwd	copy_u/sum	512	0.3928	0.6762	0.581
g-SpMM	2	city-roads-M	bwd	div/max	512	1.4911	1.3284	1.123
g-SpMM	2	city-roads-M	bwd	div/min	512	1.4928	1.3284	1.124
g-SpMM	2	city-roads-M	bwd	div/sum	512	1.4740	2.5238	0.584
g-SpMM	2	city-roads-M	bwd	mul/max	512	1.4740	1.3283	1.110
g-SpMM	2	city-roads-M	bwd	mul/min	512	1.4770	1.3245	1.115
g-SpMM	2	city-roads-M	bwd	mul/sum	512	1.2003	1.9068	0.629
g-SpMM	2	city-roads-M	bwd	sub/max	512	1.0811	1.0926	0.989
g-SpMM	2	city-roads-M	bwd	sub/min	512	1.0818	1.0944	0.989
g-SpMM	2	city-roads-M	bwd	sub/sum	512	0.6998	0.9851	0.710
g-SpMM	2	city-roads-M	fb	add/max	512	1.6148	2.2451	0.719
g-SpMM	2	city-roads-M	fb	add/min	512	1.6165	2.2491	0.719
g-SpMM	2	city-roads-M	fb	add/sum	512	1.2986	2.0446	0.635
g-SpMM	2	city-roads-M	fb	copy_e/max	512	1.2629	1.4443	0.874
g-SpMM	2	city-roads-M	fb	copy_e/min	512	1.2622	1.4356	0.879
g-SpMM	2	city-roads-M	fb	copy_e/sum	512	0.7194	0.7016	1.025
g-SpMM	2	city-roads-M	fb	copy_u/max	512	0.9348	1.2351	0.757
g-SpMM	2	city-roads-M	fb	copy_u/min	512	0.9350	1.2312	0.759
g-SpMM	2	city-roads-M	fb	copy_u/sum	512	0.7846	1.3338	0.588
g-SpMM	2	city-roads-M	fb	div/max	512	2.0406	2.4751	0.824
g-SpMM	2	city-roads-M	fb	div/min	512	2.0398	2.4762	0.824
g-SpMM	2	city-roads-M	fb	div/sum	512	2.0806	3.5408	0.588
g-SpMM	2	city-roads-M	fb	mul/max	512	2.0223	2.4680	0.819
g-SpMM	2	city-roads-M	fb	mul/min	512	2.0219	2.4629	0.821
g-SpMM	2	city-roads-M	fb	mul/sum	512	1.7994	2.8898	0.623
g-SpMM	2	city-roads-M	fb	sub/max	512	1.6261	2.2426	0.725
g-SpMM	2	city-roads-M	fb	sub/min	512	1.6279	2.2423	0.726
g-SpMM	2	city-roads-M	fb	sub/sum	512	1.3026	2.0244	0.643
g-SpMM	2	city-roads-M	fwd	add/max	512	0.7871	1.1559	0.681
g-SpMM	2	city-roads-M	fwd	add/min	512	0.7957	1.1550	0.689
g-SpMM	2	city-roads-M	fwd	add/sum	512	0.6144	1.0623	0.578
g-SpMM	2	city-roads-M	fwd	copy_e/max	512	0.6451	0.7257	0.889
g-SpMM	2	city-roads-M	fwd	copy_e/min	512	0.7195	0.4606	1.562
g-SpMM	2	city-roads-M	fwd	copy_e/sum	512	0.4073	0.4008	1.016
g-SpMM	2	city-roads-M	fwd	copy_u/max	512	0.4620	0.7557	0.611
g-SpMM	2	city-roads-M	fwd	copy_u/min	512	0.5247	0.7562	0.694
g-SpMM	2	city-roads-M	fwd	copy_u/sum	512	0.3908	0.6498	0.601

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	city-roads-M	fwd	div/max	512	0.7283	1.1684	0.623
g-SpMM	2	city-roads-M	fwd	div/min	512	0.7608	1.1831	0.643
g-SpMM	2	city-roads-M	fwd	div/sum	512	0.6206	1.0459	0.593
g-SpMM	2	city-roads-M	fwd	mul/max	512	0.7415	1.4085	0.526
g-SpMM	2	city-roads-M	fwd	mul/min	512	0.5545	1.4034	0.395
g-SpMM	2	city-roads-M	fwd	mul/sum	512	0.6144	1.0132	0.606
g-SpMM	2	city-roads-M	fwd	sub/max	512	0.7708	1.3596	0.567
g-SpMM	2	city-roads-M	fwd	sub/min	512	0.7796	1.1558	0.675
g-SpMM	2	city-roads-M	fwd	sub/sum	512	0.6264	1.2907	0.485
g-SpMM	2	cora	bwd	add/max	64	0.2107	0.2205	0.955
g-SpMM	2	cora	bwd	add/min	64	0.2068	0.2345	0.882
g-SpMM	2	cora	bwd	add/sum	64	0.2606	0.3096	0.842
g-SpMM	2	cora	bwd	copy_e/max	64	0.1823	0.2012	0.906
g-SpMM	2	cora	bwd	copy_e/min	64	0.1940	0.2013	0.964
g-SpMM	2	cora	bwd	copy_e/sum	64	0.1833	0.1986	0.923
g-SpMM	2	cora	bwd	copy_u/max	64	0.1769	0.2025	0.874
g-SpMM	2	cora	bwd	copy_u/min	64	0.1827	0.1971	0.927
g-SpMM	2	cora	bwd	copy_u/sum	64	0.2075	0.2273	0.913
g-SpMM	2	cora	bwd	div/max	64	0.2159	0.2247	0.961
g-SpMM	2	cora	bwd	div/min	64	0.2057	0.2134	0.964
g-SpMM	2	cora	bwd	div/sum	64	0.2707	0.2544	1.064
g-SpMM	2	cora	bwd	mul/max	64	0.2180	0.2398	0.909
g-SpMM	2	cora	bwd	mul/min	64	0.2280	0.2365	0.964
g-SpMM	2	cora	bwd	mul/sum	64	0.2466	0.2779	0.887
g-SpMM	2	cora	bwd	sub/max	64	0.2159	0.2252	0.959
g-SpMM	2	cora	bwd	sub/min	64	0.2161	0.2131	1.014
g-SpMM	2	cora	bwd	sub/sum	64	0.2947	0.2879	1.023
g-SpMM	2	cora	fb	add/max	64	0.4254	0.4589	0.927
g-SpMM	2	cora	fb	add/min	64	0.4364	0.4763	0.916
g-SpMM	2	cora	fb	add/sum	64	0.5032	0.5308	0.948
g-SpMM	2	cora	fb	copy_e/max	64	0.4120	0.4368	0.943
g-SpMM	2	cora	fb	copy_e/min	64	0.4183	0.4502	0.929
g-SpMM	2	cora	fb	copy_e/sum	64	0.4162	0.4014	1.037
g-SpMM	2	cora	fb	copy_u/max	64	0.4104	0.4228	0.971
g-SpMM	2	cora	fb	copy_u/min	64	0.4411	0.4771	0.925
g-SpMM	2	cora	fb	copy_u/sum	64	0.4104	0.4539	0.904
g-SpMM	2	cora	fb	div/max	64	0.4196	0.4413	0.951
g-SpMM	2	cora	fb	div/min	64	0.4462	0.4715	0.946
g-SpMM	2	cora	fb	div/sum	64	0.4859	0.5094	0.954
g-SpMM	2	cora	fb	mul/max	64	0.4651	0.5137	0.905
g-SpMM	2	cora	fb	mul/min	64	0.4482	0.5044	0.889
g-SpMM	2	cora	fb	mul/sum	64	0.5049	0.5246	0.962
g-SpMM	2	cora	fb	sub/max	64	0.5294	0.4650	1.139
g-SpMM	2	cora	fb	sub/min	64	0.4468	0.4546	0.983
g-SpMM	2	cora	fb	sub/sum	64	0.4889	0.5202	0.940
g-SpMM	2	cora	fwd	add/max	64	0.0941	0.0873	1.078
g-SpMM	2	cora	fwd	add/min	64	0.0890	0.0877	1.015
g-SpMM	2	cora	fwd	add/sum	64	0.0809	0.0802	1.008
g-SpMM	2	cora	fwd	copy_e/max	64	0.0854	0.0858	0.996
g-SpMM	2	cora	fwd	copy_e/min	64	0.0861	0.0893	0.963
g-SpMM	2	cora	fwd	copy_e/sum	64	0.0799	0.0803	0.994
g-SpMM	2	cora	fwd	copy_u/max	64	0.0854	0.0856	0.998
g-SpMM	2	cora	fwd	copy_u/min	64	0.0882	0.0882	0.999
g-SpMM	2	cora	fwd	copy_u/sum	64	0.0809	0.0816	0.992
g-SpMM	2	cora	fwd	div/max	64	0.0866	0.0864	1.003
g-SpMM	2	cora	fwd	div/min	64	0.0860	0.0878	0.979
g-SpMM	2	cora	fwd	div/sum	64	0.0791	0.0869	0.910
g-SpMM	2	cora	fwd	mul/max	64	0.0881	0.0919	0.959
g-SpMM	2	cora	fwd	mul/min	64	0.0861	0.0925	0.931
g-SpMM	2	cora	fwd	mul/sum	64	0.0816	0.0863	0.947
g-SpMM	2	cora	fwd	sub/max	64	0.0875	0.0866	1.010
g-SpMM	2	cora	fwd	sub/min	64	0.0891	0.0868	1.026
g-SpMM	2	cora	fwd	sub/sum	64	0.0809	0.0804	1.006
g-SpMM	2	cora	bwd	add/max	128	0.2198	0.1979	1.111
g-SpMM	2	cora	bwd	add/min	128	0.2207	0.1959	1.127
g-SpMM	2	cora	bwd	add/sum	128	0.2813	0.2718	1.035
g-SpMM	2	cora	bwd	copy_e/max	128	0.2093	0.1776	1.179
g-SpMM	2	cora	bwd	copy_e/min	128	0.1907	0.1757	1.085
g-SpMM	2	cora	bwd	copy_e/sum	128	0.3437	0.1694	2.029
g-SpMM	2	cora	bwd	copy_u/max	128	0.2249	0.1643	1.369
g-SpMM	2	cora	bwd	copy_u/min	128	0.1980	0.1759	1.126
g-SpMM	2	cora	bwd	copy_u/sum	128	0.2240	0.1958	1.144
g-SpMM	2	cora	bwd	div/max	128	0.2237	0.1906	1.174
g-SpMM	2	cora	bwd	div/min	128	0.2218	0.2001	1.109
g-SpMM	2	cora	bwd	div/sum	128	0.2513	0.2397	1.049
g-SpMM	2	cora	bwd	mul/max	128	0.2216	0.1982	1.118
g-SpMM	2	cora	bwd	mul/min	128	0.2251	0.1983	1.135
g-SpMM	2	cora	bwd	mul/sum	128	0.2645	0.2293	1.153

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	cora	bwd	sub/max	128	0.2355	0.1985	1.187
g-SpMM	2	cora	bwd	sub/min	128	0.2173	0.1966	1.105
g-SpMM	2	cora	bwd	sub/sum	128	0.2938	0.2723	1.079
g-SpMM	2	cora	fb	add/max	128	0.4517	0.4184	1.080
g-SpMM	2	cora	fb	add/min	128	0.4355	0.4185	1.041
g-SpMM	2	cora	fb	add/sum	128	0.4995	0.4828	1.035
g-SpMM	2	cora	fb	copy_e/max	128	0.4205	0.3829	1.098
g-SpMM	2	cora	fb	copy_e/min	128	0.4128	0.4685	0.881
g-SpMM	2	cora	fb	copy_e/sum	128	0.5725	0.4243	1.349
g-SpMM	2	cora	fb	copy_u/max	128	0.4254	0.3795	1.121
g-SpMM	2	cora	fb	copy_u/min	128	0.4268	0.3874	1.102
g-SpMM	2	cora	fb	copy_u/sum	128	0.4719	0.3974	1.187
g-SpMM	2	cora	fb	div/max	128	0.4726	0.4053	1.166
g-SpMM	2	cora	fb	div/min	128	0.4588	0.4187	1.096
g-SpMM	2	cora	fb	div/sum	128	0.4865	0.4387	1.109
g-SpMM	2	cora	fb	mul/max	128	0.4739	0.4175	1.135
g-SpMM	2	cora	fb	mul/min	128	0.4600	0.4205	1.094
g-SpMM	2	cora	fb	mul/sum	128	0.5004	0.4493	1.114
g-SpMM	2	cora	fb	sub/max	128	0.4460	0.4207	1.060
g-SpMM	2	cora	fb	sub/min	128	0.4511	0.4328	1.042
g-SpMM	2	cora	fb	sub/sum	128	0.5074	0.4806	1.056
g-SpMM	2	cora	fwd	add/max	128	0.0884	0.0887	0.996
g-SpMM	2	cora	fwd	add/min	128	0.0869	0.0891	0.975
g-SpMM	2	cora	fwd	add/sum	128	0.0818	0.0902	0.907
g-SpMM	2	cora	fwd	copy_e/max	128	0.0866	0.0955	0.907
g-SpMM	2	cora	fwd	copy_e/min	128	0.0882	0.0894	0.987
g-SpMM	2	cora	fwd	copy_e/sum	128	0.0799	0.0808	0.989
g-SpMM	2	cora	fwd	copy_u/max	128	0.0882	0.0897	0.983
g-SpMM	2	cora	fwd	copy_u/min	128	0.0867	0.0886	0.978
g-SpMM	2	cora	fwd	copy_u/sum	128	0.0781	0.0870	0.898
g-SpMM	2	cora	fwd	div/max	128	0.0910	0.0892	1.021
g-SpMM	2	cora	fwd	div/min	128	0.0899	0.0894	1.006
g-SpMM	2	cora	fwd	div/sum	128	0.0801	0.0836	0.959
g-SpMM	2	cora	fwd	mul/max	128	0.0908	0.0886	1.025
g-SpMM	2	cora	fwd	mul/min	128	0.0875	0.0894	0.979
g-SpMM	2	cora	fwd	mul/sum	128	0.0847	0.0832	1.017
g-SpMM	2	cora	fwd	sub/max	128	0.0874	0.0892	0.980
g-SpMM	2	cora	fwd	sub/min	128	0.0873	0.0891	0.980
g-SpMM	2	cora	fwd	sub/sum	128	0.0807	0.0826	0.976
g-SpMM	2	cora	bwd	add/max	256	0.2217	0.2164	1.024
g-SpMM	2	cora	bwd	add/min	256	0.2264	0.2136	1.060
g-SpMM	2	cora	bwd	add/sum	256	0.2910	0.3003	0.969
g-SpMM	2	cora	bwd	copy_e/max	256	0.2016	0.1975	1.021
g-SpMM	2	cora	bwd	copy_e/min	256	0.1993	0.2002	0.995
g-SpMM	2	cora	bwd	copy_e/sum	256	0.2152	0.1928	1.116
g-SpMM	2	cora	bwd	copy_u/max	256	0.1963	0.1948	1.008
g-SpMM	2	cora	bwd	copy_u/min	256	0.1971	0.2007	0.982
g-SpMM	2	cora	bwd	copy_u/sum	256	0.2272	0.2284	0.995
g-SpMM	2	cora	bwd	div/max	256	0.2193	0.2304	0.952
g-SpMM	2	cora	bwd	div/min	256	0.2249	0.2108	1.067
g-SpMM	2	cora	bwd	div/sum	256	0.2566	0.2782	0.922
g-SpMM	2	cora	bwd	mul/max	256	0.2286	0.2155	1.061
g-SpMM	2	cora	bwd	mul/min	256	0.2206	0.2308	0.956
g-SpMM	2	cora	bwd	mul/sum	256	0.2779	0.2501	1.112
g-SpMM	2	cora	bwd	sub/max	256	0.2276	0.2090	1.089
g-SpMM	2	cora	bwd	sub/min	256	0.2213	0.2183	1.013
g-SpMM	2	cora	bwd	sub/sum	256	0.2890	0.3236	0.893
g-SpMM	2	cora	fb	add/max	256	0.4894	0.4422	1.107
g-SpMM	2	cora	fb	add/min	256	0.4617	0.4466	1.034
g-SpMM	2	cora	fb	add/sum	256	0.5123	0.5023	1.020
g-SpMM	2	cora	fb	copy_e/max	256	0.4271	0.4297	0.994
g-SpMM	2	cora	fb	copy_e/min	256	0.4259	0.4158	1.024
g-SpMM	2	cora	fb	copy_e/sum	256	0.4154	0.4055	1.024
g-SpMM	2	cora	fb	copy_u/max	256	0.4228	0.4303	0.983
g-SpMM	2	cora	fb	copy_u/min	256	0.5021	0.4397	1.142
g-SpMM	2	cora	fb	copy_u/sum	256	0.4524	0.4259	1.062
g-SpMM	2	cora	fb	div/max	256	0.4534	0.4654	0.974
g-SpMM	2	cora	fb	div/min	256	0.4649	0.4617	1.007
g-SpMM	2	cora	fb	div/sum	256	0.4893	0.4968	0.985
g-SpMM	2	cora	fb	mul/max	256	0.4675	0.4471	1.045
g-SpMM	2	cora	fb	mul/min	256	0.4555	0.4488	1.015
g-SpMM	2	cora	fb	mul/sum	256	0.4944	0.4709	1.050
g-SpMM	2	cora	fb	sub/max	256	0.4521	0.4349	1.040
g-SpMM	2	cora	fb	sub/min	256	0.4671	0.4479	1.043
g-SpMM	2	cora	fb	sub/sum	256	0.5104	0.5005	1.020
g-SpMM	2	cora	fwd	add/max	256	0.0968	0.0954	1.015
g-SpMM	2	cora	fwd	add/min	256	0.0882	0.1080	0.817
g-SpMM	2	cora	fwd	add/sum	256	0.0887	0.0836	1.061

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	cora	fwd	copy_e/max	256	0.0877	0.0870	1.007
g-SpMM	2	cora	fwd	copy_e/min	256	0.0874	0.0872	1.002
g-SpMM	2	cora	fwd	copy_e/sum	256	0.0788	0.0800	0.985
g-SpMM	2	cora	fwd	copy_u/max	256	0.0833	0.0909	0.916
g-SpMM	2	cora	fwd	copy_u/min	256	0.0842	0.0922	0.913
g-SpMM	2	cora	fwd	copy_u/sum	256	0.0811	0.0810	1.001
g-SpMM	2	cora	fwd	div/max	256	0.0926	0.0929	0.996
g-SpMM	2	cora	fwd	div/min	256	0.0865	0.1026	0.843
g-SpMM	2	cora	fwd	div/sum	256	0.0797	0.0867	0.919
g-SpMM	2	cora	fwd	mul/max	256	0.0850	0.1025	0.829
g-SpMM	2	cora	fwd	mul/min	256	0.0868	0.1034	0.839
g-SpMM	2	cora	fwd	mul/sum	256	0.0807	0.0841	0.959
g-SpMM	2	cora	fwd	sub/max	256	0.0851	0.1061	0.802
g-SpMM	2	cora	fwd	sub/min	256	0.0871	0.0945	0.921
g-SpMM	2	cora	fwd	sub/sum	256	0.0824	0.0838	0.983
g-SpMM	2	cora	bwd	add/max	512	0.2398	0.2287	1.049
g-SpMM	2	cora	bwd	add/min	512	0.2310	0.2284	1.011
g-SpMM	2	cora	bwd	add/sum	512	0.3007	0.3212	0.936
g-SpMM	2	cora	bwd	copy_e/max	512	0.1963	0.1816	1.081
g-SpMM	2	cora	bwd	copy_e/min	512	0.2052	0.2042	1.005
g-SpMM	2	cora	bwd	copy_e/sum	512	0.1985	0.1956	1.015
g-SpMM	2	cora	bwd	copy_u/max	512	0.1962	0.1832	1.071
g-SpMM	2	cora	bwd	copy_u/min	512	0.1907	0.1862	1.024
g-SpMM	2	cora	bwd	copy_u/sum	512	0.2165	0.2202	0.984
g-SpMM	2	cora	bwd	div/max	512	0.4314	0.3146	1.371
g-SpMM	2	cora	bwd	div/min	512	0.4316	0.3153	1.369
g-SpMM	2	cora	bwd	div/sum	512	0.3362	0.7212	0.466
g-SpMM	2	cora	bwd	mul/max	512	0.4152	0.3142	1.321
g-SpMM	2	cora	bwd	mul/min	512	0.4161	0.3086	1.348
g-SpMM	2	cora	bwd	mul/sum	512	0.2376	0.4666	0.509
g-SpMM	2	cora	bwd	sub/max	512	0.2063	0.2333	0.884
g-SpMM	2	cora	bwd	sub/min	512	0.2066	0.2343	0.882
g-SpMM	2	cora	bwd	sub/sum	512	0.3056	0.2883	1.060
g-SpMM	2	cora	fb	add/max	512	0.4781	0.5266	0.908
g-SpMM	2	cora	fb	add/min	512	0.4804	0.5327	0.902
g-SpMM	2	cora	fb	add/sum	512	0.5511	0.5811	0.948
g-SpMM	2	cora	fb	copy_e/max	512	0.4247	0.3421	1.242
g-SpMM	2	cora	fb	copy_e/min	512	0.4357	0.4464	0.976
g-SpMM	2	cora	fb	copy_e/sum	512	0.4110	0.4066	1.011
g-SpMM	2	cora	fb	copy_u/max	512	0.4347	0.4099	1.061
g-SpMM	2	cora	fb	copy_u/min	512	0.4162	0.4295	0.969
g-SpMM	2	cora	fb	copy_u/sum	512	0.4472	0.4437	1.008
g-SpMM	2	cora	fb	div/max	512	0.6031	0.8296	0.727
g-SpMM	2	cora	fb	div/min	512	0.6110	0.6551	0.933
g-SpMM	2	cora	fb	div/sum	512	0.5285	0.9787	0.540
g-SpMM	2	cora	fb	mul/max	512	0.5912	0.6446	0.917
g-SpMM	2	cora	fb	mul/min	512	0.5896	0.6437	0.916
g-SpMM	2	cora	fb	mul/sum	512	0.3811	0.7727	0.493
g-SpMM	2	cora	fb	sub/max	512	0.3851	0.5346	0.720
g-SpMM	2	cora	fb	sub/min	512	0.4734	0.5348	0.885
g-SpMM	2	cora	fb	sub/sum	512	0.5079	0.5323	0.954
g-SpMM	2	cora	fwd	add/max	512	0.1555	0.3317	0.469
g-SpMM	2	cora	fwd	add/min	512	0.1558	0.3281	0.475
g-SpMM	2	cora	fwd	add/sum	512	0.1158	0.2725	0.425
g-SpMM	2	cora	fwd	copy_e/max	512	0.0929	0.0871	1.067
g-SpMM	2	cora	fwd	copy_e/min	512	0.0914	0.1011	0.904
g-SpMM	2	cora	fwd	copy_e/sum	512	0.0934	0.0951	0.982
g-SpMM	2	cora	fwd	copy_u/max	512	0.0895	0.1292	0.693
g-SpMM	2	cora	fwd	copy_u/min	512	0.0902	0.1284	0.703
g-SpMM	2	cora	fwd	copy_u/sum	512	0.0866	0.1139	0.760
g-SpMM	2	cora	fwd	div/max	512	0.1557	0.3302	0.472
g-SpMM	2	cora	fwd	div/min	512	0.1573	0.3292	0.478
g-SpMM	2	cora	fwd	div/sum	512	0.1227	0.2417	0.508
g-SpMM	2	cora	fwd	mul/max	512	0.1546	0.3250	0.476
g-SpMM	2	cora	fwd	mul/min	512	0.1541	0.3227	0.478
g-SpMM	2	cora	fwd	mul/sum	512	0.1012	0.2554	0.396
g-SpMM	2	cora	fwd	sub/max	512	0.1587	0.3235	0.491
g-SpMM	2	cora	fwd	sub/min	512	0.1548	0.3211	0.482
g-SpMM	2	cora	fwd	sub/sum	512	0.1154	0.2662	0.434
g-SpMM	2	hm-categories	bwd	copy_u/max	64	0.1891	0.1980	0.955
g-SpMM	2	hm-categories	bwd	copy_u/min	64	0.1840	0.2015	0.913
g-SpMM	2	hm-categories	bwd	copy_u/sum	64	2.2221	4.6044	0.483
g-SpMM	2	hm-categories	fb	copy_u/max	64	2.1660	5.0247	0.431
g-SpMM	2	hm-categories	fb	copy_u/min	64	2.1381	5.0785	0.421
g-SpMM	2	hm-categories	fb	copy_u/sum	64	4.5294	9.5709	0.473
g-SpMM	2	hm-categories	fwd	copy_u/max	64	1.9096	4.7909	0.399
g-SpMM	2	hm-categories	fwd	copy_u/min	64	1.9039	4.7193	0.403
g-SpMM	2	hm-categories	fwd	copy_u/sum	64	2.2186	4.5894	0.483

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	hm-categories	bwd	copy_u/max	128	0.2520	0.2976	0.847
g-SpMM	2	hm-categories	bwd	copy_u/min	128	0.2481	0.2505	0.990
g-SpMM	2	hm-categories	bwd	copy_u/sum	128	4.2229	8.7719	0.481
g-SpMM	2	hm-categories	fb	copy_u/max	128	3.7514	9.1403	0.410
g-SpMM	2	hm-categories	fb	copy_u/min	128	3.8477	9.1047	0.423
g-SpMM	2	hm-categories	fb	copy_u/sum	128	8.5041	17.9701	0.473
g-SpMM	2	hm-categories	fwd	copy_u/max	128	3.6437	9.0247	0.404
g-SpMM	2	hm-categories	fwd	copy_u/min	128	3.6275	9.2316	0.393
g-SpMM	2	hm-categories	fwd	copy_u/sum	128	4.1597	8.6174	0.483
g-SpMM	2	hm-categories	bwd	copy_u/max	256	0.4226	0.4337	0.974
g-SpMM	2	hm-categories	bwd	copy_u/min	256	0.4555	0.4527	1.006
g-SpMM	2	hm-categories	bwd	copy_u/sum	256	8.7640	18.5453	0.473
g-SpMM	2	hm-categories	fb	copy_u/max	256	7.4696	19.6943	0.379
g-SpMM	2	hm-categories	fb	copy_u/min	256	7.6801	20.1311	0.382
g-SpMM	2	hm-categories	fb	copy_u/sum	256	17.9019	38.0561	0.470
g-SpMM	2	hm-categories	fwd	copy_u/max	256	7.2628	19.7010	0.369
g-SpMM	2	hm-categories	fwd	copy_u/min	256	7.3107	19.1079	0.383
g-SpMM	2	hm-categories	fwd	copy_u/sum	256	8.8532	18.6221	0.475
g-SpMM	2	hm-categories	bwd	copy_u/max	512	0.7180	0.7136	1.006
g-SpMM	2	hm-categories	bwd	copy_u/min	512	0.7583	0.7228	1.049
g-SpMM	2	hm-categories	bwd	copy_u/sum	512	19.0305	39.0054	0.488
g-SpMM	2	hm-categories	fb	copy_u/max	512	16.1316	41.8218	0.386
g-SpMM	2	hm-categories	fb	copy_u/min	512	15.9780	42.2989	0.378
g-SpMM	2	hm-categories	fb	copy_u/sum	512	39.3782	80.5289	0.489
g-SpMM	2	hm-categories	fwd	copy_u/max	512	15.5890	41.5343	0.375
g-SpMM	2	hm-categories	fwd	copy_u/min	512	15.6775	40.7331	0.385
g-SpMM	2	hm-categories	fwd	copy_u/sum	512	19.5086	39.3826	0.495
g-SpMM	2	ogbn-arxiv	bwd	add/max	64	0.9456	0.8339	1.134
g-SpMM	2	ogbn-arxiv	bwd	add/min	64	0.9459	0.8279	1.143
g-SpMM	2	ogbn-arxiv	bwd	add/sum	64	0.5812	0.8075	0.720
g-SpMM	2	ogbn-arxiv	bwd	copy_e/max	64	0.6667	0.8057	0.827
g-SpMM	2	ogbn-arxiv	bwd	copy_e/min	64	0.6673	0.8020	0.832
g-SpMM	2	ogbn-arxiv	bwd	copy_e/sum	64	0.4247	0.4011	1.059
g-SpMM	2	ogbn-arxiv	bwd	copy_u/max	64	0.2280	0.2269	1.005
g-SpMM	2	ogbn-arxiv	bwd	copy_u/min	64	0.2264	0.2262	1.001
g-SpMM	2	ogbn-arxiv	bwd	copy_u/sum	64	0.2649	0.4725	0.561
g-SpMM	2	ogbn-arxiv	bwd	div/max	64	1.1226	0.9611	1.168
g-SpMM	2	ogbn-arxiv	bwd	div/min	64	1.1192	0.9616	1.164
g-SpMM	2	ogbn-arxiv	bwd	div/sum	64	1.2971	2.5438	0.510
g-SpMM	2	ogbn-arxiv	bwd	mul/max	64	1.1025	0.9736	1.132
g-SpMM	2	ogbn-arxiv	bwd	mul/min	64	1.1039	0.9530	1.158
g-SpMM	2	ogbn-arxiv	bwd	mul/sum	64	1.0688	1.8276	0.585
g-SpMM	2	ogbn-arxiv	bwd	sub/max	64	0.9575	0.8288	1.155
g-SpMM	2	ogbn-arxiv	bwd	sub/min	64	0.9570	0.8249	1.160
g-SpMM	2	ogbn-arxiv	bwd	sub/sum	64	0.5805	0.8052	0.721
g-SpMM	2	ogbn-arxiv	fb	add/max	64	2.5991	4.0473	0.642
g-SpMM	2	ogbn-arxiv	fb	add/min	64	2.5856	4.0936	0.632
g-SpMM	2	ogbn-arxiv	fb	add/sum	64	2.5467	3.9724	0.641
g-SpMM	2	ogbn-arxiv	fb	copy_e/max	64	1.2854	1.4176	0.907
g-SpMM	2	ogbn-arxiv	fb	copy_e/min	64	1.2845	1.4281	0.899
g-SpMM	2	ogbn-arxiv	fb	copy_e/sum	64	1.9990	1.9907	1.004
g-SpMM	2	ogbn-arxiv	fb	copy_u/max	64	0.8940	1.8547	0.482
g-SpMM	2	ogbn-arxiv	fb	copy_u/min	64	0.8947	1.8537	0.483
g-SpMM	2	ogbn-arxiv	fb	copy_u/sum	64	1.0832	1.9566	0.554
g-SpMM	2	ogbn-arxiv	fb	div/max	64	2.7760	4.1872	0.663
g-SpMM	2	ogbn-arxiv	fb	div/min	64	2.7910	4.1743	0.669
g-SpMM	2	ogbn-arxiv	fb	div/sum	64	3.2960	5.3306	0.618
g-SpMM	2	ogbn-arxiv	fb	mul/max	64	2.7396	4.1700	0.657
g-SpMM	2	ogbn-arxiv	fb	mul/min	64	2.7445	4.1860	0.656
g-SpMM	2	ogbn-arxiv	fb	mul/sum	64	2.6955	4.9471	0.545
g-SpMM	2	ogbn-arxiv	fb	sub/max	64	2.5852	4.0212	0.643
g-SpMM	2	ogbn-arxiv	fb	sub/min	64	2.5883	4.0081	0.646
g-SpMM	2	ogbn-arxiv	fb	sub/sum	64	2.5599	3.9631	0.646
g-SpMM	2	ogbn-arxiv	fwd	add/max	64	1.6874	3.1988	0.528
g-SpMM	2	ogbn-arxiv	fwd	add/min	64	1.6450	3.2062	0.513
g-SpMM	2	ogbn-arxiv	fwd	add/sum	64	1.9632	3.1465	0.624
g-SpMM	2	ogbn-arxiv	fwd	copy_e/max	64	0.6195	0.6218	0.996
g-SpMM	2	ogbn-arxiv	fwd	copy_e/min	64	0.6410	0.6423	0.998
g-SpMM	2	ogbn-arxiv	fwd	copy_e/sum	64	1.6642	1.6739	0.994
g-SpMM	2	ogbn-arxiv	fwd	copy_u/max	64	0.6641	1.5887	0.418
g-SpMM	2	ogbn-arxiv	fwd	copy_u/min	64	0.6596	1.5962	0.413
g-SpMM	2	ogbn-arxiv	fwd	copy_u/sum	64	0.7919	1.4558	0.544
g-SpMM	2	ogbn-arxiv	fwd	div/max	64	1.6944	3.1997	0.530
g-SpMM	2	ogbn-arxiv	fwd	div/min	64	1.6967	3.2461	0.523
g-SpMM	2	ogbn-arxiv	fwd	div/sum	64	1.9678	2.7747	0.709
g-SpMM	2	ogbn-arxiv	fwd	mul/max	64	1.6933	3.2105	0.527
g-SpMM	2	ogbn-arxiv	fwd	mul/min	64	1.6341	3.1955	0.511
g-SpMM	2	ogbn-arxiv	fwd	mul/sum	64	1.6680	3.1139	0.536

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	ogbn-arxiv	fwd	sub/max	64	1.6771	3.1802	0.527
g-SpMM	2	ogbn-arxiv	fwd	sub/min	64	1.6608	3.1472	0.528
g-SpMM	2	ogbn-arxiv	fwd	sub/sum	64	1.9980	3.1621	0.632
g-SpMM	2	ogbn-arxiv	bwd	add/max	128	1.7240	1.5325	1.125
g-SpMM	2	ogbn-arxiv	bwd	add/min	128	1.7189	1.5303	1.123
g-SpMM	2	ogbn-arxiv	bwd	add/sum	128	0.9683	1.3671	0.708
g-SpMM	2	ogbn-arxiv	bwd	copy_e/max	128	1.2372	1.4672	0.843
g-SpMM	2	ogbn-arxiv	bwd	copy_e/min	128	1.2405	1.4616	0.849
g-SpMM	2	ogbn-arxiv	bwd	copy_e/sum	128	0.4564	0.4606	0.991
g-SpMM	2	ogbn-arxiv	bwd	copy_u/max	128	0.5141	0.5167	0.995
g-SpMM	2	ogbn-arxiv	bwd	copy_u/min	128	0.5217	0.5163	1.010
g-SpMM	2	ogbn-arxiv	bwd	copy_u/sum	128	0.4895	0.8755	0.559
g-SpMM	2	ogbn-arxiv	bwd	div/max	128	2.0532	1.7803	1.153
g-SpMM	2	ogbn-arxiv	bwd	div/min	128	2.0507	1.7659	1.161
g-SpMM	2	ogbn-arxiv	bwd	div/sum	128	2.3194	4.3870	0.529
g-SpMM	2	ogbn-arxiv	bwd	mul/max	128	2.0312	1.7578	1.156
g-SpMM	2	ogbn-arxiv	bwd	mul/min	128	2.0315	1.7480	1.162
g-SpMM	2	ogbn-arxiv	bwd	mul/sum	128	1.8695	3.1818	0.588
g-SpMM	2	ogbn-arxiv	bwd	sub/max	128	1.7425	1.5431	1.129
g-SpMM	2	ogbn-arxiv	bwd	sub/min	128	1.7383	1.5318	1.135
g-SpMM	2	ogbn-arxiv	bwd	sub/sum	128	0.9697	1.3688	0.708
g-SpMM	2	ogbn-arxiv	fb	add/max	128	5.0470	7.9530	0.635
g-SpMM	2	ogbn-arxiv	fb	add/min	128	5.0310	7.9277	0.635
g-SpMM	2	ogbn-arxiv	fb	add/sum	128	4.8919	7.7222	0.633
g-SpMM	2	ogbn-arxiv	fb	copy_e/max	128	2.4760	2.6973	0.918
g-SpMM	2	ogbn-arxiv	fb	copy_e/min	128	2.4768	2.6662	0.929
g-SpMM	2	ogbn-arxiv	fb	copy_e/sum	128	3.7835	3.7616	1.006
g-SpMM	2	ogbn-arxiv	fb	copy_u/max	128	1.9023	3.8808	0.490
g-SpMM	2	ogbn-arxiv	fb	copy_u/min	128	1.8961	3.8766	0.489
g-SpMM	2	ogbn-arxiv	fb	copy_u/sum	128	2.2655	4.0263	0.563
g-SpMM	2	ogbn-arxiv	fb	div/max	128	5.4006	8.2250	0.657
g-SpMM	2	ogbn-arxiv	fb	div/min	128	5.4378	8.1893	0.664
g-SpMM	2	ogbn-arxiv	fb	div/sum	128	6.3285	10.0353	0.631
g-SpMM	2	ogbn-arxiv	fb	mul/max	128	5.3497	8.2054	0.652
g-SpMM	2	ogbn-arxiv	fb	mul/min	128	5.3610	8.1686	0.656
g-SpMM	2	ogbn-arxiv	fb	mul/sum	128	5.1149	9.4717	0.540
g-SpMM	2	ogbn-arxiv	fb	sub/max	128	5.0330	7.9314	0.635
g-SpMM	2	ogbn-arxiv	fb	sub/min	128	5.0914	7.9448	0.641
g-SpMM	2	ogbn-arxiv	fb	sub/sum	128	4.9152	7.7431	0.635
g-SpMM	2	ogbn-arxiv	fwd	add/max	128	3.3659	6.4278	0.524
g-SpMM	2	ogbn-arxiv	fwd	add/min	128	3.3448	6.3944	0.523
g-SpMM	2	ogbn-arxiv	fwd	add/sum	128	3.9308	6.3006	0.624
g-SpMM	2	ogbn-arxiv	fwd	copy_e/max	128	1.2822	1.2819	1.000
g-SpMM	2	ogbn-arxiv	fwd	copy_e/min	128	1.2645	1.2669	0.998
g-SpMM	2	ogbn-arxiv	fwd	copy_e/sum	128	3.3058	3.3195	0.996
g-SpMM	2	ogbn-arxiv	fwd	copy_u/max	128	1.3941	3.3794	0.413
g-SpMM	2	ogbn-arxiv	fwd	copy_u/min	128	1.3951	3.3687	0.414
g-SpMM	2	ogbn-arxiv	fwd	copy_u/sum	128	1.7787	3.1725	0.561
g-SpMM	2	ogbn-arxiv	fwd	div/max	128	3.4148	6.4801	0.527
g-SpMM	2	ogbn-arxiv	fwd	div/min	128	3.4164	6.4372	0.531
g-SpMM	2	ogbn-arxiv	fwd	div/sum	128	4.0336	5.6307	0.716
g-SpMM	2	ogbn-arxiv	fwd	mul/max	128	3.3867	6.4377	0.526
g-SpMM	2	ogbn-arxiv	fwd	mul/min	128	3.3477	6.4037	0.523
g-SpMM	2	ogbn-arxiv	fwd	mul/sum	128	3.3512	6.3116	0.531
g-SpMM	2	ogbn-arxiv	fwd	sub/max	128	3.4631	6.4330	0.538
g-SpMM	2	ogbn-arxiv	fwd	sub/min	128	3.3440	6.4510	0.518
g-SpMM	2	ogbn-arxiv	fwd	sub/sum	128	3.9948	6.3486	0.629
g-SpMM	2	ogbn-arxiv	bwd	add/max	256	3.2709	2.9190	1.121
g-SpMM	2	ogbn-arxiv	bwd	add/min	256	3.2813	2.9466	1.114
g-SpMM	2	ogbn-arxiv	bwd	add/sum	256	1.8017	2.5843	0.697
g-SpMM	2	ogbn-arxiv	bwd	copy_e/max	256	2.4019	2.7700	0.867
g-SpMM	2	ogbn-arxiv	bwd	copy_e/min	256	2.4076	2.7698	0.869
g-SpMM	2	ogbn-arxiv	bwd	copy_e/sum	256	0.8437	0.8498	0.993
g-SpMM	2	ogbn-arxiv	bwd	copy_u/max	256	1.1058	1.1140	0.993
g-SpMM	2	ogbn-arxiv	bwd	copy_u/min	256	1.1059	1.1135	0.993
g-SpMM	2	ogbn-arxiv	bwd	copy_u/sum	256	0.9396	1.6939	0.555
g-SpMM	2	ogbn-arxiv	bwd	div/max	256	3.9687	3.3700	1.178
g-SpMM	2	ogbn-arxiv	bwd	div/min	256	3.9628	3.3912	1.169
g-SpMM	2	ogbn-arxiv	bwd	div/sum	256	4.3375	8.1019	0.535
g-SpMM	2	ogbn-arxiv	bwd	mul/max	256	3.9212	3.3635	1.166
g-SpMM	2	ogbn-arxiv	bwd	mul/min	256	3.9253	3.3649	1.167
g-SpMM	2	ogbn-arxiv	bwd	mul/sum	256	3.4578	5.8515	0.591
g-SpMM	2	ogbn-arxiv	bwd	sub/max	256	3.3259	2.9260	1.137
g-SpMM	2	ogbn-arxiv	bwd	sub/min	256	3.3188	2.9144	1.139
g-SpMM	2	ogbn-arxiv	bwd	sub/sum	256	1.7901	2.5538	0.701
g-SpMM	2	ogbn-arxiv	fb	add/max	256	9.9519	15.8132	0.629
g-SpMM	2	ogbn-arxiv	fb	add/min	256	9.9587	15.9194	0.626
g-SpMM	2	ogbn-arxiv	fb	add/sum	256	9.7537	15.3151	0.637

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	ogbn-arxiv	fb	copy_e/max	256	4.8729	5.2158	0.934
g-SpMM	2	ogbn-arxiv	fb	copy_e/min	256	4.8248	5.2310	0.922
g-SpMM	2	ogbn-arxiv	fb	copy_e/sum	256	7.3806	7.3399	1.006
g-SpMM	2	ogbn-arxiv	fb	copy_u/max	256	4.0360	8.3109	0.486
g-SpMM	2	ogbn-arxiv	fb	copy_u/min	256	4.0530	8.2867	0.489
g-SpMM	2	ogbn-arxiv	fb	copy_u/sum	256	4.9199	8.5756	0.574
g-SpMM	2	ogbn-arxiv	fb	div/max	256	10.7123	16.4056	0.653
g-SpMM	2	ogbn-arxiv	fb	div/min	256	10.7335	16.3698	0.656
g-SpMM	2	ogbn-arxiv	fb	div/sum	256	12.3551	19.6078	0.630
g-SpMM	2	ogbn-arxiv	fb	mul/max	256	10.5515	16.3303	0.646
g-SpMM	2	ogbn-arxiv	fb	mul/min	256	10.6142	16.2868	0.652
g-SpMM	2	ogbn-arxiv	fb	mul/sum	256	10.1125	18.5912	0.544
g-SpMM	2	ogbn-arxiv	fb	sub/max	256	9.9968	15.8772	0.630
g-SpMM	2	ogbn-arxiv	fb	sub/min	256	10.0364	15.9160	0.631
g-SpMM	2	ogbn-arxiv	fb	sub/sum	256	9.7548	15.3700	0.635
g-SpMM	2	ogbn-arxiv	fwd	add/max	256	6.8843	12.8670	0.535
g-SpMM	2	ogbn-arxiv	fwd	add/min	256	6.9045	12.8799	0.536
g-SpMM	2	ogbn-arxiv	fwd	add/sum	256	8.0230	12.6702	0.633
g-SpMM	2	ogbn-arxiv	fwd	copy_e/max	256	2.5132	2.4753	1.015
g-SpMM	2	ogbn-arxiv	fwd	copy_e/min	256	2.4973	2.4699	1.011
g-SpMM	2	ogbn-arxiv	fwd	copy_e/sum	256	6.4325	6.5398	0.984
g-SpMM	2	ogbn-arxiv	fwd	copy_u/max	256	2.9820	7.2225	0.413
g-SpMM	2	ogbn-arxiv	fwd	copy_u/min	256	2.9909	7.2199	0.414
g-SpMM	2	ogbn-arxiv	fwd	copy_u/sum	256	3.9717	6.9069	0.575
g-SpMM	2	ogbn-arxiv	fwd	div/max	256	7.0291	12.9837	0.541
g-SpMM	2	ogbn-arxiv	fwd	div/min	256	6.9703	12.9550	0.538
g-SpMM	2	ogbn-arxiv	fwd	div/sum	256	8.1353	11.5826	0.702
g-SpMM	2	ogbn-arxiv	fwd	mul/max	256	6.9037	12.9381	0.534
g-SpMM	2	ogbn-arxiv	fwd	mul/min	256	6.8764	12.9071	0.533
g-SpMM	2	ogbn-arxiv	fwd	mul/sum	256	6.7623	12.7268	0.531
g-SpMM	2	ogbn-arxiv	fwd	sub/max	256	6.9181	12.9812	0.533
g-SpMM	2	ogbn-arxiv	fwd	sub/min	256	6.7608	13.0635	0.518
g-SpMM	2	ogbn-arxiv	fwd	sub/sum	256	8.1937	12.7703	0.642
g-SpMM	2	ogbn-arxiv	bwd	add/max	512	6.0940	5.2567	1.159
g-SpMM	2	ogbn-arxiv	bwd	add/min	512	6.1023	5.2608	1.160
g-SpMM	2	ogbn-arxiv	bwd	add/sum	512	3.1461	4.7351	0.664
g-SpMM	2	ogbn-arxiv	bwd	copy_e/max	512	4.5920	4.9726	0.923
g-SpMM	2	ogbn-arxiv	bwd	copy_e/min	512	4.6135	4.9551	0.931
g-SpMM	2	ogbn-arxiv	bwd	copy_e/sum	512	1.5267	1.5417	0.990
g-SpMM	2	ogbn-arxiv	bwd	copy_u/max	512	2.2650	2.2628	1.001
g-SpMM	2	ogbn-arxiv	bwd	copy_u/min	512	2.2647	2.2636	1.001
g-SpMM	2	ogbn-arxiv	bwd	copy_u/sum	512	1.6186	3.1868	0.508
g-SpMM	2	ogbn-arxiv	bwd	div/max	512	7.5105	6.1994	1.211
g-SpMM	2	ogbn-arxiv	bwd	div/min	512	7.5535	6.1971	1.219
g-SpMM	2	ogbn-arxiv	bwd	div/sum	512	8.1347	16.1635	0.503
g-SpMM	2	ogbn-arxiv	bwd	mul/max	512	7.5075	6.1725	1.216
g-SpMM	2	ogbn-arxiv	bwd	mul/min	512	7.5019	6.1333	1.223
g-SpMM	2	ogbn-arxiv	bwd	mul/sum	512	6.2707	11.2956	0.555
g-SpMM	2	ogbn-arxiv	bwd	sub/max	512	6.1502	5.2739	1.166
g-SpMM	2	ogbn-arxiv	bwd	sub/min	512	6.1501	5.2793	1.165
g-SpMM	2	ogbn-arxiv	bwd	sub/sum	512	3.1591	4.7394	0.667
g-SpMM	2	ogbn-arxiv	fb	add/max	512	19.6261	31.2451	0.628
g-SpMM	2	ogbn-arxiv	fb	add/min	512	19.4889	31.3540	0.622
g-SpMM	2	ogbn-arxiv	fb	add/sum	512	18.9156	30.6043	0.618
g-SpMM	2	ogbn-arxiv	fb	copy_e/max	512	9.6217	10.0655	0.956
g-SpMM	2	ogbn-arxiv	fb	copy_e/min	512	9.6936	9.9682	0.972
g-SpMM	2	ogbn-arxiv	fb	copy_e/sum	512	14.4278	14.4689	0.997
g-SpMM	2	ogbn-arxiv	fb	copy_u/max	512	8.3144	17.4869	0.475
g-SpMM	2	ogbn-arxiv	fb	copy_u/min	512	8.3529	17.4095	0.480
g-SpMM	2	ogbn-arxiv	fb	copy_u/sum	512	10.1110	17.9312	0.564
g-SpMM	2	ogbn-arxiv	fb	div/max	512	21.2377	32.6257	0.651
g-SpMM	2	ogbn-arxiv	fb	div/min	512	21.2331	32.6405	0.651
g-SpMM	2	ogbn-arxiv	fb	div/sum	512	24.2653	39.4443	0.615
g-SpMM	2	ogbn-arxiv	fb	mul/max	512	20.9334	32.2934	0.648
g-SpMM	2	ogbn-arxiv	fb	mul/min	512	21.0824	32.2916	0.653
g-SpMM	2	ogbn-arxiv	fb	mul/sum	512	19.3992	37.0217	0.524
g-SpMM	2	ogbn-arxiv	fb	sub/max	512	19.6816	31.3182	0.628
g-SpMM	2	ogbn-arxiv	fb	sub/min	512	19.6196	31.5830	0.621
g-SpMM	2	ogbn-arxiv	fb	sub/sum	512	19.1975	30.6296	0.627
g-SpMM	2	ogbn-arxiv	fwd	add/max	512	14.0076	26.0661	0.537
g-SpMM	2	ogbn-arxiv	fwd	add/min	512	13.6259	26.1251	0.522
g-SpMM	2	ogbn-arxiv	fwd	add/sum	512	16.0676	25.8074	0.623
g-SpMM	2	ogbn-arxiv	fwd	copy_e/max	512	5.1131	5.1870	0.986
g-SpMM	2	ogbn-arxiv	fwd	copy_e/min	512	5.1870	5.2034	0.997
g-SpMM	2	ogbn-arxiv	fwd	copy_e/sum	512	12.8759	13.0210	0.989
g-SpMM	2	ogbn-arxiv	fwd	copy_u/max	512	6.1267	15.3250	0.400
g-SpMM	2	ogbn-arxiv	fwd	copy_u/min	512	6.1151	15.2303	0.402
g-SpMM	2	ogbn-arxiv	fwd	copy_u/sum	512	8.4831	14.6284	0.580

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	ogbn-arxiv	fwd	div/max	512	14.0726	26.5599	0.530
g-SpMM	2	ogbn-arxiv	fwd	div/min	512	13.8942	26.3976	0.526
g-SpMM	2	ogbn-arxiv	fwd	div/sum	512	16.5794	23.1891	0.715
g-SpMM	2	ogbn-arxiv	fwd	mul/max	512	13.8496	26.1755	0.529
g-SpMM	2	ogbn-arxiv	fwd	mul/min	512	13.7838	26.5039	0.520
g-SpMM	2	ogbn-arxiv	fwd	mul/sum	512	13.5287	25.4770	0.531
g-SpMM	2	ogbn-arxiv	fwd	sub/max	512	13.9384	25.9579	0.537
g-SpMM	2	ogbn-arxiv	fwd	sub/min	512	13.8048	26.0726	0.529
g-SpMM	2	ogbn-arxiv	fwd	sub/sum	512	16.4284	25.7893	0.637
g-SpMM	2	ogbn-products	bwd	copy_u/max	64	13.7501	13.7432	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/min	64	13.7391	13.7471	0.999
g-SpMM	2	ogbn-products	bwd	copy_u/sum	64	16.5686	37.8170	0.438
g-SpMM	2	ogbn-products	fb	copy_u/max	64	30.7156	52.9577	0.580
g-SpMM	2	ogbn-products	fb	copy_u/min	64	30.7266	52.9003	0.581
g-SpMM	2	ogbn-products	fb	copy_u/sum	64	33.1601	75.7050	0.438
g-SpMM	2	ogbn-products	fwd	copy_u/max	64	17.0203	39.2011	0.434
g-SpMM	2	ogbn-products	fwd	copy_u/min	64	16.9978	39.2278	0.433
g-SpMM	2	ogbn-products	fwd	copy_u/sum	64	16.5551	37.8124	0.438
g-SpMM	2	ogbn-products	bwd	copy_u/max	128	29.6977	29.7023	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/min	128	29.6818	29.6834	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/sum	128	30.8622	69.1940	0.446
g-SpMM	2	ogbn-products	fb	copy_u/max	128	61.2342	101.3441	0.604
g-SpMM	2	ogbn-products	fb	copy_u/min	128	61.2311	101.3751	0.604
g-SpMM	2	ogbn-products	fb	copy_u/sum	128	61.8012	138.5922	0.446
g-SpMM	2	ogbn-products	fwd	copy_u/max	128	31.5998	71.6912	0.441
g-SpMM	2	ogbn-products	fwd	copy_u/min	128	31.5408	71.6488	0.440
g-SpMM	2	ogbn-products	fwd	copy_u/sum	128	30.8180	69.1565	0.446
g-SpMM	2	ogbn-products	bwd	copy_u/max	256	58.9270	58.9588	0.999
g-SpMM	2	ogbn-products	bwd	copy_u/min	256	58.9533	58.9609	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/sum	256	61.2247	133.1234	0.460
g-SpMM	2	ogbn-products	fb	copy_u/max	256	149.2710	225.1170	0.663
g-SpMM	2	ogbn-products	fb	copy_u/min	256	153.2847	224.6664	0.682
g-SpMM	2	ogbn-products	fb	copy_u/sum	256	122.5419	266.6529	0.460
g-SpMM	2	ogbn-products	fwd	copy_u/max	256	90.4307	166.2100	0.544
g-SpMM	2	ogbn-products	fwd	copy_u/min	256	63.1958	169.2851	0.373
g-SpMM	2	ogbn-products	fwd	copy_u/sum	256	61.1012	133.2840	0.458
g-SpMM	2	ogbn-products	bwd	copy_u/max	512	123.1265	123.0878	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/min	512	123.1409	123.0802	1.000
g-SpMM	2	ogbn-products	bwd	copy_u/sum	512	123.7424	287.8492	0.430
g-SpMM	2	ogbn-products	fb	copy_u/max	512	304.3282	455.6798	0.668
g-SpMM	2	ogbn-products	fb	copy_u/min	512	303.6015	453.1979	0.670
g-SpMM	2	ogbn-products	fb	copy_u/sum	512	269.3409	552.3973	0.488
g-SpMM	2	ogbn-products	fwd	copy_u/max	512	171.5782	347.4954	0.494
g-SpMM	2	ogbn-products	fwd	copy_u/min	512	158.8181	343.7779	0.462
g-SpMM	2	ogbn-products	fwd	copy_u/sum	512	120.6923	263.4832	0.458
g-SpMM	2	ogbn-proteins	bwd	copy_u/max	64	0.3365	0.3375	0.997
g-SpMM	2	ogbn-proteins	bwd	copy_u/min	64	0.3369	0.3395	0.992
g-SpMM	2	ogbn-proteins	bwd	copy_u/sum	64	5.2808	14.4132	0.366
g-SpMM	2	ogbn-proteins	fb	copy_u/max	64	6.4688	15.0866	0.429
g-SpMM	2	ogbn-proteins	fb	copy_u/min	64	6.4630	15.0890	0.428
g-SpMM	2	ogbn-proteins	fb	copy_u/sum	64	10.4929	28.6660	0.366
g-SpMM	2	ogbn-proteins	fwd	copy_u/max	64	6.1327	14.7764	0.415
g-SpMM	2	ogbn-proteins	fwd	copy_u/min	64	6.1331	14.7630	0.415
g-SpMM	2	ogbn-proteins	fwd	copy_u/sum	64	5.2516	14.3785	0.365
g-SpMM	2	ogbn-proteins	bwd	copy_u/max	128	0.5705	0.5702	1.000
g-SpMM	2	ogbn-proteins	bwd	copy_u/min	128	0.5705	0.5717	0.998
g-SpMM	2	ogbn-proteins	bwd	copy_u/sum	128	9.6071	25.4177	0.378
g-SpMM	2	ogbn-proteins	fb	copy_u/max	128	12.0288	27.0913	0.444
g-SpMM	2	ogbn-proteins	fb	copy_u/min	128	12.0092	27.0909	0.443
g-SpMM	2	ogbn-proteins	fb	copy_u/sum	128	19.1858	50.7442	0.378
g-SpMM	2	ogbn-proteins	fwd	copy_u/max	128	11.4427	26.4986	0.432
g-SpMM	2	ogbn-proteins	fwd	copy_u/min	128	11.4472	26.4912	0.432
g-SpMM	2	ogbn-proteins	fwd	copy_u/sum	128	9.5946	25.3942	0.378
g-SpMM	2	ogbn-proteins	bwd	copy_u/max	256	1.0172	1.0207	0.997
g-SpMM	2	ogbn-proteins	bwd	copy_u/min	256	1.0214	1.0261	0.995
g-SpMM	2	ogbn-proteins	bwd	copy_u/sum	256	19.2390	49.1008	0.392
g-SpMM	2	ogbn-proteins	fb	copy_u/max	256	23.5973	52.9466	0.446
g-SpMM	2	ogbn-proteins	fb	copy_u/min	256	23.6102	52.9792	0.446
g-SpMM	2	ogbn-proteins	fb	copy_u/sum	256	38.3152	98.1897	0.390
g-SpMM	2	ogbn-proteins	fwd	copy_u/max	256	22.5803	51.9079	0.435
g-SpMM	2	ogbn-proteins	fwd	copy_u/min	256	22.5778	51.8934	0.435
g-SpMM	2	ogbn-proteins	fwd	copy_u/sum	256	19.0995	48.9700	0.390
g-SpMM	2	ogbn-proteins	bwd	copy_u/max	512	2.0967	2.0838	1.006
g-SpMM	2	ogbn-proteins	bwd	copy_u/min	512	2.0749	2.0707	1.002
g-SpMM	2	ogbn-proteins	bwd	copy_u/sum	512	40.8700	108.1254	0.378
g-SpMM	2	ogbn-proteins	fb	copy_u/max	512	48.0453	115.2506	0.417
g-SpMM	2	ogbn-proteins	fb	copy_u/min	512	48.0589	115.2540	0.417
g-SpMM	2	ogbn-proteins	fb	copy_u/sum	512	81.9283	216.6572	0.378

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	ogbn-proteins	fwd	copy_u/max	512	45.9952	113.0236	0.407
g-SpMM	2	ogbn-proteins	fwd	copy_u/min	512	45.9558	113.0050	0.407
g-SpMM	2	ogbn-proteins	fwd	copy_u/sum	512	40.7025	108.0814	0.377
g-SpMM	2	pokec-regions	bwd	copy_u/max	64	5.1667	5.1576	1.002
g-SpMM	2	pokec-regions	bwd	copy_u/min	64	5.1547	5.1536	1.000
g-SpMM	2	pokec-regions	bwd	copy_u/sum	64	4.7302	10.0122	0.472
g-SpMM	2	pokec-regions	fb	copy_u/max	64	10.1908	15.7624	0.647
g-SpMM	2	pokec-regions	fb	copy_u/min	64	10.1960	15.7644	0.647
g-SpMM	2	pokec-regions	fb	copy_u/sum	64	9.4634	19.9999	0.473
g-SpMM	2	pokec-regions	fwd	copy_u/max	64	5.0708	10.6275	0.477
g-SpMM	2	pokec-regions	fwd	copy_u/min	64	5.0499	10.6195	0.476
g-SpMM	2	pokec-regions	fwd	copy_u/sum	64	4.7386	9.9926	0.474
g-SpMM	2	pokec-regions	bwd	copy_u/max	128	11.1779	11.1704	1.001
g-SpMM	2	pokec-regions	bwd	copy_u/min	128	11.1667	11.1693	1.000
g-SpMM	2	pokec-regions	bwd	copy_u/sum	128	8.7691	18.4656	0.475
g-SpMM	2	pokec-regions	fb	copy_u/max	128	20.4596	30.6647	0.667
g-SpMM	2	pokec-regions	fb	copy_u/min	128	20.4620	30.6816	0.667
g-SpMM	2	pokec-regions	fb	copy_u/sum	128	17.6538	36.8175	0.479
g-SpMM	2	pokec-regions	fwd	copy_u/max	128	9.3695	19.5472	0.479
g-SpMM	2	pokec-regions	fwd	copy_u/min	128	9.3288	19.5407	0.477
g-SpMM	2	pokec-regions	fwd	copy_u/sum	128	8.8878	18.4051	0.483
g-SpMM	2	pokec-regions	bwd	copy_u/max	256	21.8430	21.8473	1.000
g-SpMM	2	pokec-regions	bwd	copy_u/min	256	23.5766	21.8334	1.080
g-SpMM	2	pokec-regions	bwd	copy_u/sum	256	17.0448	35.4463	0.481
g-SpMM	2	pokec-regions	fb	copy_u/max	256	40.7090	60.2366	0.676
g-SpMM	2	pokec-regions	fb	copy_u/min	256	40.7338	60.2311	0.676
g-SpMM	2	pokec-regions	fb	copy_u/sum	256	34.4201	70.7571	0.486
g-SpMM	2	pokec-regions	fwd	copy_u/max	256	18.2178	37.5514	0.485
g-SpMM	2	pokec-regions	fwd	copy_u/min	256	18.0694	37.5567	0.481
g-SpMM	2	pokec-regions	fwd	copy_u/sum	256	17.4521	35.3445	0.494
g-SpMM	2	pokec-regions	bwd	copy_u/max	512	46.1982	46.2127	1.000
g-SpMM	2	pokec-regions	bwd	copy_u/min	512	46.2444	46.2165	1.001
g-SpMM	2	pokec-regions	bwd	copy_u/sum	512	31.9027	68.2464	0.467
g-SpMM	2	pokec-regions	fb	copy_u/max	512	104.5971	145.8902	0.717
g-SpMM	2	pokec-regions	fb	copy_u/min	512	104.1012	141.7130	0.735
g-SpMM	2	pokec-regions	fb	copy_u/sum	512	91.7780	158.9704	0.577
g-SpMM	2	pokec-regions	fwd	copy_u/max	512	65.2315	108.0374	0.604
g-SpMM	2	pokec-regions	fwd	copy_u/min	512	66.6299	106.3880	0.626
g-SpMM	2	pokec-regions	fwd	copy_u/sum	512	32.9303	68.0766	0.484
g-SpMM	2	pubmed	bwd	add/max	64	0.2279	0.2277	1.001
g-SpMM	2	pubmed	bwd	add/min	64	0.2148	0.2246	0.956
g-SpMM	2	pubmed	bwd	add/sum	64	0.2889	0.2944	0.981
g-SpMM	2	pubmed	bwd	copy_e/max	64	0.2116	0.2057	1.029
g-SpMM	2	pubmed	bwd	copy_e/min	64	0.2054	0.1950	1.053
g-SpMM	2	pubmed	bwd	copy_e/sum	64	0.1987	0.1934	1.028
g-SpMM	2	pubmed	bwd	copy_u/max	64	0.2008	0.2032	0.988
g-SpMM	2	pubmed	bwd	copy_u/min	64	0.1919	0.2011	0.954
g-SpMM	2	pubmed	bwd	copy_u/sum	64	0.2211	0.2385	0.927
g-SpMM	2	pubmed	bwd	div/max	64	0.2222	0.2258	0.984
g-SpMM	2	pubmed	bwd	div/min	64	0.2300	0.2183	1.054
g-SpMM	2	pubmed	bwd	div/sum	64	0.2500	0.2759	0.906
g-SpMM	2	pubmed	bwd	mul/max	64	0.2167	0.2163	1.002
g-SpMM	2	pubmed	bwd	mul/min	64	0.2275	0.2229	1.021
g-SpMM	2	pubmed	bwd	mul/sum	64	0.2482	0.2626	0.945
g-SpMM	2	pubmed	bwd	sub/max	64	0.2280	0.2246	1.015
g-SpMM	2	pubmed	bwd	sub/min	64	0.2150	0.2263	0.950
g-SpMM	2	pubmed	bwd	sub/sum	64	0.2866	0.2982	0.961
g-SpMM	2	pubmed	fb	add/max	64	0.4660	0.4733	0.985
g-SpMM	2	pubmed	fb	add/min	64	0.4615	0.4724	0.977
g-SpMM	2	pubmed	fb	add/sum	64	0.5171	0.5060	1.022
g-SpMM	2	pubmed	fb	copy_e/max	64	0.4328	0.4281	1.011
g-SpMM	2	pubmed	fb	copy_e/min	64	0.4357	0.4332	1.006
g-SpMM	2	pubmed	fb	copy_e/sum	64	0.4075	0.4046	1.007
g-SpMM	2	pubmed	fb	copy_u/max	64	0.4147	0.4279	0.969
g-SpMM	2	pubmed	fb	copy_u/min	64	0.4276	0.4683	0.913
g-SpMM	2	pubmed	fb	copy_u/sum	64	0.4354	0.4746	0.917
g-SpMM	2	pubmed	fb	div/max	64	0.4693	0.4629	1.014
g-SpMM	2	pubmed	fb	div/min	64	0.4393	0.4512	0.974
g-SpMM	2	pubmed	fb	div/sum	64	0.4918	0.5095	0.965
g-SpMM	2	pubmed	fb	mul/max	64	0.4427	0.4482	0.988
g-SpMM	2	pubmed	fb	mul/min	64	0.4428	0.4660	0.950
g-SpMM	2	pubmed	fb	mul/sum	64	0.4897	0.5054	0.969
g-SpMM	2	pubmed	fb	sub/max	64	0.4453	0.4776	0.932
g-SpMM	2	pubmed	fb	sub/min	64	0.4408	0.4692	0.939
g-SpMM	2	pubmed	fb	sub/sum	64	0.5046	0.5211	0.968
g-SpMM	2	pubmed	fwd	add/max	64	0.0868	0.1044	0.831
g-SpMM	2	pubmed	fwd	add/min	64	0.0888	0.1029	0.863
g-SpMM	2	pubmed	fwd	add/sum	64	0.0787	0.0879	0.896

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	pubmed	fwd	copy_e/max	64	0.0870	0.0857	1.016
g-SpMM	2	pubmed	fwd	copy_e/min	64	0.0850	0.0860	0.988
g-SpMM	2	pubmed	fwd	copy_e/sum	64	0.0770	0.0779	0.989
g-SpMM	2	pubmed	fwd	copy_u/max	64	0.0841	0.0848	0.992
g-SpMM	2	pubmed	fwd	copy_u/min	64	0.0873	0.0944	0.925
g-SpMM	2	pubmed	fwd	copy_u/sum	64	0.0864	0.0796	1.085
g-SpMM	2	pubmed	fwd	div/max	64	0.0877	0.1077	0.814
g-SpMM	2	pubmed	fwd	div/min	64	0.0869	0.1047	0.830
g-SpMM	2	pubmed	fwd	div/sum	64	0.0784	0.0853	0.919
g-SpMM	2	pubmed	fwd	mul/max	64	0.0847	0.1066	0.794
g-SpMM	2	pubmed	fwd	mul/min	64	0.0858	0.1025	0.837
g-SpMM	2	pubmed	fwd	mul/sum	64	0.0817	0.0853	0.958
g-SpMM	2	pubmed	fwd	sub/max	64	0.0858	0.1029	0.834
g-SpMM	2	pubmed	fwd	sub/min	64	0.0863	0.1082	0.797
g-SpMM	2	pubmed	fwd	sub/sum	64	0.0858	0.0880	0.975
g-SpMM	2	pubmed	bwd	add/max	128	0.1884	0.2354	0.800
g-SpMM	2	pubmed	bwd	add/min	128	0.2251	0.2212	1.018
g-SpMM	2	pubmed	bwd	add/sum	128	0.2956	0.2916	1.014
g-SpMM	2	pubmed	bwd	copy_e/max	128	0.2125	0.2000	1.062
g-SpMM	2	pubmed	bwd	copy_e/min	128	0.2091	0.2004	1.043
g-SpMM	2	pubmed	bwd	copy_e/sum	128	0.1969	0.1908	1.032
g-SpMM	2	pubmed	bwd	copy_u/max	128	0.2076	0.1925	1.078
g-SpMM	2	pubmed	bwd	copy_u/min	128	0.2075	0.1944	1.068
g-SpMM	2	pubmed	bwd	copy_u/sum	128	0.2489	0.2245	1.109
g-SpMM	2	pubmed	bwd	div/max	128	0.3523	0.2267	1.554
g-SpMM	2	pubmed	bwd	div/min	128	0.2568	0.2262	1.135
g-SpMM	2	pubmed	bwd	div/sum	128	0.2668	0.4240	0.629
g-SpMM	2	pubmed	bwd	mul/max	128	0.2464	0.2239	1.101
g-SpMM	2	pubmed	bwd	mul/min	128	0.2544	0.2267	1.122
g-SpMM	2	pubmed	bwd	mul/sum	128	0.2357	0.3191	0.739
g-SpMM	2	pubmed	bwd	sub/max	128	0.1925	0.2262	0.851
g-SpMM	2	pubmed	bwd	sub/min	128	0.1852	0.2245	0.825
g-SpMM	2	pubmed	bwd	sub/sum	128	0.2384	0.2940	0.811
g-SpMM	2	pubmed	fb	add/max	128	0.3901	0.4412	0.884
g-SpMM	2	pubmed	fb	add/min	128	0.4762	0.4682	1.017
g-SpMM	2	pubmed	fb	add/sum	128	0.5211	0.5134	1.015
g-SpMM	2	pubmed	fb	copy_e/max	128	0.5001	0.4143	1.207
g-SpMM	2	pubmed	fb	copy_e/min	128	0.4812	0.4233	1.137
g-SpMM	2	pubmed	fb	copy_e/sum	128	0.4425	0.3972	1.114
g-SpMM	2	pubmed	fb	copy_u/max	128	0.4613	0.4230	1.091
g-SpMM	2	pubmed	fb	copy_u/min	128	0.4641	0.4214	1.101
g-SpMM	2	pubmed	fb	copy_u/sum	128	0.4726	0.4334	1.090
g-SpMM	2	pubmed	fb	div/max	128	0.4647	0.4738	0.981
g-SpMM	2	pubmed	fb	div/min	128	0.5023	0.4794	1.048
g-SpMM	2	pubmed	fb	div/sum	128	0.5244	0.6079	0.863
g-SpMM	2	pubmed	fb	mul/max	128	0.4090	0.4633	0.883
g-SpMM	2	pubmed	fb	mul/min	128	0.3942	0.4567	0.863
g-SpMM	2	pubmed	fb	mul/sum	128	0.4210	0.5006	0.841
g-SpMM	2	pubmed	fb	sub/max	128	0.3931	0.4547	0.865
g-SpMM	2	pubmed	fb	sub/min	128	0.3810	0.4482	0.850
g-SpMM	2	pubmed	fb	sub/sum	128	0.4510	0.5066	0.890
g-SpMM	2	pubmed	fwd	add/max	128	0.1156	0.1829	0.632
g-SpMM	2	pubmed	fwd	add/min	128	0.1076	0.1895	0.568
g-SpMM	2	pubmed	fwd	add/sum	128	0.1049	0.1731	0.606
g-SpMM	2	pubmed	fwd	copy_e/max	128	0.0985	0.0906	1.087
g-SpMM	2	pubmed	fwd	copy_e/min	128	0.0961	0.0895	1.074
g-SpMM	2	pubmed	fwd	copy_e/sum	128	0.1005	0.0835	1.203
g-SpMM	2	pubmed	fwd	copy_u/max	128	0.0957	0.0913	1.048
g-SpMM	2	pubmed	fwd	copy_u/min	128	0.0964	0.0908	1.062
g-SpMM	2	pubmed	fwd	copy_u/sum	128	0.0866	0.0816	1.061
g-SpMM	2	pubmed	fwd	div/max	128	0.2470	0.1844	1.340
g-SpMM	2	pubmed	fwd	div/min	128	0.1012	0.1892	0.535
g-SpMM	2	pubmed	fwd	div/sum	128	0.1075	0.1671	0.643
g-SpMM	2	pubmed	fwd	mul/max	128	0.0994	0.1842	0.540
g-SpMM	2	pubmed	fwd	mul/min	128	0.1007	0.1867	0.539
g-SpMM	2	pubmed	fwd	mul/sum	128	0.1041	0.1735	0.600
g-SpMM	2	pubmed	fwd	sub/max	128	0.1003	0.1791	0.560
g-SpMM	2	pubmed	fwd	sub/min	128	0.1020	0.1804	0.565
g-SpMM	2	pubmed	fwd	sub/sum	128	0.1075	0.1768	0.608
g-SpMM	2	pubmed	bwd	add/max	256	0.3638	0.3221	1.129
g-SpMM	2	pubmed	bwd	add/min	256	0.3600	0.3238	1.112
g-SpMM	2	pubmed	bwd	add/sum	256	0.3170	0.3076	1.031
g-SpMM	2	pubmed	bwd	copy_e/max	256	0.2641	0.3042	0.868
g-SpMM	2	pubmed	bwd	copy_e/min	256	0.2636	0.3058	0.862
g-SpMM	2	pubmed	bwd	copy_e/sum	256	0.2003	0.2095	0.956
g-SpMM	2	pubmed	bwd	copy_u/max	256	0.2076	0.2054	1.011
g-SpMM	2	pubmed	bwd	copy_u/min	256	0.1935	0.2067	0.936
g-SpMM	2	pubmed	bwd	copy_u/sum	256	0.2279	0.2451	0.930

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	pubmed	bwd	div/max	256	0.4500	0.3953	1.138
g-SpMM	2	pubmed	bwd	div/min	256	0.4514	0.3889	1.161
g-SpMM	2	pubmed	bwd	div/sum	256	0.4479	0.8096	0.553
g-SpMM	2	pubmed	bwd	mul/max	256	0.4572	0.3884	1.177
g-SpMM	2	pubmed	bwd	mul/min	256	0.4507	0.3877	1.163
g-SpMM	2	pubmed	bwd	mul/sum	256	0.3584	0.5951	0.602
g-SpMM	2	pubmed	bwd	sub/max	256	0.3640	0.3186	1.142
g-SpMM	2	pubmed	bwd	sub/min	256	0.3579	0.3193	1.121
g-SpMM	2	pubmed	bwd	sub/sum	256	0.3370	0.3169	1.064
g-SpMM	2	pubmed	fb	add/max	256	0.5485	0.6693	0.820
g-SpMM	2	pubmed	fb	add/min	256	0.5403	0.6758	0.799
g-SpMM	2	pubmed	fb	add/sum	256	0.5558	0.5740	0.968
g-SpMM	2	pubmed	fb	copy_e/max	256	0.4746	0.4491	1.057
g-SpMM	2	pubmed	fb	copy_e/min	256	0.4569	0.4870	0.938
g-SpMM	2	pubmed	fb	copy_e/sum	256	0.4181	0.4246	0.985
g-SpMM	2	pubmed	fb	copy_u/max	256	0.4565	0.4531	1.007
g-SpMM	2	pubmed	fb	copy_u/min	256	0.4294	0.4579	0.938
g-SpMM	2	pubmed	fb	copy_u/sum	256	0.4670	0.4668	1.000
g-SpMM	2	pubmed	fb	div/max	256	0.6276	0.7502	0.837
g-SpMM	2	pubmed	fb	div/min	256	0.6396	0.7370	0.868
g-SpMM	2	pubmed	fb	div/sum	256	0.6392	1.1374	0.562
g-SpMM	2	pubmed	fb	mul/max	256	0.6440	0.7392	0.871
g-SpMM	2	pubmed	fb	mul/min	256	0.6231	0.7325	0.851
g-SpMM	2	pubmed	fb	mul/sum	256	0.5504	0.9093	0.605
g-SpMM	2	pubmed	fb	sub/max	256	0.5566	0.6826	0.815
g-SpMM	2	pubmed	fb	sub/min	256	0.5362	0.6699	0.800
g-SpMM	2	pubmed	fb	sub/sum	256	0.5855	0.5794	1.011
g-SpMM	2	pubmed	fwd	add/max	256	0.1834	0.3456	0.531
g-SpMM	2	pubmed	fwd	add/min	256	0.1825	0.3498	0.522
g-SpMM	2	pubmed	fwd	add/sum	256	0.2078	0.3237	0.642
g-SpMM	2	pubmed	fwd	copy_e/max	256	0.1220	0.1263	0.966
g-SpMM	2	pubmed	fwd	copy_e/min	256	0.1235	0.1236	0.999
g-SpMM	2	pubmed	fwd	copy_e/sum	256	0.1428	0.1397	1.022
g-SpMM	2	pubmed	fwd	copy_u/max	256	0.1178	0.1943	0.606
g-SpMM	2	pubmed	fwd	copy_u/min	256	0.1177	0.2028	0.580
g-SpMM	2	pubmed	fwd	copy_u/sum	256	0.0916	0.1483	0.617
g-SpMM	2	pubmed	fwd	div/max	256	0.1986	0.3478	0.571
g-SpMM	2	pubmed	fwd	div/min	256	0.1846	0.3610	0.511
g-SpMM	2	pubmed	fwd	div/sum	256	0.2095	0.3169	0.661
g-SpMM	2	pubmed	fwd	mul/max	256	0.1839	0.3541	0.519
g-SpMM	2	pubmed	fwd	mul/min	256	0.1798	0.3643	0.494
g-SpMM	2	pubmed	fwd	mul/sum	256	0.1862	0.3289	0.566
g-SpMM	2	pubmed	fwd	sub/max	256	0.1819	0.3498	0.520
g-SpMM	2	pubmed	fwd	sub/min	256	0.1865	0.3491	0.534
g-SpMM	2	pubmed	fwd	sub/sum	256	0.1932	0.3336	0.579
g-SpMM	2	pubmed	bwd	add/max	512	0.7140	0.5869	1.217
g-SpMM	2	pubmed	bwd	add/min	512	0.6823	0.5875	1.161
g-SpMM	2	pubmed	bwd	add/sum	512	0.3124	0.4692	0.666
g-SpMM	2	pubmed	bwd	copy_e/max	512	0.5020	0.5502	0.912
g-SpMM	2	pubmed	bwd	copy_e/min	512	0.4988	0.5392	0.925
g-SpMM	2	pubmed	bwd	copy_e/sum	512	0.2080	0.2010	1.035
g-SpMM	2	pubmed	bwd	copy_u/max	512	0.2185	0.2060	1.061
g-SpMM	2	pubmed	bwd	copy_u/min	512	0.2328	0.2066	1.127
g-SpMM	2	pubmed	bwd	copy_u/sum	512	0.2732	0.3265	0.837
g-SpMM	2	pubmed	bwd	div/max	512	0.8638	0.7192	1.201
g-SpMM	2	pubmed	bwd	div/min	512	0.8616	0.7175	1.201
g-SpMM	2	pubmed	bwd	div/sum	512	0.8007	1.5187	0.527
g-SpMM	2	pubmed	bwd	mul/max	512	0.8515	1.2108	0.703
g-SpMM	2	pubmed	bwd	mul/min	512	0.8684	0.7139	1.216
g-SpMM	2	pubmed	bwd	mul/sum	512	0.6127	1.0911	0.562
g-SpMM	2	pubmed	bwd	sub/max	512	0.6722	0.5886	1.142
g-SpMM	2	pubmed	bwd	sub/min	512	0.6844	0.5863	1.167
g-SpMM	2	pubmed	bwd	sub/sum	512	0.3180	0.4602	0.691
g-SpMM	2	pubmed	fb	add/max	512	0.9942	1.2263	0.811
g-SpMM	2	pubmed	fb	add/min	512	1.0117	1.2367	0.818
g-SpMM	2	pubmed	fb	add/sum	512	0.6821	1.0843	0.629
g-SpMM	2	pubmed	fb	copy_e/max	512	0.7095	0.7624	0.931
g-SpMM	2	pubmed	fb	copy_e/min	512	0.7233	0.7563	0.956
g-SpMM	2	pubmed	fb	copy_e/sum	512	0.4310	0.4427	0.974
g-SpMM	2	pubmed	fb	copy_u/max	512	0.4356	0.5882	0.741
g-SpMM	2	pubmed	fb	copy_u/min	512	0.4987	0.5790	0.861
g-SpMM	2	pubmed	fb	copy_u/sum	512	0.4835	0.6730	0.719
g-SpMM	2	pubmed	fb	div/max	512	1.1970	1.3755	0.870
g-SpMM	2	pubmed	fb	div/min	512	1.1626	1.3583	0.856
g-SpMM	2	pubmed	fb	div/sum	512	1.1549	2.1354	0.541
g-SpMM	2	pubmed	fb	mul/max	512	1.1788	1.3671	0.862
g-SpMM	2	pubmed	fb	mul/min	512	1.1450	1.3828	0.828
g-SpMM	2	pubmed	fb	mul/sum	512	0.9583	1.7480	0.548

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	pubmed	fb	sub/max	512	1.0002	1.2612	0.793
g-SpMM	2	pubmed	fb	sub/min	512	0.9825	1.2537	0.784
g-SpMM	2	pubmed	fb	sub/sum	512	0.6790	1.1061	0.614
g-SpMM	2	pubmed	fwd	add/max	512	0.3266	0.6521	0.501
g-SpMM	2	pubmed	fwd	add/min	512	0.3327	0.6595	0.504
g-SpMM	2	pubmed	fwd	add/sum	512	0.3760	0.6375	0.590
g-SpMM	2	pubmed	fwd	copy_e/max	512	0.2214	0.2874	0.770
g-SpMM	2	pubmed	fwd	copy_e/min	512	0.2190	0.2186	1.002
g-SpMM	2	pubmed	fwd	copy_e/sum	512	0.2764	0.2877	0.961
g-SpMM	2	pubmed	fwd	copy_u/max	512	0.2050	0.3628	0.565
g-SpMM	2	pubmed	fwd	copy_u/min	512	0.2022	0.3692	0.548
g-SpMM	2	pubmed	fwd	copy_u/sum	512	0.1779	0.3241	0.549
g-SpMM	2	pubmed	fwd	div/max	512	0.3491	0.6763	0.516
g-SpMM	2	pubmed	fwd	div/min	512	0.3216	0.6806	0.473
g-SpMM	2	pubmed	fwd	div/sum	512	0.3807	0.6061	0.628
g-SpMM	2	pubmed	fwd	mul/max	512	0.3334	0.6668	0.500
g-SpMM	2	pubmed	fwd	mul/min	512	0.3359	0.6774	0.496
g-SpMM	2	pubmed	fwd	mul/sum	512	0.3432	0.5948	0.577
g-SpMM	2	pubmed	fwd	sub/max	512	0.3427	0.6581	0.521
g-SpMM	2	pubmed	fwd	sub/min	512	0.3196	0.6590	0.485
g-SpMM	2	pubmed	fwd	sub/sum	512	0.3600	0.6457	0.558
g-SpMM	2	tolokers-2	bwd	add/max	64	0.2264	0.2245	1.009
g-SpMM	2	tolokers-2	bwd	add/min	64	0.2247	0.2340	0.960
g-SpMM	2	tolokers-2	bwd	add/sum	64	0.5024	0.5143	0.977
g-SpMM	2	tolokers-2	bwd	copy_e/max	64	0.1754	0.1760	0.997
g-SpMM	2	tolokers-2	bwd	copy_e/min	64	0.1823	0.1753	1.040
g-SpMM	2	tolokers-2	bwd	copy_e/sum	64	0.4014	0.4223	0.951
g-SpMM	2	tolokers-2	bwd	copy_u/max	64	0.1933	0.1980	0.976
g-SpMM	2	tolokers-2	bwd	copy_u/min	64	0.2011	0.1967	1.022
g-SpMM	2	tolokers-2	bwd	copy_u/sum	64	0.2216	0.2508	0.883
g-SpMM	2	tolokers-2	bwd	div/max	64	0.2030	0.1968	1.031
g-SpMM	2	tolokers-2	bwd	div/min	64	0.2159	0.2000	1.079
g-SpMM	2	tolokers-2	bwd	div/sum	64	0.8895	1.9236	0.462
g-SpMM	2	tolokers-2	bwd	mul/max	64	0.2039	0.2281	0.894
g-SpMM	2	tolokers-2	bwd	mul/min	64	0.2051	0.2209	0.929
g-SpMM	2	tolokers-2	bwd	mul/sum	64	0.6287	1.3042	0.482
g-SpMM	2	tolokers-2	bwd	sub/max	64	0.2018	0.2268	0.890
g-SpMM	2	tolokers-2	bwd	sub/min	64	0.2042	0.2178	0.938
g-SpMM	2	tolokers-2	bwd	sub/sum	64	0.5370	0.5129	1.047
g-SpMM	2	tolokers-2	fb	add/max	64	0.4946	0.9527	0.519
g-SpMM	2	tolokers-2	fb	add/min	64	0.4937	0.9496	0.520
g-SpMM	2	tolokers-2	fb	add/sum	64	0.7377	1.2602	0.585
g-SpMM	2	tolokers-2	fb	copy_e/max	64	0.4168	0.4147	1.005
g-SpMM	2	tolokers-2	fb	copy_e/min	64	0.4145	0.4329	0.957
g-SpMM	2	tolokers-2	fb	copy_e/sum	64	0.6560	0.6480	1.012
g-SpMM	2	tolokers-2	fb	copy_u/max	64	0.4289	0.4401	0.974
g-SpMM	2	tolokers-2	fb	copy_u/min	64	0.4341	0.4471	0.971
g-SpMM	2	tolokers-2	fb	copy_u/sum	64	0.4306	0.4941	0.872
g-SpMM	2	tolokers-2	fb	div/max	64	0.4978	0.9718	0.512
g-SpMM	2	tolokers-2	fb	div/min	64	0.4881	0.9814	0.497
g-SpMM	2	tolokers-2	fb	div/sum	64	1.3131	2.6663	0.492
g-SpMM	2	tolokers-2	fb	mul/max	64	0.4740	0.9688	0.489
g-SpMM	2	tolokers-2	fb	mul/min	64	0.4818	0.9704	0.496
g-SpMM	2	tolokers-2	fb	mul/sum	64	0.9970	2.0691	0.482
g-SpMM	2	tolokers-2	fb	sub/max	64	0.4634	0.9598	0.483
g-SpMM	2	tolokers-2	fb	sub/min	64	0.4613	0.9595	0.481
g-SpMM	2	tolokers-2	fb	sub/sum	64	0.7280	1.2671	0.575
g-SpMM	2	tolokers-2	fwd	add/max	64	0.3230	0.8080	0.400
g-SpMM	2	tolokers-2	fwd	add/min	64	0.3266	0.8053	0.406
g-SpMM	2	tolokers-2	fwd	add/sum	64	0.4115	0.7859	0.524
g-SpMM	2	tolokers-2	fwd	copy_e/max	64	0.1673	0.1718	0.974
g-SpMM	2	tolokers-2	fwd	copy_e/min	64	0.1685	0.1720	0.980
g-SpMM	2	tolokers-2	fwd	copy_e/sum	64	0.3229	0.3252	0.993
g-SpMM	2	tolokers-2	fwd	copy_u/max	64	0.1252	0.2689	0.466
g-SpMM	2	tolokers-2	fwd	copy_u/min	64	0.1249	0.2702	0.462
g-SpMM	2	tolokers-2	fwd	copy_u/sum	64	0.1090	0.2461	0.443
g-SpMM	2	tolokers-2	fwd	div/max	64	0.3294	0.8158	0.404
g-SpMM	2	tolokers-2	fwd	div/min	64	0.3348	0.8189	0.409
g-SpMM	2	tolokers-2	fwd	div/sum	64	0.4190	0.7427	0.564
g-SpMM	2	tolokers-2	fwd	mul/max	64	0.3284	0.8028	0.409
g-SpMM	2	tolokers-2	fwd	mul/min	64	0.3341	0.8096	0.413
g-SpMM	2	tolokers-2	fwd	mul/sum	64	0.3762	0.7668	0.491
g-SpMM	2	tolokers-2	fwd	sub/max	64	0.3180	0.8011	0.397
g-SpMM	2	tolokers-2	fwd	sub/min	64	0.3232	0.8091	0.399
g-SpMM	2	tolokers-2	fwd	sub/sum	64	0.4214	0.7898	0.533
g-SpMM	2	tolokers-2	bwd	add/max	128	0.2815	0.2869	0.981
g-SpMM	2	tolokers-2	bwd	add/min	128	0.2835	0.2835	1.000
g-SpMM	2	tolokers-2	bwd	add/sum	128	0.5012	0.7837	0.640

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	tolokers-2	bwd	copy_e/max	128	0.2573	0.2585	0.995
g-SpMM	2	tolokers-2	bwd	copy_e/min	128	0.2571	0.2579	0.997
g-SpMM	2	tolokers-2	bwd	copy_e/sum	128	0.4039	0.4194	0.963
g-SpMM	2	tolokers-2	bwd	copy_u/max	128	0.2005	0.2014	0.995
g-SpMM	2	tolokers-2	bwd	copy_u/min	128	0.1956	0.2206	0.887
g-SpMM	2	tolokers-2	bwd	copy_u/sum	128	0.2403	0.4226	0.568
g-SpMM	2	tolokers-2	bwd	div/max	128	0.3227	0.3222	1.001
g-SpMM	2	tolokers-2	bwd	div/min	128	0.3223	0.3225	0.999
g-SpMM	2	tolokers-2	bwd	div/sum	128	1.4321	3.2569	0.440
g-SpMM	2	tolokers-2	bwd	mul/max	128	0.3225	0.3224	1.001
g-SpMM	2	tolokers-2	bwd	mul/min	128	0.3218	0.3216	1.001
g-SpMM	2	tolokers-2	bwd	mul/sum	128	1.0929	2.1693	0.504
g-SpMM	2	tolokers-2	bwd	sub/max	128	0.2817	0.2821	0.999
g-SpMM	2	tolokers-2	bwd	sub/min	128	0.2823	0.2831	0.997
g-SpMM	2	tolokers-2	bwd	sub/sum	128	0.4928	0.7814	0.631
g-SpMM	2	tolokers-2	fb	add/max	128	0.9082	1.6776	0.541
g-SpMM	2	tolokers-2	fb	add/min	128	0.9044	1.7181	0.526
g-SpMM	2	tolokers-2	fb	add/sum	128	1.2803	2.1773	0.588
g-SpMM	2	tolokers-2	fb	copy_e/max	128	0.5596	0.5634	0.993
g-SpMM	2	tolokers-2	fb	copy_e/min	128	0.5480	0.5644	0.971
g-SpMM	2	tolokers-2	fb	copy_e/sum	128	0.9069	0.9141	0.992
g-SpMM	2	tolokers-2	fb	copy_u/max	128	0.4220	0.5490	0.769
g-SpMM	2	tolokers-2	fb	copy_u/min	128	0.4300	0.5324	0.808
g-SpMM	2	tolokers-2	fb	copy_u/sum	128	0.4673	0.9060	0.516
g-SpMM	2	tolokers-2	fb	div/max	128	0.9557	1.7054	0.560
g-SpMM	2	tolokers-2	fb	div/min	128	0.9541	1.7043	0.560
g-SpMM	2	tolokers-2	fb	div/sum	128	2.2397	4.5798	0.489
g-SpMM	2	tolokers-2	fb	mul/max	128	0.9425	1.7255	0.546
g-SpMM	2	tolokers-2	fb	mul/min	128	0.9568	1.7256	0.554
g-SpMM	2	tolokers-2	fb	mul/sum	128	1.7077	3.6031	0.474
g-SpMM	2	tolokers-2	fb	sub/max	128	0.9046	1.6922	0.535
g-SpMM	2	tolokers-2	fb	sub/min	128	0.9114	1.6654	0.547
g-SpMM	2	tolokers-2	fb	sub/sum	128	1.2889	2.2257	0.579
g-SpMM	2	tolokers-2	fwd	add/max	128	0.6289	1.3651	0.461
g-SpMM	2	tolokers-2	fwd	add/min	128	0.6327	1.4210	0.445
g-SpMM	2	tolokers-2	fwd	add/sum	128	0.7711	1.3543	0.569
g-SpMM	2	tolokers-2	fwd	copy_e/max	128	0.3201	0.3085	1.038
g-SpMM	2	tolokers-2	fwd	copy_e/min	128	0.3179	0.3135	1.014
g-SpMM	2	tolokers-2	fwd	copy_e/sum	128	0.6348	0.6343	1.001
g-SpMM	2	tolokers-2	fwd	copy_u/max	128	0.2164	0.4537	0.477
g-SpMM	2	tolokers-2	fwd	copy_u/min	128	0.2123	0.4556	0.466
g-SpMM	2	tolokers-2	fwd	copy_u/sum	128	0.1960	0.4294	0.456
g-SpMM	2	tolokers-2	fwd	div/max	128	0.6362	1.3915	0.457
g-SpMM	2	tolokers-2	fwd	div/min	128	0.6778	1.4548	0.466
g-SpMM	2	tolokers-2	fwd	div/sum	128	0.7636	1.2859	0.594
g-SpMM	2	tolokers-2	fwd	mul/max	128	0.6232	1.3610	0.458
g-SpMM	2	tolokers-2	fwd	mul/min	128	0.6519	1.4309	0.456
g-SpMM	2	tolokers-2	fwd	mul/sum	128	0.6604	1.2957	0.510
g-SpMM	2	tolokers-2	fwd	sub/max	128	0.6377	1.3662	0.467
g-SpMM	2	tolokers-2	fwd	sub/min	128	0.6321	1.4290	0.442
g-SpMM	2	tolokers-2	fwd	sub/sum	128	0.7493	1.3189	0.568
g-SpMM	2	tolokers-2	bwd	add/max	256	0.5429	0.5435	0.999
g-SpMM	2	tolokers-2	bwd	add/min	256	0.5427	0.5432	0.999
g-SpMM	2	tolokers-2	bwd	add/sum	256	0.8961	1.3833	0.648
g-SpMM	2	tolokers-2	bwd	copy_e/max	256	0.4938	0.4939	1.000
g-SpMM	2	tolokers-2	bwd	copy_e/min	256	0.4995	0.4966	1.006
g-SpMM	2	tolokers-2	bwd	copy_e/sum	256	0.4570	0.4804	0.951
g-SpMM	2	tolokers-2	bwd	copy_u/max	256	0.2207	0.1961	1.125
g-SpMM	2	tolokers-2	bwd	copy_u/min	256	0.2074	0.1905	1.089
g-SpMM	2	tolokers-2	bwd	copy_u/sum	256	0.3743	0.8490	0.441
g-SpMM	2	tolokers-2	bwd	div/max	256	0.6359	0.6375	0.998
g-SpMM	2	tolokers-2	bwd	div/min	256	0.6458	0.6377	1.013
g-SpMM	2	tolokers-2	bwd	div/sum	256	2.6638	5.9457	0.448
g-SpMM	2	tolokers-2	bwd	mul/max	256	0.6344	0.6415	0.989
g-SpMM	2	tolokers-2	bwd	mul/min	256	0.6357	0.6342	1.002
g-SpMM	2	tolokers-2	bwd	mul/sum	256	1.9952	4.2045	0.475
g-SpMM	2	tolokers-2	bwd	sub/max	256	0.5453	0.5462	0.998
g-SpMM	2	tolokers-2	bwd	sub/min	256	0.5468	1.0651	0.513
g-SpMM	2	tolokers-2	bwd	sub/sum	256	0.8955	2.7207	0.329
g-SpMM	2	tolokers-2	fb	add/max	256	1.7738	3.1866	0.557
g-SpMM	2	tolokers-2	fb	add/min	256	1.7639	3.1959	0.552
g-SpMM	2	tolokers-2	fb	add/sum	256	2.3937	4.0176	0.596
g-SpMM	2	tolokers-2	fb	copy_e/max	256	1.0869	1.0809	1.006
g-SpMM	2	tolokers-2	fb	copy_e/min	256	1.0868	1.0857	1.001
g-SpMM	2	tolokers-2	fb	copy_e/sum	256	1.7149	1.7259	0.994
g-SpMM	2	tolokers-2	fb	copy_u/max	256	0.5172	1.0810	0.478
g-SpMM	2	tolokers-2	fb	copy_u/min	256	0.5017	1.0798	0.465
g-SpMM	2	tolokers-2	fb	copy_u/sum	256	0.8388	1.8486	0.454

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	tolokers-2	fb	div/max	256	1.9000	3.3396	0.569
g-SpMM	2	tolokers-2	fb	div/min	256	1.9071	3.3896	0.563
g-SpMM	2	tolokers-2	fb	div/sum	256	4.1856	8.4306	0.496
g-SpMM	2	tolokers-2	fb	mul/max	256	1.8797	3.3730	0.557
g-SpMM	2	tolokers-2	fb	mul/min	256	1.9137	3.2574	0.587
g-SpMM	2	tolokers-2	fb	mul/sum	256	3.3428	6.6976	0.499
g-SpMM	2	tolokers-2	fb	sub/max	256	1.7963	3.2436	0.554
g-SpMM	2	tolokers-2	fb	sub/min	256	1.7877	3.1750	0.563
g-SpMM	2	tolokers-2	fb	sub/sum	256	2.4232	4.9660	0.488
g-SpMM	2	tolokers-2	fwd	add/max	256	1.2258	2.6610	0.461
g-SpMM	2	tolokers-2	fwd	add/min	256	1.2963	2.7408	0.473
g-SpMM	2	tolokers-2	fwd	add/sum	256	1.4908	2.6621	0.560
g-SpMM	2	tolokers-2	fwd	copy_e/max	256	0.5853	0.5955	0.983
g-SpMM	2	tolokers-2	fwd	copy_e/min	256	0.6127	0.6187	0.990
g-SpMM	2	tolokers-2	fwd	copy_e/sum	256	1.2606	1.2627	0.998
g-SpMM	2	tolokers-2	fwd	copy_u/max	256	0.4245	0.9473	0.448
g-SpMM	2	tolokers-2	fwd	copy_u/min	256	0.4096	0.9511	0.431
g-SpMM	2	tolokers-2	fwd	copy_u/sum	256	0.3720	0.8115	0.458
g-SpMM	2	tolokers-2	fwd	div/max	256	1.2754	2.7514	0.464
g-SpMM	2	tolokers-2	fwd	div/min	256	1.2993	2.6761	0.486
g-SpMM	2	tolokers-2	fwd	div/sum	256	1.4938	2.3748	0.629
g-SpMM	2	tolokers-2	fwd	mul/max	256	1.2387	2.7059	0.458
g-SpMM	2	tolokers-2	fwd	mul/min	256	1.2913	2.6896	0.480
g-SpMM	2	tolokers-2	fwd	mul/sum	256	1.2765	2.5224	0.506
g-SpMM	2	tolokers-2	fwd	sub/max	256	1.2383	2.7185	0.456
g-SpMM	2	tolokers-2	fwd	sub/min	256	1.2964	2.6398	0.491
g-SpMM	2	tolokers-2	fwd	sub/sum	256	1.4471	2.6052	0.555
g-SpMM	2	tolokers-2	bwd	add/max	512	1.1677	1.1770	0.992
g-SpMM	2	tolokers-2	bwd	add/min	512	1.1728	1.1759	0.997
g-SpMM	2	tolokers-2	bwd	add/sum	512	1.8691	2.8538	0.655
g-SpMM	2	tolokers-2	bwd	copy_e/max	512	1.0095	1.0088	1.001
g-SpMM	2	tolokers-2	bwd	copy_e/min	512	1.0115	1.0109	1.001
g-SpMM	2	tolokers-2	bwd	copy_e/sum	512	1.0489	1.0351	1.013
g-SpMM	2	tolokers-2	bwd	copy_u/max	512	0.3788	0.9390	0.403
g-SpMM	2	tolokers-2	bwd	copy_u/min	512	0.3411	0.3213	1.061
g-SpMM	2	tolokers-2	bwd	copy_u/sum	512	0.7808	1.7482	0.447
g-SpMM	2	tolokers-2	bwd	div/max	512	1.4310	1.4298	1.001
g-SpMM	2	tolokers-2	bwd	div/min	512	1.4290	1.4297	1.000
g-SpMM	2	tolokers-2	bwd	div/sum	512	5.5165	12.1036	0.456
g-SpMM	2	tolokers-2	bwd	mul/max	512	1.4257	1.4242	1.001
g-SpMM	2	tolokers-2	bwd	mul/min	512	1.4292	1.4260	1.002
g-SpMM	2	tolokers-2	bwd	mul/sum	512	4.1841	8.4036	0.498
g-SpMM	2	tolokers-2	bwd	sub/max	512	1.1717	1.1674	1.004
g-SpMM	2	tolokers-2	bwd	sub/min	512	1.1719	1.1747	0.998
g-SpMM	2	tolokers-2	bwd	sub/sum	512	1.8538	2.8400	0.653
g-SpMM	2	tolokers-2	fb	add/max	512	3.7250	6.4662	0.576
g-SpMM	2	tolokers-2	fb	add/min	512	3.7341	6.5487	0.570
g-SpMM	2	tolokers-2	fb	add/sum	512	4.8762	8.2519	0.591
g-SpMM	2	tolokers-2	fb	copy_e/max	512	2.2922	2.2731	1.008
g-SpMM	2	tolokers-2	fb	copy_e/min	512	2.3017	2.2939	1.003
g-SpMM	2	tolokers-2	fb	copy_e/sum	512	3.5529	3.5640	0.997
g-SpMM	2	tolokers-2	fb	copy_u/max	512	0.9828	2.1186	0.464
g-SpMM	2	tolokers-2	fb	copy_u/min	512	0.9654	2.2836	0.423
g-SpMM	2	tolokers-2	fb	copy_u/sum	512	1.6124	3.6245	0.445
g-SpMM	2	tolokers-2	fb	div/max	512	3.9723	7.0429	0.564
g-SpMM	2	tolokers-2	fb	div/min	512	4.0569	6.8559	0.592
g-SpMM	2	tolokers-2	fb	div/sum	512	8.7206	17.3440	0.503
g-SpMM	2	tolokers-2	fb	mul/max	512	3.9626	6.6711	0.594
g-SpMM	2	tolokers-2	fb	mul/min	512	3.9854	6.7383	0.591
g-SpMM	2	tolokers-2	fb	mul/sum	512	6.7903	14.0389	0.484
g-SpMM	2	tolokers-2	fb	sub/max	512	3.6813	6.4927	0.567
g-SpMM	2	tolokers-2	fb	sub/min	512	3.7149	6.5426	0.568
g-SpMM	2	tolokers-2	fb	sub/sum	512	4.9470	8.2264	0.601
g-SpMM	2	tolokers-2	fwd	add/max	512	2.5364	5.4500	0.465
g-SpMM	2	tolokers-2	fwd	add/min	512	2.6799	5.3487	0.501
g-SpMM	2	tolokers-2	fwd	add/sum	512	3.0445	5.3313	0.571
g-SpMM	2	tolokers-2	fwd	copy_e/max	512	1.2708	1.2914	0.984
g-SpMM	2	tolokers-2	fwd	copy_e/min	512	1.3470	2.0149	0.669
g-SpMM	2	tolokers-2	fwd	copy_e/sum	512	2.5364	2.5368	1.000
g-SpMM	2	tolokers-2	fwd	copy_u/max	512	0.8223	1.9103	0.430
g-SpMM	2	tolokers-2	fwd	copy_u/min	512	0.8392	1.9059	0.440
g-SpMM	2	tolokers-2	fwd	copy_u/sum	512	0.7729	1.6758	0.461
g-SpMM	2	tolokers-2	fwd	div/max	512	2.6065	5.5120	0.473
g-SpMM	2	tolokers-2	fwd	div/min	512	2.7021	5.5988	0.483
g-SpMM	2	tolokers-2	fwd	div/sum	512	3.0601	4.9309	0.621
g-SpMM	2	tolokers-2	fwd	mul/max	512	2.5060	5.2438	0.478
g-SpMM	2	tolokers-2	fwd	mul/min	512	2.6662	5.5407	0.481
g-SpMM	2	tolokers-2	fwd	mul/sum	512	2.5715	5.2498	0.490

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	2	tolokers-2	fwd	sub/max	512	2.5367	5.4551	0.465
g-SpMM	2	tolokers-2	fwd	sub/min	512	2.7148	5.5605	0.488
g-SpMM	2	tolokers-2	fwd	sub/sum	512	3.0496	5.3130	0.574
g-SpMM	2	twitch-views	bwd	copy_u/max	64	0.3624	0.3640	0.996
g-SpMM	2	twitch-views	bwd	copy_u/min	64	0.3692	0.3674	1.005
g-SpMM	2	twitch-views	bwd	copy_u/sum	64	2.5204	5.0808	0.496
g-SpMM	2	twitch-views	fb	copy_u/max	64	2.4715	5.7233	0.432
g-SpMM	2	twitch-views	fb	copy_u/min	64	2.4543	5.7509	0.427
g-SpMM	2	twitch-views	fb	copy_u/sum	64	5.0314	10.4010	0.484
g-SpMM	2	twitch-views	fwd	copy_u/max	64	2.0971	5.3265	0.394
g-SpMM	2	twitch-views	fwd	copy_u/min	64	2.1017	5.4031	0.389
g-SpMM	2	twitch-views	fwd	copy_u/sum	64	2.5053	5.0689	0.494
g-SpMM	2	twitch-views	bwd	copy_u/max	128	0.7855	0.7841	1.002
g-SpMM	2	twitch-views	bwd	copy_u/min	128	0.7921	0.7868	1.007
g-SpMM	2	twitch-views	bwd	copy_u/sum	128	5.7285	11.2221	0.510
g-SpMM	2	twitch-views	fb	copy_u/max	128	5.2889	12.0781	0.438
g-SpMM	2	twitch-views	fb	copy_u/min	128	5.2459	12.1915	0.430
g-SpMM	2	twitch-views	fb	copy_u/sum	128	11.5131	22.6602	0.508
g-SpMM	2	twitch-views	fwd	copy_u/max	128	4.4401	11.4451	0.388
g-SpMM	2	twitch-views	fwd	copy_u/min	128	4.4394	11.4952	0.386
g-SpMM	2	twitch-views	fwd	copy_u/sum	128	5.7618	11.0777	0.520
g-SpMM	2	twitch-views	bwd	copy_u/max	256	2.1162	2.1159	1.000
g-SpMM	2	twitch-views	bwd	copy_u/min	256	2.1203	2.1101	1.005
g-SpMM	2	twitch-views	bwd	copy_u/sum	256	12.7565	23.9899	0.532
g-SpMM	2	twitch-views	fb	copy_u/max	256	11.7507	27.3381	0.430
g-SpMM	2	twitch-views	fb	copy_u/min	256	11.7189	26.5986	0.441
g-SpMM	2	twitch-views	fb	copy_u/sum	256	25.5881	48.6309	0.526
g-SpMM	2	twitch-views	fwd	copy_u/max	256	9.6130	25.0105	0.384
g-SpMM	2	twitch-views	fwd	copy_u/min	256	9.5850	25.5014	0.376
g-SpMM	2	twitch-views	fwd	copy_u/sum	256	12.5033	24.0835	0.519
g-SpMM	2	twitch-views	bwd	copy_u/max	512	5.4141	5.4128	1.000
g-SpMM	2	twitch-views	bwd	copy_u/min	512	5.4572	5.4473	1.002
g-SpMM	2	twitch-views	bwd	copy_u/sum	512	26.6411	50.1751	0.531
g-SpMM	2	twitch-views	fb	copy_u/max	512	25.4791	56.5126	0.451
g-SpMM	2	twitch-views	fb	copy_u/min	512	25.3114	57.4640	0.440
g-SpMM	2	twitch-views	fb	copy_u/sum	512	53.9893	102.3604	0.527
g-SpMM	2	twitch-views	fwd	copy_u/max	512	20.4989	51.7886	0.396
g-SpMM	2	twitch-views	fwd	copy_u/min	512	20.1041	51.8627	0.388
g-SpMM	2	twitch-views	fwd	copy_u/sum	512	26.5513	50.7024	0.524
g-SpMM	2	web-fraud	bwd	copy_u/max	64	12.6533	12.6645	0.999
g-SpMM	2	web-fraud	bwd	copy_u/min	64	12.7784	12.7461	1.003
g-SpMM	2	web-fraud	bwd	copy_u/sum	64	74.5888	132.8012	0.562
g-SpMM	2	web-fraud	fb	copy_u/max	64	26.2978	48.6654	0.540
g-SpMM	2	web-fraud	fb	copy_u/min	64	26.3815	49.0371	0.538
g-SpMM	2	web-fraud	fb	copy_u/sum	64	92.8230	168.9721	0.549
g-SpMM	2	web-fraud	fwd	copy_u/max	64	13.6663	36.2643	0.377
g-SpMM	2	web-fraud	fwd	copy_u/min	64	13.5791	36.0865	0.376
g-SpMM	2	web-fraud	fwd	copy_u/sum	64	17.5692	34.9538	0.503
g-SpMM	2	web-fraud	bwd	copy_u/max	128	16.2701	16.2591	1.001
g-SpMM	2	web-fraud	bwd	copy_u/min	128	16.6026	16.5997	1.000
g-SpMM	2	web-fraud	bwd	copy_u/sum	128	149.9857	265.8802	0.564
g-SpMM	2	web-fraud	fb	copy_u/max	128	42.7517	88.1747	0.485
g-SpMM	2	web-fraud	fb	copy_u/min	128	43.3043	89.3797	0.484
g-SpMM	2	web-fraud	fb	copy_u/sum	128	185.2705	337.7521	0.549
g-SpMM	2	web-fraud	fwd	copy_u/max	128	27.1672	71.7845	0.378
g-SpMM	2	web-fraud	fwd	copy_u/min	128	27.0870	72.2435	0.375
g-SpMM	2	web-fraud	fwd	copy_u/sum	128	35.7578	70.2742	0.509
g-SpMM	2	web-fraud	bwd	copy_u/max	256	32.3781	32.2879	1.003
g-SpMM	2	web-fraud	bwd	copy_u/min	256	31.9456	31.9168	1.001
g-SpMM	2	web-fraud	bwd	copy_u/sum	256	301.7913	530.1656	0.569
g-SpMM	2	web-fraud	fb	copy_u/max	256	103.8889	193.7831	0.536
g-SpMM	2	web-fraud	fb	copy_u/min	256	104.8676	195.1356	0.537
g-SpMM	2	web-fraud	fb	copy_u/sum	256	400.3877	698.3790	0.573
g-SpMM	2	web-fraud	fwd	copy_u/max	256	55.7480	177.7359	0.314
g-SpMM	2	web-fraud	fwd	copy_u/min	256	88.1386	177.3913	0.497
g-SpMM	2	web-fraud	fwd	copy_u/sum	256	70.1338	139.2256	0.504
g-SpMM	2	web-fraud	bwd	copy_u/max	512	45.5700	50.9665	0.894
g-SpMM	2	web-fraud	bwd	copy_u/min	512	44.8344	46.1587	0.971
g-SpMM	2	web-fraud	bwd	copy_u/sum	512	623.9840	1077.8171	0.579
g-SpMM	2	web-fraud	fb	copy_u/max	512	226.4346	442.9517	0.511
g-SpMM	2	web-fraud	fb	copy_u/min	512	219.5975	425.7122	0.516
g-SpMM	2	web-fraud	fb	copy_u/sum	512	792.9253	1380.4385	0.574
g-SpMM	2	web-fraud	fwd	copy_u/max	512	188.2454	366.6080	0.513
g-SpMM	2	web-fraud	fwd	copy_u/min	512	190.1446	361.2539	0.526
g-SpMM	2	web-fraud	fwd	copy_u/sum	512	166.4348	302.4224	0.550
g-SpMM	4	artnet-exp	bwd	add/max	64	0.1916	0.2249	0.852
g-SpMM	4	artnet-exp	bwd	add/min	64	0.2348	0.2243	1.047
g-SpMM	4	artnet-exp	bwd	add/sum	64	0.3018	0.2980	1.013

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	artnet-exp	bwd	copy_e/max	64	0.1869	0.1806	1.035
g-SpMM	4	artnet-exp	bwd	copy_e/min	64	0.1819	0.1767	1.030
g-SpMM	4	artnet-exp	bwd	copy_e/sum	64	0.2062	0.2002	1.030
g-SpMM	4	artnet-exp	bwd	copy_u/max	64	0.2039	0.2009	1.015
g-SpMM	4	artnet-exp	bwd	copy_u/min	64	0.2034	0.1800	1.130
g-SpMM	4	artnet-exp	bwd	copy_u/sum	64	0.2448	0.2133	1.148
g-SpMM	4	artnet-exp	bwd	div/max	64	0.2148	0.2419	0.888
g-SpMM	4	artnet-exp	bwd	div/min	64	0.2274	0.2309	0.985
g-SpMM	4	artnet-exp	bwd	div/sum	64	0.4886	0.7335	0.666
g-SpMM	4	artnet-exp	bwd	mul/max	64	0.2148	0.2340	0.918
g-SpMM	4	artnet-exp	bwd	mul/min	64	0.2146	0.2399	0.895
g-SpMM	4	artnet-exp	bwd	mul/sum	64	0.3649	0.5470	0.667
g-SpMM	4	artnet-exp	bwd	sub/max	64	0.2015	0.2895	0.696
g-SpMM	4	artnet-exp	bwd	sub/min	64	0.2005	0.2244	0.894
g-SpMM	4	artnet-exp	bwd	sub/sum	64	0.2572	0.3057	0.841
g-SpMM	4	artnet-exp	fb	add/max	64	0.5123	0.4868	1.052
g-SpMM	4	artnet-exp	fb	add/min	64	0.4940	0.4820	1.025
g-SpMM	4	artnet-exp	fb	add/sum	64	0.5275	0.5239	1.007
g-SpMM	4	artnet-exp	fb	copy_e/max	64	0.4805	0.4139	1.161
g-SpMM	4	artnet-exp	fb	copy_e/min	64	0.4351	0.4198	1.037
g-SpMM	4	artnet-exp	fb	copy_e/sum	64	0.4287	0.4131	1.038
g-SpMM	4	artnet-exp	fb	copy_u/max	64	0.4471	0.4842	0.923
g-SpMM	4	artnet-exp	fb	copy_u/min	64	0.4626	0.4026	1.149
g-SpMM	4	artnet-exp	fb	copy_u/sum	64	0.4854	0.4255	1.141
g-SpMM	4	artnet-exp	fb	div/max	64	0.4204	0.4905	0.857
g-SpMM	4	artnet-exp	fb	div/min	64	0.4234	0.4935	0.858
g-SpMM	4	artnet-exp	fb	div/sum	64	0.6981	1.0086	0.692
g-SpMM	4	artnet-exp	fb	mul/max	64	0.4234	0.4910	0.862
g-SpMM	4	artnet-exp	fb	mul/min	64	0.4122	0.4981	0.828
g-SpMM	4	artnet-exp	fb	mul/sum	64	0.5592	0.8260	0.677
g-SpMM	4	artnet-exp	fb	sub/max	64	0.4087	0.4670	0.875
g-SpMM	4	artnet-exp	fb	sub/min	64	0.4004	0.4866	0.823
g-SpMM	4	artnet-exp	fb	sub/sum	64	0.4861	0.5405	0.899
g-SpMM	4	artnet-exp	fwd	add/max	64	0.1729	0.2811	0.615
g-SpMM	4	artnet-exp	fwd	add/min	64	0.1770	0.2843	0.623
g-SpMM	4	artnet-exp	fwd	add/sum	64	0.2135	0.2705	0.789
g-SpMM	4	artnet-exp	fwd	copy_e/max	64	0.1145	0.1147	0.998
g-SpMM	4	artnet-exp	fwd	copy_e/min	64	0.1139	0.1150	0.991
g-SpMM	4	artnet-exp	fwd	copy_e/sum	64	0.1420	0.1378	1.030
g-SpMM	4	artnet-exp	fwd	copy_u/max	64	0.1014	0.1691	0.600
g-SpMM	4	artnet-exp	fwd	copy_u/min	64	0.1022	0.1695	0.603
g-SpMM	4	artnet-exp	fwd	copy_u/sum	64	0.0898	0.1399	0.642
g-SpMM	4	artnet-exp	fwd	div/max	64	0.1739	0.2925	0.595
g-SpMM	4	artnet-exp	fwd	div/min	64	0.1784	0.2899	0.616
g-SpMM	4	artnet-exp	fwd	div/sum	64	0.2160	0.2806	0.770
g-SpMM	4	artnet-exp	fwd	mul/max	64	0.1736	0.2805	0.619
g-SpMM	4	artnet-exp	fwd	mul/min	64	0.1806	0.2854	0.633
g-SpMM	4	artnet-exp	fwd	mul/sum	64	0.2022	0.2863	0.706
g-SpMM	4	artnet-exp	fwd	sub/max	64	0.1740	0.2826	0.616
g-SpMM	4	artnet-exp	fwd	sub/min	64	0.1739	0.2833	0.614
g-SpMM	4	artnet-exp	fwd	sub/sum	64	0.2148	0.2698	0.796
g-SpMM	4	artnet-exp	bwd	add/max	128	0.3427	0.3434	0.998
g-SpMM	4	artnet-exp	bwd	add/min	128	0.3432	0.3424	1.002
g-SpMM	4	artnet-exp	bwd	add/sum	128	0.3233	0.4399	0.735
g-SpMM	4	artnet-exp	bwd	copy_e/max	128	0.2444	0.2450	0.997
g-SpMM	4	artnet-exp	bwd	copy_e/min	128	0.2437	0.2454	0.993
g-SpMM	4	artnet-exp	bwd	copy_e/sum	128	0.2010	0.1955	1.028
g-SpMM	4	artnet-exp	bwd	copy_u/max	128	0.1978	0.2354	0.840
g-SpMM	4	artnet-exp	bwd	copy_u/min	128	0.2296	0.2031	1.130
g-SpMM	4	artnet-exp	bwd	copy_u/sum	128	0.2664	0.2848	0.935
g-SpMM	4	artnet-exp	bwd	div/max	128	0.4240	0.4242	1.000
g-SpMM	4	artnet-exp	bwd	div/min	128	0.4237	0.4233	1.001
g-SpMM	4	artnet-exp	bwd	div/sum	128	0.8772	1.3221	0.663
g-SpMM	4	artnet-exp	bwd	mul/max	128	0.4244	0.4230	1.003
g-SpMM	4	artnet-exp	bwd	mul/min	128	0.4241	0.4230	1.003
g-SpMM	4	artnet-exp	bwd	mul/sum	128	0.6538	0.9789	0.668
g-SpMM	4	artnet-exp	bwd	sub/max	128	0.3451	0.3438	1.004
g-SpMM	4	artnet-exp	bwd	sub/min	128	0.3436	0.3435	1.000
g-SpMM	4	artnet-exp	bwd	sub/sum	128	0.3267	0.4403	0.742
g-SpMM	4	artnet-exp	fb	add/max	128	0.6605	0.8475	0.779
g-SpMM	4	artnet-exp	fb	add/min	128	0.6572	0.8505	0.773
g-SpMM	4	artnet-exp	fb	add/sum	128	0.7052	0.9403	0.750
g-SpMM	4	artnet-exp	fb	copy_e/max	128	0.4434	0.4436	1.000
g-SpMM	4	artnet-exp	fb	copy_e/min	128	0.4446	0.4429	1.004
g-SpMM	4	artnet-exp	fb	copy_e/sum	128	0.4066	0.4164	0.976
g-SpMM	4	artnet-exp	fb	copy_u/max	128	0.4769	0.4517	1.056
g-SpMM	4	artnet-exp	fb	copy_u/min	128	0.4919	0.4566	1.077
g-SpMM	4	artnet-exp	fb	copy_u/sum	128	0.5100	0.5817	0.877

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	artnet-exp	fb	div/max	128	0.7434	0.9419	0.789
g-SpMM	4	artnet-exp	fb	div/min	128	0.7451	0.9405	0.792
g-SpMM	4	artnet-exp	fb	div/sum	128	1.2630	1.8436	0.685
g-SpMM	4	artnet-exp	fb	mul/max	128	0.7406	0.9284	0.798
g-SpMM	4	artnet-exp	fb	mul/min	128	0.7436	0.9264	0.803
g-SpMM	4	artnet-exp	fb	mul/sum	128	1.0152	1.5009	0.676
g-SpMM	4	artnet-exp	fb	sub/max	128	0.6582	0.8486	0.776
g-SpMM	4	artnet-exp	fb	sub/min	128	0.6597	0.8528	0.774
g-SpMM	4	artnet-exp	fb	sub/sum	128	0.8401	0.9418	0.892
g-SpMM	4	artnet-exp	fwd	add/max	128	0.3280	0.5158	0.636
g-SpMM	4	artnet-exp	fwd	add/min	128	0.3231	0.5199	0.621
g-SpMM	4	artnet-exp	fwd	add/sum	128	0.3957	0.5014	0.789
g-SpMM	4	artnet-exp	fwd	copy_e/max	128	0.2144	0.2189	0.979
g-SpMM	4	artnet-exp	fwd	copy_e/min	128	0.2132	0.3628	0.588
g-SpMM	4	artnet-exp	fwd	copy_e/sum	128	0.2533	0.2542	0.996
g-SpMM	4	artnet-exp	fwd	copy_u/max	128	0.1960	0.3221	0.609
g-SpMM	4	artnet-exp	fwd	copy_u/min	128	0.1951	0.3216	0.607
g-SpMM	4	artnet-exp	fwd	copy_u/sum	128	0.1643	0.2809	0.585
g-SpMM	4	artnet-exp	fwd	div/max	128	0.3262	0.5284	0.617
g-SpMM	4	artnet-exp	fwd	div/min	128	0.3296	0.5400	0.610
g-SpMM	4	artnet-exp	fwd	div/sum	128	0.3879	0.5274	0.735
g-SpMM	4	artnet-exp	fwd	mul/max	128	0.3923	0.5134	0.764
g-SpMM	4	artnet-exp	fwd	mul/min	128	0.3311	0.5274	0.628
g-SpMM	4	artnet-exp	fwd	mul/sum	128	0.3647	0.5255	0.694
g-SpMM	4	artnet-exp	fwd	sub/max	128	0.3213	0.5205	0.617
g-SpMM	4	artnet-exp	fwd	sub/min	128	0.3228	0.5185	0.623
g-SpMM	4	artnet-exp	fwd	sub/sum	128	0.3851	0.5043	0.764
g-SpMM	4	artnet-exp	bwd	add/max	256	0.7015	0.7009	1.001
g-SpMM	4	artnet-exp	bwd	add/min	256	0.7018	0.7032	0.998
g-SpMM	4	artnet-exp	bwd	add/sum	256	0.6362	0.8625	0.738
g-SpMM	4	artnet-exp	bwd	copy_e/max	256	0.4684	0.4675	1.002
g-SpMM	4	artnet-exp	bwd	copy_e/min	256	0.4692	0.4689	1.001
g-SpMM	4	artnet-exp	bwd	copy_e/sum	256	0.2924	0.2868	1.019
g-SpMM	4	artnet-exp	bwd	copy_u/max	256	0.2644	0.2649	0.998
g-SpMM	4	artnet-exp	bwd	copy_u/min	256	0.2647	0.2643	1.002
g-SpMM	4	artnet-exp	bwd	copy_u/sum	256	0.3375	0.5687	0.593
g-SpMM	4	artnet-exp	bwd	div/max	256	0.8784	0.8779	1.001
g-SpMM	4	artnet-exp	bwd	div/min	256	0.8751	0.8703	1.006
g-SpMM	4	artnet-exp	bwd	div/sum	256	1.6723	2.5219	0.663
g-SpMM	4	artnet-exp	bwd	mul/max	256	0.8727	0.8758	0.996
g-SpMM	4	artnet-exp	bwd	mul/min	256	0.8800	0.8688	1.013
g-SpMM	4	artnet-exp	bwd	mul/sum	256	1.2434	1.8729	0.664
g-SpMM	4	artnet-exp	bwd	sub/max	256	0.7010	0.7042	0.996
g-SpMM	4	artnet-exp	bwd	sub/min	256	0.7028	0.7021	1.001
g-SpMM	4	artnet-exp	bwd	sub/sum	256	0.6373	0.8613	0.740
g-SpMM	4	artnet-exp	fb	add/max	256	1.3061	1.6774	0.779
g-SpMM	4	artnet-exp	fb	add/min	256	1.3071	1.6734	0.781
g-SpMM	4	artnet-exp	fb	add/sum	256	1.3606	1.8317	0.743
g-SpMM	4	artnet-exp	fb	copy_e/max	256	0.8528	0.8517	1.001
g-SpMM	4	artnet-exp	fb	copy_e/min	256	0.8552	0.8503	1.006
g-SpMM	4	artnet-exp	fb	copy_e/sum	256	0.7609	0.7625	0.998
g-SpMM	4	artnet-exp	fb	copy_u/max	256	0.6381	0.9131	0.699
g-SpMM	4	artnet-exp	fb	copy_u/min	256	0.6384	0.9130	0.699
g-SpMM	4	artnet-exp	fb	copy_u/sum	256	0.6830	1.1505	0.594
g-SpMM	4	artnet-exp	fb	div/max	256	1.4940	1.8823	0.794
g-SpMM	4	artnet-exp	fb	div/min	256	1.5028	1.8839	0.798
g-SpMM	4	artnet-exp	fb	div/sum	256	2.4097	3.5257	0.683
g-SpMM	4	artnet-exp	fb	mul/max	256	1.4859	1.8606	0.799
g-SpMM	4	artnet-exp	fb	mul/min	256	1.4975	1.8616	0.804
g-SpMM	4	artnet-exp	fb	mul/sum	256	1.9188	2.8909	0.664
g-SpMM	4	artnet-exp	fb	sub/max	256	1.2952	1.6739	0.774
g-SpMM	4	artnet-exp	fb	sub/min	256	1.3043	1.6721	0.780
g-SpMM	4	artnet-exp	fb	sub/sum	256	1.3578	1.8332	0.741
g-SpMM	4	artnet-exp	fwd	add/max	256	0.6153	0.9869	0.623
g-SpMM	4	artnet-exp	fwd	add/min	256	0.6306	1.0164	0.620
g-SpMM	4	artnet-exp	fwd	add/sum	256	0.7361	0.9794	0.752
g-SpMM	4	artnet-exp	fwd	copy_e/max	256	0.3955	0.3971	0.996
g-SpMM	4	artnet-exp	fwd	copy_e/min	256	0.4247	0.4181	1.016
g-SpMM	4	artnet-exp	fwd	copy_e/sum	256	0.4897	0.4978	0.984
g-SpMM	4	artnet-exp	fwd	copy_u/max	256	0.3791	0.6389	0.593
g-SpMM	4	artnet-exp	fwd	copy_u/min	256	0.3741	0.6416	0.583
g-SpMM	4	artnet-exp	fwd	copy_u/sum	256	0.3337	0.5655	0.590
g-SpMM	4	artnet-exp	fwd	div/max	256	0.6253	1.0075	0.621
g-SpMM	4	artnet-exp	fwd	div/min	256	0.6341	1.0335	0.614
g-SpMM	4	artnet-exp	fwd	div/sum	256	0.7436	1.0085	0.737
g-SpMM	4	artnet-exp	fwd	mul/max	256	0.6182	0.9871	0.626
g-SpMM	4	artnet-exp	fwd	mul/min	256	0.8611	1.0092	0.853
g-SpMM	4	artnet-exp	fwd	mul/sum	256	0.6778	1.0152	0.668

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	artnet-exp	fwd	sub/max	256	0.6140	0.9868	0.622
g-SpMM	4	artnet-exp	fwd	sub/min	256	0.6345	1.0083	0.629
g-SpMM	4	artnet-exp	fwd	sub/sum	256	0.7318	0.9743	0.751
g-SpMM	4	artnet-exp	bwd	add/max	512	1.5567	1.5616	0.997
g-SpMM	4	artnet-exp	bwd	add/min	512	1.5636	1.5612	1.002
g-SpMM	4	artnet-exp	bwd	add/sum	512	1.2048	1.6847	0.715
g-SpMM	4	artnet-exp	bwd	copy_e/max	512	0.9502	0.9459	1.005
g-SpMM	4	artnet-exp	bwd	copy_e/min	512	0.9494	0.9507	0.999
g-SpMM	4	artnet-exp	bwd	copy_e/sum	512	0.6041	0.5955	1.014
g-SpMM	4	artnet-exp	bwd	copy_u/max	512	0.5815	0.5811	1.001
g-SpMM	4	artnet-exp	bwd	copy_u/min	512	0.5817	0.5816	1.000
g-SpMM	4	artnet-exp	bwd	copy_u/sum	512	0.6122	1.1017	0.556
g-SpMM	4	artnet-exp	bwd	div/max	512	1.9724	1.9632	1.005
g-SpMM	4	artnet-exp	bwd	div/min	512	1.9644	1.9584	1.003
g-SpMM	4	artnet-exp	bwd	div/sum	512	3.2054	4.8299	0.664
g-SpMM	4	artnet-exp	bwd	mul/max	512	1.9565	1.9548	1.001
g-SpMM	4	artnet-exp	bwd	mul/min	512	1.9542	1.9583	0.998
g-SpMM	4	artnet-exp	bwd	mul/sum	512	2.3023	3.5797	0.643
g-SpMM	4	artnet-exp	bwd	sub/max	512	1.5597	1.5556	1.003
g-SpMM	4	artnet-exp	bwd	sub/min	512	1.5665	1.5621	1.003
g-SpMM	4	artnet-exp	bwd	sub/sum	512	1.1972	1.6867	0.710
g-SpMM	4	artnet-exp	fb	add/max	512	2.7451	3.4919	0.786
g-SpMM	4	artnet-exp	fb	add/min	512	2.7415	3.4828	0.787
g-SpMM	4	artnet-exp	fb	add/sum	512	2.9775	3.6367	0.819
g-SpMM	4	artnet-exp	fb	copy_e/max	512	1.7314	1.7182	1.008
g-SpMM	4	artnet-exp	fb	copy_e/min	512	1.7141	1.7211	0.996
g-SpMM	4	artnet-exp	fb	copy_e/sum	512	1.5090	1.4787	1.020
g-SpMM	4	artnet-exp	fb	copy_u/max	512	1.2421	1.8221	0.682
g-SpMM	4	artnet-exp	fb	copy_u/min	512	1.2369	1.8178	0.680
g-SpMM	4	artnet-exp	fb	copy_u/sum	512	1.2209	2.1887	0.558
g-SpMM	4	artnet-exp	fb	div/max	512	3.1317	3.9224	0.798
g-SpMM	4	artnet-exp	fb	div/min	512	3.1822	3.9345	0.809
g-SpMM	4	artnet-exp	fb	div/sum	512	4.6294	6.8024	0.681
g-SpMM	4	artnet-exp	fb	mul/max	512	3.1133	3.8666	0.805
g-SpMM	4	artnet-exp	fb	mul/min	512	3.1267	3.8726	0.807
g-SpMM	4	artnet-exp	fb	mul/sum	512	3.6147	5.6203	0.643
g-SpMM	4	artnet-exp	fb	sub/max	512	2.7428	3.4860	0.787
g-SpMM	4	artnet-exp	fb	sub/min	512	2.7351	3.4904	0.784
g-SpMM	4	artnet-exp	fb	sub/sum	512	2.6000	3.6301	0.716
g-SpMM	4	artnet-exp	fwd	add/max	512	1.1827	1.9199	0.616
g-SpMM	4	artnet-exp	fwd	add/min	512	1.2087	1.9690	0.614
g-SpMM	4	artnet-exp	fwd	add/sum	512	1.4036	1.9522	0.719
g-SpMM	4	artnet-exp	fwd	copy_e/max	512	0.7763	0.7816	0.993
g-SpMM	4	artnet-exp	fwd	copy_e/min	512	0.7986	0.8327	0.959
g-SpMM	4	artnet-exp	fwd	copy_e/sum	512	0.9142	0.9215	0.992
g-SpMM	4	artnet-exp	fwd	copy_u/max	512	0.7532	1.2334	0.611
g-SpMM	4	artnet-exp	fwd	copy_u/min	512	0.6610	1.2331	0.536
g-SpMM	4	artnet-exp	fwd	copy_u/sum	512	0.6109	1.0946	0.558
g-SpMM	4	artnet-exp	fwd	div/max	512	1.1865	1.9697	0.602
g-SpMM	4	artnet-exp	fwd	div/min	512	1.2283	2.0207	0.608
g-SpMM	4	artnet-exp	fwd	div/sum	512	1.4184	1.9610	0.723
g-SpMM	4	artnet-exp	fwd	mul/max	512	1.1690	1.9223	0.608
g-SpMM	4	artnet-exp	fwd	mul/min	512	1.2192	1.9728	0.618
g-SpMM	4	artnet-exp	fwd	mul/sum	512	1.3106	2.0270	0.647
g-SpMM	4	artnet-exp	fwd	sub/max	512	1.1846	1.9274	0.615
g-SpMM	4	artnet-exp	fwd	sub/min	512	1.2636	1.9580	0.645
g-SpMM	4	artnet-exp	fwd	sub/sum	512	1.4055	1.9386	0.725
g-SpMM	4	avazu-ctr	bwd	copy_u/max	64	0.2630	0.2634	0.998
g-SpMM	4	avazu-ctr	bwd	copy_u/min	64	0.2812	0.2825	0.995
g-SpMM	4	avazu-ctr	bwd	copy_u/sum	64	3.6112	5.1515	0.701
g-SpMM	4	avazu-ctr	fb	copy_u/max	64	2.9174	6.2644	0.466
g-SpMM	4	avazu-ctr	fb	copy_u/min	64	2.9609	6.1890	0.478
g-SpMM	4	avazu-ctr	fb	copy_u/sum	64	7.2759	10.3167	0.705
g-SpMM	4	avazu-ctr	fwd	copy_u/max	64	2.5988	6.0392	0.430
g-SpMM	4	avazu-ctr	fwd	copy_u/min	64	2.5724	6.0089	0.428
g-SpMM	4	avazu-ctr	fwd	copy_u/sum	64	3.5313	4.9786	0.709
g-SpMM	4	avazu-ctr	bwd	copy_u/max	128	0.4053	0.3992	1.015
g-SpMM	4	avazu-ctr	bwd	copy_u/min	128	0.4146	0.4205	0.986
g-SpMM	4	avazu-ctr	bwd	copy_u/sum	128	7.2122	10.2702	0.702
g-SpMM	4	avazu-ctr	fb	copy_u/max	128	5.5951	12.7357	0.439
g-SpMM	4	avazu-ctr	fb	copy_u/min	128	5.5243	12.7067	0.435
g-SpMM	4	avazu-ctr	fb	copy_u/sum	128	14.5191	20.7265	0.701
g-SpMM	4	avazu-ctr	fwd	copy_u/max	128	5.2039	12.2605	0.424
g-SpMM	4	avazu-ctr	fwd	copy_u/min	128	5.2965	12.2046	0.434
g-SpMM	4	avazu-ctr	fwd	copy_u/sum	128	7.2027	10.1303	0.711
g-SpMM	4	avazu-ctr	bwd	copy_u/max	256	0.7147	0.7144	1.000
g-SpMM	4	avazu-ctr	bwd	copy_u/min	256	0.7269	0.7273	0.999
g-SpMM	4	avazu-ctr	bwd	copy_u/sum	256	14.8422	20.4335	0.726

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	avazu-ctr	fb	copy_u/max	256	11.2733	25.6537	0.439
g-SpMM	4	avazu-ctr	fb	copy_u/min	256	11.2188	25.5241	0.440
g-SpMM	4	avazu-ctr	fb	copy_u/sum	256	30.1132	41.9947	0.717
g-SpMM	4	avazu-ctr	fwd	copy_u/max	256	10.3586	24.9158	0.416
g-SpMM	4	avazu-ctr	fwd	copy_u/min	256	10.2659	25.4097	0.404
g-SpMM	4	avazu-ctr	fwd	copy_u/sum	256	14.9378	20.4818	0.729
g-SpMM	4	avazu-ctr	bwd	copy_u/max	512	1.2005	1.2060	0.995
g-SpMM	4	avazu-ctr	bwd	copy_u/min	512	1.2457	1.2424	1.003
g-SpMM	4	avazu-ctr	bwd	copy_u/sum	512	30.4540	41.7893	0.729
g-SpMM	4	avazu-ctr	fb	copy_u/max	512	22.6107	52.0653	0.434
g-SpMM	4	avazu-ctr	fb	copy_u/min	512	21.9430	52.2390	0.420
g-SpMM	4	avazu-ctr	fb	copy_u/sum	512	60.6918	86.5456	0.701
g-SpMM	4	avazu-ctr	fwd	copy_u/max	512	21.4633	51.0197	0.421
g-SpMM	4	avazu-ctr	fwd	copy_u/min	512	21.4109	51.0296	0.420
g-SpMM	4	avazu-ctr	fwd	copy_u/sum	512	29.8641	41.9741	0.711
g-SpMM	4	citeseer	bwd	add/max	64	0.2281	0.2005	1.138
g-SpMM	4	citeseer	bwd	add/min	64	0.2218	0.1904	1.165
g-SpMM	4	citeseer	bwd	add/sum	64	0.3161	0.2655	1.191
g-SpMM	4	citeseer	bwd	copy_e/max	64	0.2036	0.1795	1.134
g-SpMM	4	citeseer	bwd	copy_e/min	64	0.2023	0.1803	1.123
g-SpMM	4	citeseer	bwd	copy_e/sum	64	0.2040	0.1770	1.152
g-SpMM	4	citeseer	bwd	copy_u/max	64	0.2082	0.1775	1.173
g-SpMM	4	citeseer	bwd	copy_u/min	64	0.2053	0.1762	1.165
g-SpMM	4	citeseer	bwd	copy_u/sum	64	0.2270	0.2011	1.128
g-SpMM	4	citeseer	bwd	div/max	64	0.2383	0.2043	1.166
g-SpMM	4	citeseer	bwd	div/min	64	0.2261	0.1989	1.136
g-SpMM	4	citeseer	bwd	div/sum	64	0.2686	0.2294	1.171
g-SpMM	4	citeseer	bwd	mul/max	64	0.2469	0.1981	1.247
g-SpMM	4	citeseer	bwd	mul/min	64	0.2250	0.2007	1.121
g-SpMM	4	citeseer	bwd	mul/sum	64	0.2598	0.2321	1.119
g-SpMM	4	citeseer	bwd	sub/max	64	0.2391	0.1984	1.205
g-SpMM	4	citeseer	bwd	sub/min	64	0.2250	0.2001	1.124
g-SpMM	4	citeseer	bwd	sub/sum	64	0.3182	0.2633	1.208
g-SpMM	4	citeseer	fb	add/max	64	0.4873	0.4134	1.179
g-SpMM	4	citeseer	fb	add/min	64	0.4679	0.4000	1.170
g-SpMM	4	citeseer	fb	add/sum	64	0.6091	0.4762	1.279
g-SpMM	4	citeseer	fb	copy_e/max	64	0.4485	0.3896	1.151
g-SpMM	4	citeseer	fb	copy_e/min	64	0.4399	0.3925	1.121
g-SpMM	4	citeseer	fb	copy_e/sum	64	0.4450	0.3823	1.164
g-SpMM	4	citeseer	fb	copy_u/max	64	0.4446	0.4039	1.101
g-SpMM	4	citeseer	fb	copy_u/min	64	0.4765	0.3879	1.229
g-SpMM	4	citeseer	fb	copy_u/sum	64	0.5366	0.3993	1.344
g-SpMM	4	citeseer	fb	div/max	64	0.4933	0.4072	1.211
g-SpMM	4	citeseer	fb	div/min	64	0.4671	0.4075	1.146
g-SpMM	4	citeseer	fb	div/sum	64	0.5263	0.4264	1.234
g-SpMM	4	citeseer	fb	mul/max	64	0.4976	0.4185	1.189
g-SpMM	4	citeseer	fb	mul/min	64	0.5012	0.4868	1.030
g-SpMM	4	citeseer	fb	mul/sum	64	0.5194	0.4335	1.198
g-SpMM	4	citeseer	fb	sub/max	64	0.5078	0.4162	1.220
g-SpMM	4	citeseer	fb	sub/min	64	0.4855	0.4138	1.173
g-SpMM	4	citeseer	fb	sub/sum	64	0.5313	0.4738	1.121
g-SpMM	4	citeseer	fwd	add/max	64	0.0890	0.0898	0.990
g-SpMM	4	citeseer	fwd	add/min	64	0.0985	0.0927	1.063
g-SpMM	4	citeseer	fwd	add/sum	64	0.0813	0.0832	0.977
g-SpMM	4	citeseer	fwd	copy_e/max	64	0.0887	0.0880	1.008
g-SpMM	4	citeseer	fwd	copy_e/min	64	0.0884	0.0894	0.989
g-SpMM	4	citeseer	fwd	copy_e/sum	64	0.0818	0.0816	1.002
g-SpMM	4	citeseer	fwd	copy_u/max	64	0.0954	0.0883	1.081
g-SpMM	4	citeseer	fwd	copy_u/min	64	0.0975	0.0938	1.040
g-SpMM	4	citeseer	fwd	copy_u/sum	64	0.0920	0.0821	1.121
g-SpMM	4	citeseer	fwd	div/max	64	0.0877	0.0880	0.997
g-SpMM	4	citeseer	fwd	div/min	64	0.0897	0.0882	1.017
g-SpMM	4	citeseer	fwd	div/sum	64	0.0906	0.0815	1.111
g-SpMM	4	citeseer	fwd	mul/max	64	0.0867	0.0881	0.984
g-SpMM	4	citeseer	fwd	mul/min	64	0.0894	0.0917	0.975
g-SpMM	4	citeseer	fwd	mul/sum	64	0.0817	0.0814	1.005
g-SpMM	4	citeseer	fwd	sub/max	64	0.0880	0.0916	0.960
g-SpMM	4	citeseer	fwd	sub/min	64	0.0898	0.0889	1.011
g-SpMM	4	citeseer	fwd	sub/sum	64	0.0822	0.0840	0.978
g-SpMM	4	citeseer	bwd	add/max	128	0.1903	0.2025	0.940
g-SpMM	4	citeseer	bwd	add/min	128	0.1929	0.1922	1.004
g-SpMM	4	citeseer	bwd	add/sum	128	0.2526	0.2575	0.981
g-SpMM	4	citeseer	bwd	copy_e/max	128	0.1686	0.1778	0.949
g-SpMM	4	citeseer	bwd	copy_e/min	128	0.1728	0.1760	0.982
g-SpMM	4	citeseer	bwd	copy_e/sum	128	0.1656	0.1740	0.952
g-SpMM	4	citeseer	bwd	copy_u/max	128	0.1803	0.1731	1.041
g-SpMM	4	citeseer	bwd	copy_u/min	128	0.1675	0.1775	0.944
g-SpMM	4	citeseer	bwd	copy_u/sum	128	0.1952	0.2040	0.957

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	citeseer	bwd	div/max	128	0.1989	0.1957	1.016
g-SpMM	4	citeseer	bwd	div/min	128	0.1978	0.1938	1.021
g-SpMM	4	citeseer	bwd	div/sum	128	0.2291	0.2296	0.997
g-SpMM	4	citeseer	bwd	mul/max	128	0.1894	0.1956	0.969
g-SpMM	4	citeseer	bwd	mul/min	128	0.1966	0.1966	1.000
g-SpMM	4	citeseer	bwd	mul/sum	128	0.2177	0.2236	0.974
g-SpMM	4	citeseer	bwd	sub/max	128	0.1954	0.1955	1.000
g-SpMM	4	citeseer	bwd	sub/min	128	0.1911	0.1956	0.977
g-SpMM	4	citeseer	bwd	sub/sum	128	0.2460	0.2561	0.961
g-SpMM	4	citeseer	fb	add/max	128	0.4022	0.3965	1.014
g-SpMM	4	citeseer	fb	add/min	128	0.4106	0.4130	0.994
g-SpMM	4	citeseer	fb	add/sum	128	0.4586	0.4814	0.953
g-SpMM	4	citeseer	fb	copy_e/max	128	0.3707	0.3859	0.961
g-SpMM	4	citeseer	fb	copy_e/min	128	0.3814	0.3860	0.988
g-SpMM	4	citeseer	fb	copy_e/sum	128	0.3616	0.3647	0.991
g-SpMM	4	citeseer	fb	copy_u/max	128	0.3757	0.3978	0.945
g-SpMM	4	citeseer	fb	copy_u/min	128	0.3714	0.3946	0.941
g-SpMM	4	citeseer	fb	copy_u/sum	128	0.3886	0.3971	0.978
g-SpMM	4	citeseer	fb	div/max	128	0.4110	0.4135	0.994
g-SpMM	4	citeseer	fb	div/min	128	0.4085	0.4107	0.995
g-SpMM	4	citeseer	fb	div/sum	128	0.4303	0.4257	1.011
g-SpMM	4	citeseer	fb	mul/max	128	0.4755	0.4136	1.150
g-SpMM	4	citeseer	fb	mul/min	128	0.4116	0.4083	1.008
g-SpMM	4	citeseer	fb	mul/sum	128	0.4120	0.4281	0.962
g-SpMM	4	citeseer	fb	sub/max	128	0.3915	0.4063	0.963
g-SpMM	4	citeseer	fb	sub/min	128	0.3957	0.4532	0.873
g-SpMM	4	citeseer	fb	sub/sum	128	0.4607	0.4716	0.977
g-SpMM	4	citeseer	fwd	add/max	128	0.0911	0.0881	1.034
g-SpMM	4	citeseer	fwd	add/min	128	0.0935	0.0892	1.049
g-SpMM	4	citeseer	fwd	add/sum	128	0.0802	0.0821	0.977
g-SpMM	4	citeseer	fwd	copy_e/max	128	0.0905	0.0878	1.031
g-SpMM	4	citeseer	fwd	copy_e/min	128	0.0853	0.0888	0.961
g-SpMM	4	citeseer	fwd	copy_e/sum	128	0.0785	0.0811	0.968
g-SpMM	4	citeseer	fwd	copy_u/max	128	0.0848	0.0878	0.966
g-SpMM	4	citeseer	fwd	copy_u/min	128	0.0861	0.0906	0.951
g-SpMM	4	citeseer	fwd	copy_u/sum	128	0.0790	0.0810	0.975
g-SpMM	4	citeseer	fwd	div/max	128	0.0865	0.0877	0.986
g-SpMM	4	citeseer	fwd	div/min	128	0.0869	0.0895	0.971
g-SpMM	4	citeseer	fwd	div/sum	128	0.0807	0.0814	0.991
g-SpMM	4	citeseer	fwd	mul/max	128	0.0874	0.0876	0.998
g-SpMM	4	citeseer	fwd	mul/min	128	0.0870	0.0884	0.985
g-SpMM	4	citeseer	fwd	mul/sum	128	0.0863	0.0822	1.050
g-SpMM	4	citeseer	fwd	sub/max	128	0.0876	0.0884	0.991
g-SpMM	4	citeseer	fwd	sub/min	128	0.0921	0.0889	1.036
g-SpMM	4	citeseer	fwd	sub/sum	128	0.0861	0.0815	1.057
g-SpMM	4	citeseer	bwd	add/max	256	0.1983	0.1881	1.055
g-SpMM	4	citeseer	bwd	add/min	256	0.1880	0.1898	0.990
g-SpMM	4	citeseer	bwd	add/sum	256	0.2392	0.2770	0.864
g-SpMM	4	citeseer	bwd	copy_e/max	256	0.1779	0.1899	0.937
g-SpMM	4	citeseer	bwd	copy_e/min	256	0.1788	0.1822	0.981
g-SpMM	4	citeseer	bwd	copy_e/sum	256	0.1729	0.1764	0.980
g-SpMM	4	citeseer	bwd	copy_u/max	256	0.1730	0.1839	0.941
g-SpMM	4	citeseer	bwd	copy_u/min	256	0.1703	0.1703	1.000
g-SpMM	4	citeseer	bwd	copy_u/sum	256	0.1995	0.2026	0.985
g-SpMM	4	citeseer	bwd	div/max	256	0.1872	0.1956	0.957
g-SpMM	4	citeseer	bwd	div/min	256	0.1947	0.1951	0.998
g-SpMM	4	citeseer	bwd	div/sum	256	0.2157	0.2412	0.894
g-SpMM	4	citeseer	bwd	mul/max	256	0.1898	0.1956	0.971
g-SpMM	4	citeseer	bwd	mul/min	256	0.1865	0.1938	0.962
g-SpMM	4	citeseer	bwd	mul/sum	256	0.2325	0.2277	1.021
g-SpMM	4	citeseer	bwd	sub/max	256	0.1890	0.2047	0.924
g-SpMM	4	citeseer	bwd	sub/min	256	0.1964	0.1962	1.001
g-SpMM	4	citeseer	bwd	sub/sum	256	0.2526	0.2559	0.987
g-SpMM	4	citeseer	fb	add/max	256	0.4002	0.3973	1.007
g-SpMM	4	citeseer	fb	add/min	256	0.3893	0.4577	0.851
g-SpMM	4	citeseer	fb	add/sum	256	0.4606	0.4757	0.968
g-SpMM	4	citeseer	fb	copy_e/max	256	0.3804	0.4048	0.940
g-SpMM	4	citeseer	fb	copy_e/min	256	0.3907	0.3943	0.991
g-SpMM	4	citeseer	fb	copy_e/sum	256	0.3598	0.3711	0.970
g-SpMM	4	citeseer	fb	copy_u/max	256	0.3783	0.3902	0.969
g-SpMM	4	citeseer	fb	copy_u/min	256	0.3795	0.3799	0.999
g-SpMM	4	citeseer	fb	copy_u/sum	256	0.4042	0.4014	1.007
g-SpMM	4	citeseer	fb	div/max	256	0.3851	0.4166	0.924
g-SpMM	4	citeseer	fb	div/min	256	0.4006	0.4037	0.992
g-SpMM	4	citeseer	fb	div/sum	256	0.4023	0.4271	0.942
g-SpMM	4	citeseer	fb	mul/max	256	0.3864	0.4091	0.945
g-SpMM	4	citeseer	fb	mul/min	256	0.3829	0.4005	0.956
g-SpMM	4	citeseer	fb	mul/sum	256	0.4074	0.4255	0.957

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	citeseer	fb	sub/max	256	0.4149	0.4085	1.016
g-SpMM	4	citeseer	fb	sub/min	256	0.3988	0.4034	0.989
g-SpMM	4	citeseer	fb	sub/sum	256	0.4536	0.4508	1.006
g-SpMM	4	citeseer	fwd	add/max	256	0.0856	0.0911	0.939
g-SpMM	4	citeseer	fwd	add/min	256	0.0880	0.0942	0.934
g-SpMM	4	citeseer	fwd	add/sum	256	0.0805	0.0823	0.978
g-SpMM	4	citeseer	fwd	copy_e/max	256	0.0866	0.0865	1.001
g-SpMM	4	citeseer	fwd	copy_e/min	256	0.0829	0.0854	0.972
g-SpMM	4	citeseer	fwd	copy_e/sum	256	0.0762	0.0858	0.887
g-SpMM	4	citeseer	fwd	copy_u/max	256	0.0834	0.0847	0.984
g-SpMM	4	citeseer	fwd	copy_u/min	256	0.0848	0.0858	0.988
g-SpMM	4	citeseer	fwd	copy_u/sum	256	0.0765	0.0784	0.975
g-SpMM	4	citeseer	fwd	div/max	256	0.0849	0.0885	0.959
g-SpMM	4	citeseer	fwd	div/min	256	0.0841	0.0883	0.952
g-SpMM	4	citeseer	fwd	div/sum	256	0.0787	0.0817	0.964
g-SpMM	4	citeseer	fwd	mul/max	256	0.0837	0.0882	0.949
g-SpMM	4	citeseer	fwd	mul/min	256	0.0842	0.0887	0.949
g-SpMM	4	citeseer	fwd	mul/sum	256	0.0776	0.0822	0.944
g-SpMM	4	citeseer	fwd	sub/max	256	0.0902	0.0885	1.019
g-SpMM	4	citeseer	fwd	sub/min	256	0.0848	0.0878	0.966
g-SpMM	4	citeseer	fwd	sub/sum	256	0.0829	0.0807	1.027
g-SpMM	4	citeseer	bwd	add/max	512	0.2390	0.1981	1.206
g-SpMM	4	citeseer	bwd	add/min	512	0.2363	0.1994	1.185
g-SpMM	4	citeseer	bwd	add/sum	512	0.2995	0.2468	1.213
g-SpMM	4	citeseer	bwd	copy_e/max	512	0.1992	0.1803	1.105
g-SpMM	4	citeseer	bwd	copy_e/min	512	0.2047	0.1803	1.135
g-SpMM	4	citeseer	bwd	copy_e/sum	512	0.2004	0.1746	1.148
g-SpMM	4	citeseer	bwd	copy_u/max	512	0.1950	0.1712	1.139
g-SpMM	4	citeseer	bwd	copy_u/min	512	0.1968	0.1712	1.150
g-SpMM	4	citeseer	bwd	copy_u/sum	512	0.2242	0.1988	1.128
g-SpMM	4	citeseer	bwd	div/max	512	0.2855	0.2316	1.233
g-SpMM	4	citeseer	bwd	div/min	512	0.3075	0.2331	1.319
g-SpMM	4	citeseer	bwd	div/sum	512	0.2722	0.3384	0.804
g-SpMM	4	citeseer	bwd	mul/max	512	0.2764	0.2279	1.213
g-SpMM	4	citeseer	bwd	mul/min	512	0.2735	0.2256	1.212
g-SpMM	4	citeseer	bwd	mul/sum	512	0.2482	0.2348	1.057
g-SpMM	4	citeseer	bwd	sub/max	512	0.2258	0.1978	1.141
g-SpMM	4	citeseer	bwd	sub/min	512	0.2241	0.1991	1.126
g-SpMM	4	citeseer	bwd	sub/sum	512	0.2863	0.2689	1.065
g-SpMM	4	citeseer	fb	add/max	512	0.4757	0.4148	1.147
g-SpMM	4	citeseer	fb	add/min	512	0.4689	0.4465	1.050
g-SpMM	4	citeseer	fb	add/sum	512	0.5014	0.4498	1.115
g-SpMM	4	citeseer	fb	copy_e/max	512	0.4395	0.3879	1.133
g-SpMM	4	citeseer	fb	copy_e/min	512	0.4336	0.3884	1.116
g-SpMM	4	citeseer	fb	copy_e/sum	512	0.4139	0.3727	1.111
g-SpMM	4	citeseer	fb	copy_u/max	512	0.4393	0.3829	1.147
g-SpMM	4	citeseer	fb	copy_u/min	512	0.4438	0.4003	1.109
g-SpMM	4	citeseer	fb	copy_u/sum	512	0.4423	0.4088	1.082
g-SpMM	4	citeseer	fb	div/max	512	0.4973	0.4147	1.199
g-SpMM	4	citeseer	fb	div/min	512	0.5929	0.4180	1.418
g-SpMM	4	citeseer	fb	div/sum	512	0.5116	0.5029	1.017
g-SpMM	4	citeseer	fb	mul/max	512	0.4993	0.4195	1.190
g-SpMM	4	citeseer	fb	mul/min	512	0.4892	0.4144	1.180
g-SpMM	4	citeseer	fb	mul/sum	512	0.4751	0.4517	1.052
g-SpMM	4	citeseer	fb	sub/max	512	0.4651	0.4077	1.141
g-SpMM	4	citeseer	fb	sub/min	512	0.4634	0.4044	1.146
g-SpMM	4	citeseer	fb	sub/sum	512	0.5172	0.4748	1.089
g-SpMM	4	citeseer	fwd	add/max	512	0.1215	0.1525	0.797
g-SpMM	4	citeseer	fwd	add/min	512	0.1215	0.1485	0.818
g-SpMM	4	citeseer	fwd	add/sum	512	0.0920	0.1688	0.545
g-SpMM	4	citeseer	fwd	copy_e/max	512	0.0870	0.0888	0.980
g-SpMM	4	citeseer	fwd	copy_e/min	512	0.0915	0.0885	1.034
g-SpMM	4	citeseer	fwd	copy_e/sum	512	0.0817	0.0815	1.003
g-SpMM	4	citeseer	fwd	copy_u/max	512	0.0914	0.0958	0.954
g-SpMM	4	citeseer	fwd	copy_u/min	512	0.0861	0.0903	0.954
g-SpMM	4	citeseer	fwd	copy_u/sum	512	0.0795	0.0809	0.983
g-SpMM	4	citeseer	fwd	div/max	512	0.1230	0.1520	0.809
g-SpMM	4	citeseer	fwd	div/min	512	0.1220	0.1534	0.795
g-SpMM	4	citeseer	fwd	div/sum	512	0.0886	0.1687	0.525
g-SpMM	4	citeseer	fwd	mul/max	512	0.1208	0.1516	0.796
g-SpMM	4	citeseer	fwd	mul/min	512	0.1224	0.1540	0.795
g-SpMM	4	citeseer	fwd	mul/sum	512	0.0854	0.1654	0.516
g-SpMM	4	citeseer	fwd	sub/max	512	0.1220	0.1509	0.809
g-SpMM	4	citeseer	fwd	sub/min	512	0.1199	0.1520	0.789
g-SpMM	4	citeseer	fwd	sub/sum	512	0.0914	0.1654	0.553
g-SpMM	4	city-reviews	bwd	add/max	64	0.6338	0.6327	1.002
g-SpMM	4	city-reviews	bwd	add/min	64	0.6352	0.6326	1.004
g-SpMM	4	city-reviews	bwd	add/sum	64	0.8802	1.1468	0.767

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-reviews	bwd	copy_e/max	64	0.4018	0.4008	1.002
g-SpMM	4	city-reviews	bwd	copy_e/min	64	0.4002	0.3995	1.002
g-SpMM	4	city-reviews	bwd	copy_e/sum	64	0.4334	0.4245	1.021
g-SpMM	4	city-reviews	bwd	copy_u/max	64	0.2142	0.2152	0.995
g-SpMM	4	city-reviews	bwd	copy_u/min	64	0.2161	0.2195	0.984
g-SpMM	4	city-reviews	bwd	copy_u/sum	64	0.5205	0.8182	0.636
g-SpMM	4	city-reviews	bwd	div/max	64	0.7908	0.7923	0.998
g-SpMM	4	city-reviews	bwd	div/min	64	0.7933	0.7930	1.000
g-SpMM	4	city-reviews	bwd	div/sum	64	2.2805	3.6289	0.628
g-SpMM	4	city-reviews	bwd	mul/max	64	0.7880	0.7900	0.997
g-SpMM	4	city-reviews	bwd	mul/min	64	0.7989	0.7912	1.010
g-SpMM	4	city-reviews	bwd	mul/sum	64	1.8219	2.8971	0.629
g-SpMM	4	city-reviews	bwd	sub/max	64	0.6309	0.6327	0.997
g-SpMM	4	city-reviews	bwd	sub/min	64	0.6325	0.6311	1.002
g-SpMM	4	city-reviews	bwd	sub/sum	64	0.8932	1.1435	0.781
g-SpMM	4	city-reviews	fb	add/max	64	1.7362	2.0969	0.828
g-SpMM	4	city-reviews	fb	add/min	64	1.7458	2.0944	0.834
g-SpMM	4	city-reviews	fb	add/sum	64	2.2693	2.9892	0.759
g-SpMM	4	city-reviews	fb	copy_e/max	64	0.8627	0.8611	1.002
g-SpMM	4	city-reviews	fb	copy_e/min	64	0.8643	0.8481	1.019
g-SpMM	4	city-reviews	fb	copy_e/sum	64	1.4027	1.3994	1.002
g-SpMM	4	city-reviews	fb	copy_u/max	64	0.7016	1.1956	0.587
g-SpMM	4	city-reviews	fb	copy_u/min	64	0.7062	1.1983	0.589
g-SpMM	4	city-reviews	fb	copy_u/sum	64	1.0873	1.6405	0.663
g-SpMM	4	city-reviews	fb	div/max	64	1.9272	2.2924	0.841
g-SpMM	4	city-reviews	fb	div/min	64	1.9243	2.2676	0.849
g-SpMM	4	city-reviews	fb	div/sum	64	3.6276	5.5110	0.658
g-SpMM	4	city-reviews	fb	mul/max	64	1.8912	2.2751	0.831
g-SpMM	4	city-reviews	fb	mul/min	64	1.9022	2.2367	0.850
g-SpMM	4	city-reviews	fb	mul/sum	64	3.0020	4.8590	0.618
g-SpMM	4	city-reviews	fb	sub/max	64	1.7288	2.1286	0.812
g-SpMM	4	city-reviews	fb	sub/min	64	1.7300	2.1145	0.818
g-SpMM	4	city-reviews	fb	sub/sum	64	2.2200	3.0235	0.734
g-SpMM	4	city-reviews	fwd	add/max	64	1.1196	1.4980	0.747
g-SpMM	4	city-reviews	fwd	add/min	64	1.1359	1.5561	0.730
g-SpMM	4	city-reviews	fwd	add/sum	64	1.3162	1.8125	0.726
g-SpMM	4	city-reviews	fwd	copy_e/max	64	0.4872	0.4695	1.038
g-SpMM	4	city-reviews	fwd	copy_e/min	64	0.5359	0.5020	1.068
g-SpMM	4	city-reviews	fwd	copy_e/sum	64	1.0820	1.0594	1.021
g-SpMM	4	city-reviews	fwd	copy_u/max	64	0.4686	0.9580	0.489
g-SpMM	4	city-reviews	fwd	copy_u/min	64	0.4633	0.9578	0.484
g-SpMM	4	city-reviews	fwd	copy_u/sum	64	0.5340	0.7820	0.683
g-SpMM	4	city-reviews	fwd	div/max	64	1.1209	1.4986	0.748
g-SpMM	4	city-reviews	fwd	div/min	64	1.1687	1.5403	0.759
g-SpMM	4	city-reviews	fwd	div/sum	64	1.3190	1.8387	0.717
g-SpMM	4	city-reviews	fwd	mul/max	64	1.1109	1.5143	0.734
g-SpMM	4	city-reviews	fwd	mul/min	64	1.1231	1.5330	0.733
g-SpMM	4	city-reviews	fwd	mul/sum	64	1.1233	1.8559	0.605
g-SpMM	4	city-reviews	fwd	sub/max	64	1.1091	1.5477	0.717
g-SpMM	4	city-reviews	fwd	sub/min	64	1.1494	1.5014	0.766
g-SpMM	4	city-reviews	fwd	sub/sum	64	1.3382	1.8144	0.738
g-SpMM	4	city-reviews	bwd	add/max	128	1.3897	1.3951	0.996
g-SpMM	4	city-reviews	bwd	add/min	128	1.3912	1.3884	1.002
g-SpMM	4	city-reviews	bwd	add/sum	128	1.7032	2.2532	0.756
g-SpMM	4	city-reviews	bwd	copy_e/max	128	0.7714	0.7721	0.999
g-SpMM	4	city-reviews	bwd	copy_e/min	128	0.7733	0.7724	1.001
g-SpMM	4	city-reviews	bwd	copy_e/sum	128	0.5689	0.5587	1.018
g-SpMM	4	city-reviews	bwd	copy_u/max	128	0.5104	0.5114	0.998
g-SpMM	4	city-reviews	bwd	copy_u/min	128	0.5130	0.5129	1.000
g-SpMM	4	city-reviews	bwd	copy_u/sum	128	1.1231	1.6937	0.663
g-SpMM	4	city-reviews	bwd	div/max	128	1.6842	1.6910	0.996
g-SpMM	4	city-reviews	bwd	div/min	128	1.6763	1.6713	1.003
g-SpMM	4	city-reviews	bwd	div/sum	128	4.2206	6.7827	0.622
g-SpMM	4	city-reviews	bwd	mul/max	128	1.6662	1.6667	1.000
g-SpMM	4	city-reviews	bwd	mul/min	128	1.6762	1.6659	1.006
g-SpMM	4	city-reviews	bwd	mul/sum	128	3.4167	5.5202	0.619
g-SpMM	4	city-reviews	bwd	sub/max	128	1.3984	1.4001	0.999
g-SpMM	4	city-reviews	bwd	sub/min	128	1.3930	1.3930	1.000
g-SpMM	4	city-reviews	bwd	sub/sum	128	1.7054	2.2610	0.754
g-SpMM	4	city-reviews	fb	add/max	128	3.6067	4.4035	0.819
g-SpMM	4	city-reviews	fb	add/min	128	3.5930	4.2954	0.836
g-SpMM	4	city-reviews	fb	add/sum	128	4.3664	5.9479	0.734
g-SpMM	4	city-reviews	fb	copy_e/max	128	1.6974	1.7473	0.971
g-SpMM	4	city-reviews	fb	copy_e/min	128	1.7183	1.7471	0.984
g-SpMM	4	city-reviews	fb	copy_e/sum	128	2.6400	2.6388	1.000
g-SpMM	4	city-reviews	fb	copy_u/max	128	1.4592	2.5089	0.582
g-SpMM	4	city-reviews	fb	copy_u/min	128	1.4582	2.5037	0.582
g-SpMM	4	city-reviews	fb	copy_u/sum	128	2.2559	3.3815	0.667

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-reviews	fb	div/max	128	3.8912	4.5506	0.855
g-SpMM	4	city-reviews	fb	div/min	128	3.8735	4.6587	0.831
g-SpMM	4	city-reviews	fb	div/sum	128	6.9209	10.4718	0.661
g-SpMM	4	city-reviews	fb	mul/max	128	3.8765	4.5584	0.850
g-SpMM	4	city-reviews	fb	mul/min	128	3.8691	4.5658	0.847
g-SpMM	4	city-reviews	fb	mul/sum	128	5.6864	9.2214	0.617
g-SpMM	4	city-reviews	fb	sub/max	128	3.5739	4.2794	0.835
g-SpMM	4	city-reviews	fb	sub/min	128	3.5874	4.3576	0.823
g-SpMM	4	city-reviews	fb	sub/sum	128	4.3783	5.9568	0.735
g-SpMM	4	city-reviews	fwd	add/max	128	2.2050	2.8951	0.762
g-SpMM	4	city-reviews	fwd	add/min	128	2.2715	2.9877	0.760
g-SpMM	4	city-reviews	fwd	add/sum	128	2.5510	3.6362	0.702
g-SpMM	4	city-reviews	fwd	copy_e/max	128	0.9561	0.9236	1.035
g-SpMM	4	city-reviews	fwd	copy_e/min	128	0.9987	1.0047	0.994
g-SpMM	4	city-reviews	fwd	copy_e/sum	128	2.1098	2.1133	0.998
g-SpMM	4	city-reviews	fwd	copy_u/max	128	0.9209	1.9993	0.461
g-SpMM	4	city-reviews	fwd	copy_u/min	128	0.9327	1.9942	0.468
g-SpMM	4	city-reviews	fwd	copy_u/sum	128	1.1121	1.6838	0.660
g-SpMM	4	city-reviews	fwd	div/max	128	2.2186	3.0552	0.726
g-SpMM	4	city-reviews	fwd	div/min	128	2.3144	3.0059	0.770
g-SpMM	4	city-reviews	fwd	div/sum	128	2.6435	3.6562	0.723
g-SpMM	4	city-reviews	fwd	mul/max	128	2.2006	2.8825	0.763
g-SpMM	4	city-reviews	fwd	mul/min	128	2.2511	2.9823	0.755
g-SpMM	4	city-reviews	fwd	mul/sum	128	2.2527	3.7290	0.604
g-SpMM	4	city-reviews	fwd	sub/max	128	2.2003	2.9058	0.757
g-SpMM	4	city-reviews	fwd	sub/min	128	2.2931	2.9671	0.773
g-SpMM	4	city-reviews	fwd	sub/sum	128	2.5859	3.6153	0.715
g-SpMM	4	city-reviews	bwd	add/max	256	3.0436	3.0434	1.000
g-SpMM	4	city-reviews	bwd	add/min	256	3.0474	3.0046	1.014
g-SpMM	4	city-reviews	bwd	add/sum	256	3.4864	4.6397	0.751
g-SpMM	4	city-reviews	bwd	copy_e/max	256	1.5089	1.5118	0.998
g-SpMM	4	city-reviews	bwd	copy_e/min	256	1.5136	1.5116	1.001
g-SpMM	4	city-reviews	bwd	copy_e/sum	256	1.0621	1.0594	1.003
g-SpMM	4	city-reviews	bwd	copy_u/max	256	1.1946	1.1948	1.000
g-SpMM	4	city-reviews	bwd	copy_u/min	256	1.1576	1.1884	0.974
g-SpMM	4	city-reviews	bwd	copy_u/sum	256	2.4380	3.5579	0.685
g-SpMM	4	city-reviews	bwd	div/max	256	3.5436	3.5459	0.999
g-SpMM	4	city-reviews	bwd	div/min	256	3.4990	3.5462	0.987
g-SpMM	4	city-reviews	bwd	div/sum	256	8.2809	13.2561	0.625
g-SpMM	4	city-reviews	bwd	mul/max	256	3.5354	3.5361	1.000
g-SpMM	4	city-reviews	bwd	mul/min	256	3.5364	3.4862	1.014
g-SpMM	4	city-reviews	bwd	mul/sum	256	6.6588	10.7085	0.622
g-SpMM	4	city-reviews	bwd	sub/max	256	3.0476	3.0452	1.001
g-SpMM	4	city-reviews	bwd	sub/min	256	2.9968	3.0500	0.983
g-SpMM	4	city-reviews	bwd	sub/sum	256	3.4982	4.6514	0.752
g-SpMM	4	city-reviews	fb	add/max	256	7.4640	8.8850	0.840
g-SpMM	4	city-reviews	fb	add/min	256	7.4707	8.9167	0.838
g-SpMM	4	city-reviews	fb	add/sum	256	8.6967	12.0950	0.719
g-SpMM	4	city-reviews	fb	copy_e/max	256	3.3509	3.3794	0.992
g-SpMM	4	city-reviews	fb	copy_e/min	256	3.4096	3.8060	0.896
g-SpMM	4	city-reviews	fb	copy_e/sum	256	5.2504	5.1898	1.012
g-SpMM	4	city-reviews	fb	copy_u/max	256	3.1004	5.4291	0.571
g-SpMM	4	city-reviews	fb	copy_u/min	256	3.0771	5.3848	0.571
g-SpMM	4	city-reviews	fb	copy_u/sum	256	4.9132	7.1827	0.684
g-SpMM	4	city-reviews	fb	div/max	256	7.9632	9.3542	0.851
g-SpMM	4	city-reviews	fb	div/min	256	7.9821	9.3997	0.849
g-SpMM	4	city-reviews	fb	div/sum	256	13.6333	20.6624	0.660
g-SpMM	4	city-reviews	fb	mul/max	256	7.9078	9.0933	0.870
g-SpMM	4	city-reviews	fb	mul/min	256	7.9140	9.3333	0.848
g-SpMM	4	city-reviews	fb	mul/sum	256	11.1614	18.3740	0.607
g-SpMM	4	city-reviews	fb	sub/max	256	7.4608	8.8719	0.841
g-SpMM	4	city-reviews	fb	sub/min	256	7.4112	8.8852	0.834
g-SpMM	4	city-reviews	fb	sub/sum	256	8.7767	12.0880	0.726
g-SpMM	4	city-reviews	fwd	add/max	256	4.4090	5.8725	0.751
g-SpMM	4	city-reviews	fwd	add/min	256	4.5730	5.8482	0.782
g-SpMM	4	city-reviews	fwd	add/sum	256	5.2288	7.3412	0.712
g-SpMM	4	city-reviews	fwd	copy_e/max	256	1.8830	1.8850	0.999
g-SpMM	4	city-reviews	fwd	copy_e/min	256	1.8965	1.9139	0.991
g-SpMM	4	city-reviews	fwd	copy_e/sum	256	4.1811	4.1931	0.997
g-SpMM	4	city-reviews	fwd	copy_u/max	256	1.9304	4.3087	0.448
g-SpMM	4	city-reviews	fwd	copy_u/min	256	1.9121	4.2627	0.449
g-SpMM	4	city-reviews	fwd	copy_u/sum	256	2.4219	3.4910	0.694
g-SpMM	4	city-reviews	fwd	div/max	256	4.4818	5.9039	0.759
g-SpMM	4	city-reviews	fwd	div/min	256	4.6450	5.9392	0.782
g-SpMM	4	city-reviews	fwd	div/sum	256	5.1788	7.3531	0.704
g-SpMM	4	city-reviews	fwd	mul/max	256	4.3840	5.8932	0.744
g-SpMM	4	city-reviews	fwd	mul/min	256	4.5265	6.1254	0.739
g-SpMM	4	city-reviews	fwd	mul/sum	256	4.3449	7.5416	0.576

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-reviews	fwd	sub/max	256	4.4158	5.8637	0.753
g-SpMM	4	city-reviews	fwd	sub/min	256	4.5561	6.0058	0.759
g-SpMM	4	city-reviews	fwd	sub/sum	256	5.2021	7.2784	0.715
g-SpMM	4	city-reviews	bwd	add/max	512	6.7927	6.7909	1.000
g-SpMM	4	city-reviews	bwd	add/min	512	6.7881	6.7966	0.999
g-SpMM	4	city-reviews	bwd	add/sum	512	7.5080	12.0788	0.622
g-SpMM	4	city-reviews	bwd	copy_e/max	512	3.1265	3.1004	1.008
g-SpMM	4	city-reviews	bwd	copy_e/min	512	3.1144	3.1213	0.998
g-SpMM	4	city-reviews	bwd	copy_e/sum	512	2.3528	2.3592	0.997
g-SpMM	4	city-reviews	bwd	copy_u/max	512	2.9253	2.9241	1.000
g-SpMM	4	city-reviews	bwd	copy_u/min	512	2.9301	2.9174	1.004
g-SpMM	4	city-reviews	bwd	copy_u/sum	512	5.1277	7.4319	0.690
g-SpMM	4	city-reviews	bwd	div/max	512	7.8901	7.8930	1.000
g-SpMM	4	city-reviews	bwd	div/min	512	7.9002	7.9124	0.998
g-SpMM	4	city-reviews	bwd	div/sum	512	35.0477	26.0531	1.345
g-SpMM	4	city-reviews	bwd	mul/max	512	7.8875	7.8652	1.003
g-SpMM	4	city-reviews	bwd	mul/min	512	7.8837	7.8701	1.002
g-SpMM	4	city-reviews	bwd	mul/sum	512	39.6287	21.3021	1.860
g-SpMM	4	city-reviews	bwd	sub/max	512	6.8098	6.7830	1.004
g-SpMM	4	city-reviews	bwd	sub/min	512	6.8136	6.7840	1.004
g-SpMM	4	city-reviews	bwd	sub/sum	512	29.0129	9.7580	2.973
g-SpMM	4	city-reviews	fb	add/max	512	15.8097	18.5705	0.851
g-SpMM	4	city-reviews	fb	add/min	512	15.9319	18.5666	0.858
g-SpMM	4	city-reviews	fb	add/sum	512	18.0748	25.0778	0.721
g-SpMM	4	city-reviews	fb	copy_e/max	512	7.0893	7.0294	1.009
g-SpMM	4	city-reviews	fb	copy_e/min	512	7.0789	7.2806	0.972
g-SpMM	4	city-reviews	fb	copy_e/sum	512	10.5094	10.4917	1.002
g-SpMM	4	city-reviews	fb	copy_u/max	512	6.7766	11.7872	0.575
g-SpMM	4	city-reviews	fb	copy_u/min	512	6.6884	11.8168	0.566
g-SpMM	4	city-reviews	fb	copy_u/sum	512	10.2676	15.0222	0.683
g-SpMM	4	city-reviews	fb	div/max	512	16.9879	19.9132	0.853
g-SpMM	4	city-reviews	fb	div/min	512	16.9804	19.7923	0.858
g-SpMM	4	city-reviews	fb	div/sum	512	26.9111	43.4416	0.619
g-SpMM	4	city-reviews	fb	mul/max	512	16.8319	19.7333	0.853
g-SpMM	4	city-reviews	fb	mul/min	512	16.9212	19.6477	0.861
g-SpMM	4	city-reviews	fb	mul/sum	512	22.1662	42.9470	0.516
g-SpMM	4	city-reviews	fb	sub/max	512	15.7610	18.5725	0.849
g-SpMM	4	city-reviews	fb	sub/min	512	15.7485	18.5188	0.850
g-SpMM	4	city-reviews	fb	sub/sum	512	18.0978	24.8130	0.729
g-SpMM	4	city-reviews	fwd	add/max	512	8.9977	11.8796	0.757
g-SpMM	4	city-reviews	fwd	add/min	512	9.3003	11.9622	0.777
g-SpMM	4	city-reviews	fwd	add/sum	512	10.4733	14.7985	0.708
g-SpMM	4	city-reviews	fwd	copy_e/max	512	3.9732	3.9761	0.999
g-SpMM	4	city-reviews	fwd	copy_e/min	512	4.0946	4.0697	1.006
g-SpMM	4	city-reviews	fwd	copy_e/sum	512	8.2123	8.2439	0.996
g-SpMM	4	city-reviews	fwd	copy_u/max	512	3.8819	8.9674	0.433
g-SpMM	4	city-reviews	fwd	copy_u/min	512	3.8874	8.8567	0.439
g-SpMM	4	city-reviews	fwd	copy_u/sum	512	5.0675	7.3313	0.691
g-SpMM	4	city-reviews	fwd	div/max	512	9.1828	11.9755	0.767
g-SpMM	4	city-reviews	fwd	div/min	512	9.1031	12.0659	0.754
g-SpMM	4	city-reviews	fwd	div/sum	512	10.5206	14.9437	0.704
g-SpMM	4	city-reviews	fwd	mul/max	512	8.8606	11.7911	0.751
g-SpMM	4	city-reviews	fwd	mul/min	512	9.0958	12.0728	0.753
g-SpMM	4	city-reviews	fwd	mul/sum	512	8.8674	15.1641	0.585
g-SpMM	4	city-reviews	fwd	sub/max	512	9.0384	12.2304	0.739
g-SpMM	4	city-reviews	fwd	sub/min	512	9.0353	12.1329	0.745
g-SpMM	4	city-reviews	fwd	sub/sum	512	10.4049	15.0013	0.694
g-SpMM	4	city-roads-L	bwd	add/max	64	0.5158	0.5823	0.886
g-SpMM	4	city-roads-L	bwd	add/min	64	0.5189	0.5820	0.892
g-SpMM	4	city-roads-L	bwd	add/sum	64	0.4036	0.5286	0.764
g-SpMM	4	city-roads-L	bwd	copy_e/max	64	0.3571	0.4854	0.736
g-SpMM	4	city-roads-L	bwd	copy_e/min	64	0.3573	0.4860	0.735
g-SpMM	4	city-roads-L	bwd	copy_e/sum	64	0.2191	0.2198	0.997
g-SpMM	4	city-roads-L	bwd	copy_u/max	64	0.1952	0.2056	0.950
g-SpMM	4	city-roads-L	bwd	copy_u/min	64	0.2020	0.2056	0.983
g-SpMM	4	city-roads-L	bwd	copy_u/sum	64	0.2316	0.3460	0.669
g-SpMM	4	city-roads-L	bwd	div/max	64	0.6222	0.6446	0.965
g-SpMM	4	city-roads-L	bwd	div/min	64	0.6211	0.6441	0.964
g-SpMM	4	city-roads-L	bwd	div/sum	64	1.1240	1.0753	1.045
g-SpMM	4	city-roads-L	bwd	mul/max	64	0.6184	0.6505	0.951
g-SpMM	4	city-roads-L	bwd	mul/min	64	0.6208	0.6523	0.952
g-SpMM	4	city-roads-L	bwd	mul/sum	64	0.6476	0.9073	0.714
g-SpMM	4	city-roads-L	bwd	sub/max	64	0.5170	0.5864	0.882
g-SpMM	4	city-roads-L	bwd	sub/min	64	0.5173	0.5820	0.889
g-SpMM	4	city-roads-L	bwd	sub/sum	64	0.4038	0.5288	0.764
g-SpMM	4	city-roads-L	fb	add/max	64	0.8099	1.1012	0.735
g-SpMM	4	city-roads-L	fb	add/min	64	0.8100	1.1016	0.735
g-SpMM	4	city-roads-L	fb	add/sum	64	0.7407	0.9555	0.775

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-L	fb	copy_e/max	64	0.5945	0.7235	0.822
g-SpMM	4	city-roads-L	fb	copy_e/min	64	0.5949	0.7238	0.822
g-SpMM	4	city-roads-L	fb	copy_e/sum	64	0.4225	0.4414	0.957
g-SpMM	4	city-roads-L	fb	copy_u/max	64	0.4423	0.5679	0.779
g-SpMM	4	city-roads-L	fb	copy_u/min	64	0.4426	0.5681	0.779
g-SpMM	4	city-roads-L	fb	copy_u/sum	64	0.4623	0.7064	0.655
g-SpMM	4	city-roads-L	fb	div/max	64	0.9178	1.1668	0.787
g-SpMM	4	city-roads-L	fb	div/min	64	0.9180	1.1681	0.786
g-SpMM	4	city-roads-L	fb	div/sum	64	1.1275	1.5145	0.744
g-SpMM	4	city-roads-L	fb	mul/max	64	0.9120	1.1667	0.782
g-SpMM	4	city-roads-L	fb	mul/min	64	0.9139	1.1708	0.781
g-SpMM	4	city-roads-L	fb	mul/sum	64	0.9642	1.3350	0.722
g-SpMM	4	city-roads-L	fb	sub/max	64	0.8129	1.1006	0.739
g-SpMM	4	city-roads-L	fb	sub/min	64	1.2709	1.1013	1.154
g-SpMM	4	city-roads-L	fb	sub/sum	64	0.7182	0.9547	0.752
g-SpMM	4	city-roads-L	fwd	add/max	64	0.2996	0.5244	0.571
g-SpMM	4	city-roads-L	fwd	add/min	64	0.2999	0.5215	0.575
g-SpMM	4	city-roads-L	fwd	add/sum	64	0.3158	0.4285	0.737
g-SpMM	4	city-roads-L	fwd	copy_e/max	64	0.2416	0.2455	0.984
g-SpMM	4	city-roads-L	fwd	copy_e/min	64	0.2413	0.2413	1.000
g-SpMM	4	city-roads-L	fwd	copy_e/sum	64	0.2108	0.2143	0.984
g-SpMM	4	city-roads-L	fwd	copy_u/max	64	0.2642	0.3981	0.664
g-SpMM	4	city-roads-L	fwd	copy_u/min	64	0.2619	0.3968	0.660
g-SpMM	4	city-roads-L	fwd	copy_u/sum	64	0.2236	0.3461	0.646
g-SpMM	4	city-roads-L	fwd	div/max	64	0.3081	0.5323	0.579
g-SpMM	4	city-roads-L	fwd	div/min	64	0.3003	0.5283	0.568
g-SpMM	4	city-roads-L	fwd	div/sum	64	0.3250	0.4500	0.722
g-SpMM	4	city-roads-L	fwd	mul/max	64	0.3066	0.5250	0.584
g-SpMM	4	city-roads-L	fwd	mul/min	64	0.2999	0.5224	0.574
g-SpMM	4	city-roads-L	fwd	mul/sum	64	0.3274	0.4424	0.740
g-SpMM	4	city-roads-L	fwd	sub/max	64	0.3002	0.5606	0.536
g-SpMM	4	city-roads-L	fwd	sub/min	64	0.4181	0.5219	0.801
g-SpMM	4	city-roads-L	fwd	sub/sum	64	0.3232	0.4366	0.740
g-SpMM	4	city-roads-L	bwd	add/max	128	0.9262	1.0457	0.886
g-SpMM	4	city-roads-L	bwd	add/min	128	0.9272	1.0454	0.887
g-SpMM	4	city-roads-L	bwd	add/sum	128	0.6983	0.9448	0.739
g-SpMM	4	city-roads-L	bwd	copy_e/max	128	0.6349	0.8518	0.745
g-SpMM	4	city-roads-L	bwd	copy_e/min	128	0.6343	0.8509	0.745
g-SpMM	4	city-roads-L	bwd	copy_e/sum	128	0.2938	0.2927	1.004
g-SpMM	4	city-roads-L	bwd	copy_u/max	128	0.2987	0.2984	1.001
g-SpMM	4	city-roads-L	bwd	copy_u/min	128	0.2992	0.2982	1.004
g-SpMM	4	city-roads-L	bwd	copy_u/sum	128	0.4005	0.6460	0.620
g-SpMM	4	city-roads-L	bwd	div/max	128	1.1476	1.1752	0.977
g-SpMM	4	city-roads-L	bwd	div/min	128	1.1484	1.1756	0.977
g-SpMM	4	city-roads-L	bwd	div/sum	128	1.2613	1.9328	0.653
g-SpMM	4	city-roads-L	bwd	mul/max	128	1.1369	1.1886	0.957
g-SpMM	4	city-roads-L	bwd	mul/min	128	1.1377	1.1873	0.958
g-SpMM	4	city-roads-L	bwd	mul/sum	128	1.1251	1.6016	0.702
g-SpMM	4	city-roads-L	bwd	sub/max	128	0.9341	1.0458	0.893
g-SpMM	4	city-roads-L	bwd	sub/min	128	0.9343	1.0460	0.893
g-SpMM	4	city-roads-L	bwd	sub/sum	128	0.6970	0.9448	0.738
g-SpMM	4	city-roads-L	fb	add/max	128	1.4494	1.9858	0.730
g-SpMM	4	city-roads-L	fb	add/min	128	1.4535	1.9858	0.732
g-SpMM	4	city-roads-L	fb	add/sum	128	1.2440	1.7243	0.721
g-SpMM	4	city-roads-L	fb	copy_e/max	128	1.0642	1.2808	0.831
g-SpMM	4	city-roads-L	fb	copy_e/min	128	1.0629	1.2804	0.830
g-SpMM	4	city-roads-L	fb	copy_e/sum	128	0.6621	0.6626	0.999
g-SpMM	4	city-roads-L	fb	copy_u/max	128	0.7662	1.0258	0.747
g-SpMM	4	city-roads-L	fb	copy_u/min	128	0.7669	1.0263	0.747
g-SpMM	4	city-roads-L	fb	copy_u/sum	128	0.8045	1.3005	0.619
g-SpMM	4	city-roads-L	fb	div/max	128	1.6728	2.1200	0.789
g-SpMM	4	city-roads-L	fb	div/min	128	1.6729	2.1214	0.789
g-SpMM	4	city-roads-L	fb	div/sum	128	1.8122	2.7321	0.663
g-SpMM	4	city-roads-L	fb	mul/max	128	1.6651	2.1239	0.784
g-SpMM	4	city-roads-L	fb	mul/min	128	1.6603	2.1265	0.781
g-SpMM	4	city-roads-L	fb	mul/sum	128	1.6682	2.3882	0.698
g-SpMM	4	city-roads-L	fb	sub/max	128	1.4581	1.9860	0.734
g-SpMM	4	city-roads-L	fb	sub/min	128	1.4585	1.9857	0.735
g-SpMM	4	city-roads-L	fb	sub/sum	128	1.2436	1.7227	0.722
g-SpMM	4	city-roads-L	fwd	add/max	128	0.5637	0.9545	0.591
g-SpMM	4	city-roads-L	fwd	add/min	128	0.5633	0.9542	0.590
g-SpMM	4	city-roads-L	fwd	add/sum	128	0.5625	0.7951	0.707
g-SpMM	4	city-roads-L	fwd	copy_e/max	128	0.5121	0.5631	0.909
g-SpMM	4	city-roads-L	fwd	copy_e/min	128	0.4332	0.4336	0.999
g-SpMM	4	city-roads-L	fwd	copy_e/sum	128	0.3840	0.3886	0.988
g-SpMM	4	city-roads-L	fwd	copy_u/max	128	0.4756	0.7312	0.650
g-SpMM	4	city-roads-L	fwd	copy_u/min	128	0.4753	0.7315	0.650
g-SpMM	4	city-roads-L	fwd	copy_u/sum	128	0.3978	0.6466	0.615

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-L	fwd	div/max	128	0.5461	0.9618	0.568
g-SpMM	4	city-roads-L	fwd	div/min	128	0.5338	0.9600	0.556
g-SpMM	4	city-roads-L	fwd	div/sum	128	0.5686	0.8230	0.691
g-SpMM	4	city-roads-L	fwd	mul/max	128	0.8107	0.9696	0.836
g-SpMM	4	city-roads-L	fwd	mul/min	128	0.5311	0.9543	0.557
g-SpMM	4	city-roads-L	fwd	mul/sum	128	0.5624	0.8062	0.698
g-SpMM	4	city-roads-L	fwd	sub/max	128	0.7930	0.9543	0.831
g-SpMM	4	city-roads-L	fwd	sub/min	128	0.5448	0.9492	0.574
g-SpMM	4	city-roads-L	fwd	sub/sum	128	0.5636	0.7965	0.708
g-SpMM	4	city-roads-L	bwd	add/max	256	1.7280	1.9592	0.882
g-SpMM	4	city-roads-L	bwd	add/min	256	1.7269	1.9567	0.883
g-SpMM	4	city-roads-L	bwd	add/sum	256	1.2609	1.7450	0.723
g-SpMM	4	city-roads-L	bwd	copy_e/max	256	1.1720	1.5721	0.746
g-SpMM	4	city-roads-L	bwd	copy_e/min	256	1.1760	1.5721	0.748
g-SpMM	4	city-roads-L	bwd	copy_e/sum	256	0.5235	0.5231	1.001
g-SpMM	4	city-roads-L	bwd	copy_u/max	256	0.5743	0.5708	1.006
g-SpMM	4	city-roads-L	bwd	copy_u/min	256	0.5716	0.5717	1.000
g-SpMM	4	city-roads-L	bwd	copy_u/sum	256	0.7386	1.2230	0.604
g-SpMM	4	city-roads-L	bwd	div/max	256	2.1691	2.2062	0.983
g-SpMM	4	city-roads-L	bwd	div/min	256	2.1682	2.2126	0.980
g-SpMM	4	city-roads-L	bwd	div/sum	256	2.3077	3.6130	0.639
g-SpMM	4	city-roads-L	bwd	mul/max	256	2.1600	2.2232	0.972
g-SpMM	4	city-roads-L	bwd	mul/min	256	2.1498	2.2321	0.963
g-SpMM	4	city-roads-L	bwd	mul/sum	256	2.0351	2.9817	0.683
g-SpMM	4	city-roads-L	bwd	sub/max	256	1.7431	1.9547	0.892
g-SpMM	4	city-roads-L	bwd	sub/min	256	1.7464	1.9567	0.893
g-SpMM	4	city-roads-L	bwd	sub/sum	256	1.2634	1.7466	0.723
g-SpMM	4	city-roads-L	fb	add/max	256	2.7029	3.7353	0.724
g-SpMM	4	city-roads-L	fb	add/min	256	2.7039	3.7349	0.724
g-SpMM	4	city-roads-L	fb	add/sum	256	2.2640	3.2263	0.702
g-SpMM	4	city-roads-L	fb	copy_e/max	256	1.9778	2.3803	0.831
g-SpMM	4	city-roads-L	fb	copy_e/min	256	1.9909	2.3770	0.838
g-SpMM	4	city-roads-L	fb	copy_e/sum	256	1.2042	1.2047	1.000
g-SpMM	4	city-roads-L	fb	copy_u/max	256	1.4469	1.9517	0.741
g-SpMM	4	city-roads-L	fb	copy_u/min	256	1.4460	1.9525	0.741
g-SpMM	4	city-roads-L	fb	copy_u/sum	256	1.4737	2.4444	0.603
g-SpMM	4	city-roads-L	fb	div/max	256	3.1511	3.9984	0.788
g-SpMM	4	city-roads-L	fb	div/min	256	3.1483	4.0028	0.787
g-SpMM	4	city-roads-L	fb	div/sum	256	3.3195	5.1447	0.645
g-SpMM	4	city-roads-L	fb	mul/max	256	3.1280	4.0210	0.778
g-SpMM	4	city-roads-L	fb	mul/min	256	3.1348	4.0075	0.782
g-SpMM	4	city-roads-L	fb	mul/sum	256	3.0359	4.4772	0.678
g-SpMM	4	city-roads-L	fb	sub/max	256	2.7333	3.7334	0.732
g-SpMM	4	city-roads-L	fb	sub/min	256	2.7240	3.7342	0.729
g-SpMM	4	city-roads-L	fb	sub/sum	256	2.2661	3.2275	0.702
g-SpMM	4	city-roads-L	fwd	add/max	256	1.0863	1.8061	0.601
g-SpMM	4	city-roads-L	fwd	add/min	256	1.1115	1.8038	0.616
g-SpMM	4	city-roads-L	fwd	add/sum	256	1.0269	1.5123	0.679
g-SpMM	4	city-roads-L	fwd	copy_e/max	256	1.0287	1.0250	1.004
g-SpMM	4	city-roads-L	fwd	copy_e/min	256	0.9719	0.9044	1.075
g-SpMM	4	city-roads-L	fwd	copy_e/sum	256	0.9472	0.6947	1.363
g-SpMM	4	city-roads-L	fwd	copy_u/max	256	0.8844	1.3853	0.638
g-SpMM	4	city-roads-L	fwd	copy_u/min	256	0.8797	1.3862	0.635
g-SpMM	4	city-roads-L	fwd	copy_u/sum	256	0.7394	1.2251	0.603
g-SpMM	4	city-roads-L	fwd	div/max	256	1.0817	1.8176	0.595
g-SpMM	4	city-roads-L	fwd	div/min	256	0.9818	1.8152	0.541
g-SpMM	4	city-roads-L	fwd	div/sum	256	1.0355	1.5611	0.663
g-SpMM	4	city-roads-L	fwd	mul/max	256	1.2435	1.8048	0.689
g-SpMM	4	city-roads-L	fwd	mul/min	256	1.0179	1.8027	0.565
g-SpMM	4	city-roads-L	fwd	mul/sum	256	1.0245	1.5275	0.671
g-SpMM	4	city-roads-L	fwd	sub/max	256	2.1698	1.8051	1.202
g-SpMM	4	city-roads-L	fwd	sub/min	256	1.4285	1.8040	0.792
g-SpMM	4	city-roads-L	fwd	sub/sum	256	1.0276	1.5110	0.680
g-SpMM	4	city-roads-L	bwd	add/max	512	3.0203	3.4450	0.877
g-SpMM	4	city-roads-L	bwd	add/min	512	3.0256	3.4379	0.880
g-SpMM	4	city-roads-L	bwd	add/sum	512	2.0423	3.0445	0.671
g-SpMM	4	city-roads-L	bwd	copy_e/max	512	2.0261	2.6602	0.762
g-SpMM	4	city-roads-L	bwd	copy_e/min	512	2.0244	2.6621	0.760
g-SpMM	4	city-roads-L	bwd	copy_e/sum	512	0.8338	0.8362	0.997
g-SpMM	4	city-roads-L	bwd	copy_u/max	512	1.1147	1.1161	0.999
g-SpMM	4	city-roads-L	bwd	copy_u/min	512	1.1149	1.1149	1.000
g-SpMM	4	city-roads-L	bwd	copy_u/sum	512	1.2110	2.2097	0.548
g-SpMM	4	city-roads-L	bwd	div/max	512	4.0207	3.9562	1.016
g-SpMM	4	city-roads-L	bwd	div/min	512	4.0167	3.9488	1.017
g-SpMM	4	city-roads-L	bwd	div/sum	512	4.0104	6.3919	0.627
g-SpMM	4	city-roads-L	bwd	mul/max	512	3.9738	3.9930	0.995
g-SpMM	4	city-roads-L	bwd	mul/min	512	3.9717	3.9919	0.995
g-SpMM	4	city-roads-L	bwd	mul/sum	512	3.4104	5.2475	0.650

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-L	bwd	sub/max	512	3.0509	3.4340	0.888
g-SpMM	4	city-roads-L	bwd	sub/min	512	3.0502	3.4333	0.888
g-SpMM	4	city-roads-L	bwd	sub/sum	512	2.0477	3.0495	0.671
g-SpMM	4	city-roads-L	fb	add/max	512	4.7223	6.7161	0.703
g-SpMM	4	city-roads-L	fb	add/min	512	4.7241	6.7146	0.704
g-SpMM	4	city-roads-L	fb	add/sum	512	3.8601	5.7879	0.667
g-SpMM	4	city-roads-L	fb	copy_e/max	512	3.4769	4.1226	0.843
g-SpMM	4	city-roads-L	fb	copy_e/min	512	3.4749	4.1204	0.843
g-SpMM	4	city-roads-L	fb	copy_e/sum	512	2.0343	2.0341	1.000
g-SpMM	4	city-roads-L	fb	copy_u/max	512	2.5725	3.6466	0.705
g-SpMM	4	city-roads-L	fb	copy_u/min	512	2.5757	3.6451	0.707
g-SpMM	4	city-roads-L	fb	copy_u/sum	512	2.4228	4.4124	0.549
g-SpMM	4	city-roads-L	fb	div/max	512	5.7079	7.2355	0.789
g-SpMM	4	city-roads-L	fb	div/min	512	5.7139	7.2395	0.789
g-SpMM	4	city-roads-L	fb	div/sum	512	5.7660	9.2111	0.626
g-SpMM	4	city-roads-L	fb	mul/max	512	5.6592	7.2613	0.779
g-SpMM	4	city-roads-L	fb	mul/min	512	5.6816	7.2595	0.783
g-SpMM	4	city-roads-L	fb	mul/sum	512	5.1569	8.0292	0.642
g-SpMM	4	city-roads-L	fb	sub/max	512	4.7454	6.7145	0.707
g-SpMM	4	city-roads-L	fb	sub/min	512	4.7522	6.7185	0.707
g-SpMM	4	city-roads-L	fb	sub/sum	512	3.7972	5.7961	0.655
g-SpMM	4	city-roads-L	fwd	add/max	512	2.1069	3.3290	0.633
g-SpMM	4	city-roads-L	fwd	add/min	512	2.0626	3.3302	0.619
g-SpMM	4	city-roads-L	fwd	add/sum	512	1.8349	2.7935	0.657
g-SpMM	4	city-roads-L	fwd	copy_e/max	512	2.3231	2.3719	0.979
g-SpMM	4	city-roads-L	fwd	copy_e/min	512	1.7135	1.8948	0.904
g-SpMM	4	city-roads-L	fwd	copy_e/sum	512	1.2179	1.3186	0.924
g-SpMM	4	city-roads-L	fwd	copy_u/max	512	1.7151	2.5417	0.675
g-SpMM	4	city-roads-L	fwd	copy_u/min	512	1.4691	2.5425	0.578
g-SpMM	4	city-roads-L	fwd	copy_u/sum	512	1.2130	2.2080	0.549
g-SpMM	4	city-roads-L	fwd	div/max	512	2.5395	3.3517	0.758
g-SpMM	4	city-roads-L	fwd	div/min	512	2.0052	3.3521	0.598
g-SpMM	4	city-roads-L	fwd	div/sum	512	1.8013	2.8704	0.628
g-SpMM	4	city-roads-L	fwd	mul/max	512	2.0427	3.3292	0.614
g-SpMM	4	city-roads-L	fwd	mul/min	512	2.0617	3.3265	0.620
g-SpMM	4	city-roads-L	fwd	mul/sum	512	1.7833	2.8388	0.628
g-SpMM	4	city-roads-L	fwd	sub/max	512	2.0417	3.3302	0.613
g-SpMM	4	city-roads-L	fwd	sub/min	512	2.3094	3.3252	0.695
g-SpMM	4	city-roads-L	fwd	sub/sum	512	1.7910	2.7955	0.641
g-SpMM	4	city-roads-M	bwd	add/max	64	0.2239	0.2070	1.082
g-SpMM	4	city-roads-M	bwd	add/min	64	0.2287	0.2073	1.103
g-SpMM	4	city-roads-M	bwd	add/sum	64	0.2937	0.2628	1.118
g-SpMM	4	city-roads-M	bwd	copy_e/max	64	0.1967	0.1859	1.058
g-SpMM	4	city-roads-M	bwd	copy_e/min	64	0.1946	0.1815	1.072
g-SpMM	4	city-roads-M	bwd	copy_e/sum	64	0.1893	0.1670	1.134
g-SpMM	4	city-roads-M	bwd	copy_u/max	64	0.1935	0.1805	1.072
g-SpMM	4	city-roads-M	bwd	copy_u/min	64	0.1871	0.1755	1.066
g-SpMM	4	city-roads-M	bwd	copy_u/sum	64	0.2310	0.1956	1.181
g-SpMM	4	city-roads-M	bwd	div/max	64	0.2324	0.2382	0.976
g-SpMM	4	city-roads-M	bwd	div/min	64	0.2279	0.2376	0.959
g-SpMM	4	city-roads-M	bwd	div/sum	64	0.2605	0.3793	0.687
g-SpMM	4	city-roads-M	bwd	mul/max	64	0.2247	0.2357	0.953
g-SpMM	4	city-roads-M	bwd	mul/min	64	0.2469	0.2337	1.056
g-SpMM	4	city-roads-M	bwd	mul/sum	64	0.2880	0.3119	0.923
g-SpMM	4	city-roads-M	bwd	sub/max	64	0.2437	0.2014	1.210
g-SpMM	4	city-roads-M	bwd	sub/min	64	0.2295	0.2031	1.130
g-SpMM	4	city-roads-M	bwd	sub/sum	64	0.2948	0.2671	1.104
g-SpMM	4	city-roads-M	fb	add/max	64	0.4464	0.4142	1.078
g-SpMM	4	city-roads-M	fb	add/min	64	0.4521	0.4230	1.069
g-SpMM	4	city-roads-M	fb	add/sum	64	0.5102	0.4729	1.079
g-SpMM	4	city-roads-M	fb	copy_e/max	64	0.4179	0.3822	1.094
g-SpMM	4	city-roads-M	fb	copy_e/min	64	0.4159	0.3800	1.094
g-SpMM	4	city-roads-M	fb	copy_e/sum	64	0.3866	0.3561	1.086
g-SpMM	4	city-roads-M	fb	copy_u/max	64	0.4102	0.3879	1.057
g-SpMM	4	city-roads-M	fb	copy_u/min	64	0.4172	0.4009	1.041
g-SpMM	4	city-roads-M	fb	copy_u/sum	64	0.4308	0.4046	1.065
g-SpMM	4	city-roads-M	fb	div/max	64	0.4852	0.4993	0.972
g-SpMM	4	city-roads-M	fb	div/min	64	0.4833	0.5264	0.918
g-SpMM	4	city-roads-M	fb	div/sum	64	0.4981	0.5231	0.952
g-SpMM	4	city-roads-M	fb	mul/max	64	0.4411	0.4803	0.918
g-SpMM	4	city-roads-M	fb	mul/min	64	0.5353	0.4260	1.257
g-SpMM	4	city-roads-M	fb	mul/sum	64	0.5386	0.4507	1.195
g-SpMM	4	city-roads-M	fb	sub/max	64	0.4975	0.4092	1.216
g-SpMM	4	city-roads-M	fb	sub/min	64	0.4420	0.4516	0.979
g-SpMM	4	city-roads-M	fb	sub/sum	64	0.4968	0.4714	1.054
g-SpMM	4	city-roads-M	fwd	add/max	64	0.1003	0.1591	0.631
g-SpMM	4	city-roads-M	fwd	add/min	64	0.1028	0.1598	0.643
g-SpMM	4	city-roads-M	fwd	add/sum	64	0.1064	0.1373	0.775

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-M	fwd	copy_e/max	64	0.0882	0.0896	0.985
g-SpMM	4	city-roads-M	fwd	copy_e/min	64	0.0886	0.0883	1.004
g-SpMM	4	city-roads-M	fwd	copy_e/sum	64	0.0799	0.0814	0.982
g-SpMM	4	city-roads-M	fwd	copy_u/max	64	0.0866	0.1254	0.691
g-SpMM	4	city-roads-M	fwd	copy_u/min	64	0.0917	0.1249	0.734
g-SpMM	4	city-roads-M	fwd	copy_u/sum	64	0.0788	0.1007	0.783
g-SpMM	4	city-roads-M	fwd	div/max	64	0.0995	0.1599	0.623
g-SpMM	4	city-roads-M	fwd	div/min	64	0.1000	0.1603	0.624
g-SpMM	4	city-roads-M	fwd	div/sum	64	0.1071	0.1444	0.741
g-SpMM	4	city-roads-M	fwd	mul/max	64	0.1027	0.1595	0.644
g-SpMM	4	city-roads-M	fwd	mul/min	64	0.0998	0.1595	0.626
g-SpMM	4	city-roads-M	fwd	mul/sum	64	0.1064	0.1421	0.749
g-SpMM	4	city-roads-M	fwd	sub/max	64	0.1038	0.1595	0.650
g-SpMM	4	city-roads-M	fwd	sub/min	64	0.0975	0.1593	0.612
g-SpMM	4	city-roads-M	fwd	sub/sum	64	0.1064	0.1367	0.778
g-SpMM	4	city-roads-M	bwd	add/max	128	0.3276	0.3626	0.903
g-SpMM	4	city-roads-M	bwd	add/min	128	0.3273	0.3672	0.892
g-SpMM	4	city-roads-M	bwd	add/sum	128	0.3060	0.3139	0.975
g-SpMM	4	city-roads-M	bwd	copy_e/max	128	0.2423	0.3284	0.738
g-SpMM	4	city-roads-M	bwd	copy_e/min	128	0.2920	0.3274	0.892
g-SpMM	4	city-roads-M	bwd	copy_e/sum	128	0.2100	0.1937	1.084
g-SpMM	4	city-roads-M	bwd	copy_u/max	128	0.1907	0.1867	1.021
g-SpMM	4	city-roads-M	bwd	copy_u/min	128	0.1876	0.1770	1.060
g-SpMM	4	city-roads-M	bwd	copy_u/sum	128	0.2242	0.2105	1.065
g-SpMM	4	city-roads-M	bwd	div/max	128	0.4317	0.4367	0.989
g-SpMM	4	city-roads-M	bwd	div/min	128	0.4303	0.4356	0.988
g-SpMM	4	city-roads-M	bwd	div/sum	128	0.4626	0.6936	0.667
g-SpMM	4	city-roads-M	bwd	mul/max	128	0.4258	0.4408	0.966
g-SpMM	4	city-roads-M	bwd	mul/min	128	0.4255	0.4427	0.961
g-SpMM	4	city-roads-M	bwd	mul/sum	128	0.3965	0.5666	0.700
g-SpMM	4	city-roads-M	bwd	sub/max	128	0.3314	0.3621	0.915
g-SpMM	4	city-roads-M	bwd	sub/min	128	0.3316	0.3635	0.912
g-SpMM	4	city-roads-M	bwd	sub/sum	128	0.2948	0.3143	0.938
g-SpMM	4	city-roads-M	fb	add/max	128	0.5052	0.6613	0.764
g-SpMM	4	city-roads-M	fb	add/min	128	0.5041	0.6619	0.762
g-SpMM	4	city-roads-M	fb	add/sum	128	0.5094	0.5777	0.882
g-SpMM	4	city-roads-M	fb	copy_e/max	128	0.4404	0.4695	0.938
g-SpMM	4	city-roads-M	fb	copy_e/min	128	0.4414	0.4702	0.939
g-SpMM	4	city-roads-M	fb	copy_e/sum	128	0.3977	0.3567	1.115
g-SpMM	4	city-roads-M	fb	copy_u/max	128	0.4265	0.4404	0.968
g-SpMM	4	city-roads-M	fb	copy_u/min	128	0.4142	0.3935	1.053
g-SpMM	4	city-roads-M	fb	copy_u/sum	128	0.4310	0.4289	1.005
g-SpMM	4	city-roads-M	fb	div/max	128	0.6043	0.7344	0.823
g-SpMM	4	city-roads-M	fb	div/min	128	0.6066	0.7334	0.827
g-SpMM	4	city-roads-M	fb	div/sum	128	0.6512	0.9553	0.682
g-SpMM	4	city-roads-M	fb	mul/max	128	0.6008	0.7432	0.808
g-SpMM	4	city-roads-M	fb	mul/min	128	0.6029	0.7371	0.818
g-SpMM	4	city-roads-M	fb	mul/sum	128	0.5830	0.8248	0.707
g-SpMM	4	city-roads-M	fb	sub/max	128	0.5092	0.6613	0.770
g-SpMM	4	city-roads-M	fb	sub/min	128	1.3003	0.6608	1.968
g-SpMM	4	city-roads-M	fb	sub/sum	128	0.5260	0.5683	0.926
g-SpMM	4	city-roads-M	fwd	add/max	128	0.3839	0.2939	1.307
g-SpMM	4	city-roads-M	fwd	add/min	128	0.1767	0.2939	0.601
g-SpMM	4	city-roads-M	fwd	add/sum	128	0.1907	0.2534	0.753
g-SpMM	4	city-roads-M	fwd	copy_e/max	128	0.1399	0.1404	0.997
g-SpMM	4	city-roads-M	fwd	copy_e/min	128	0.1396	0.1403	0.995
g-SpMM	4	city-roads-M	fwd	copy_e/sum	128	0.1255	0.1297	0.968
g-SpMM	4	city-roads-M	fwd	copy_u/max	128	0.1534	0.2377	0.645
g-SpMM	4	city-roads-M	fwd	copy_u/min	128	0.1538	0.2316	0.664
g-SpMM	4	city-roads-M	fwd	copy_u/sum	128	0.1323	0.2080	0.636
g-SpMM	4	city-roads-M	fwd	div/max	128	0.1769	0.2940	0.602
g-SpMM	4	city-roads-M	fwd	div/min	128	0.2047	0.2971	0.689
g-SpMM	4	city-roads-M	fwd	div/sum	128	0.1952	0.2699	0.724
g-SpMM	4	city-roads-M	fwd	mul/max	128	0.1801	0.2944	0.612
g-SpMM	4	city-roads-M	fwd	mul/min	128	0.1772	0.2934	0.604
g-SpMM	4	city-roads-M	fwd	mul/sum	128	0.1912	0.2663	0.718
g-SpMM	4	city-roads-M	fwd	sub/max	128	0.1767	0.2971	0.595
g-SpMM	4	city-roads-M	fwd	sub/min	128	0.1764	0.2940	0.600
g-SpMM	4	city-roads-M	fwd	sub/sum	128	0.1908	0.2576	0.741
g-SpMM	4	city-roads-M	bwd	add/max	256	0.6211	0.6940	0.895
g-SpMM	4	city-roads-M	bwd	add/min	256	0.6269	0.6931	0.904
g-SpMM	4	city-roads-M	bwd	add/sum	256	0.4461	0.5877	0.759
g-SpMM	4	city-roads-M	bwd	copy_e/max	256	0.4631	0.6178	0.750
g-SpMM	4	city-roads-M	bwd	copy_e/min	256	0.4682	0.6182	0.757
g-SpMM	4	city-roads-M	bwd	copy_e/sum	256	0.1930	0.2038	0.947
g-SpMM	4	city-roads-M	bwd	copy_u/max	256	0.2533	0.2449	1.034
g-SpMM	4	city-roads-M	bwd	copy_u/min	256	0.2457	0.2458	1.000
g-SpMM	4	city-roads-M	bwd	copy_u/sum	256	0.2512	0.3938	0.638

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-M	bwd	div/max	256	0.8176	0.8255	0.990
g-SpMM	4	city-roads-M	bwd	div/min	256	0.8181	0.8241	0.993
g-SpMM	4	city-roads-M	bwd	div/sum	256	0.8596	1.2983	0.662
g-SpMM	4	city-roads-M	bwd	mul/max	256	0.8077	0.8404	0.961
g-SpMM	4	city-roads-M	bwd	mul/min	256	0.8107	0.8364	0.969
g-SpMM	4	city-roads-M	bwd	mul/sum	256	0.7358	1.0567	0.696
g-SpMM	4	city-roads-M	bwd	sub/max	256	0.6354	0.6924	0.918
g-SpMM	4	city-roads-M	bwd	sub/min	256	0.6405	0.6916	0.926
g-SpMM	4	city-roads-M	bwd	sub/sum	256	0.4457	0.5886	0.757
g-SpMM	4	city-roads-M	fb	add/max	256	0.9526	1.2533	0.760
g-SpMM	4	city-roads-M	fb	add/min	256	0.9473	1.2542	0.755
g-SpMM	4	city-roads-M	fb	add/sum	256	0.7954	1.0717	0.742
g-SpMM	4	city-roads-M	fb	copy_e/max	256	0.7217	0.8779	0.822
g-SpMM	4	city-roads-M	fb	copy_e/min	256	0.7224	0.8785	0.822
g-SpMM	4	city-roads-M	fb	copy_e/sum	256	0.4266	0.4211	1.013
g-SpMM	4	city-roads-M	fb	copy_u/max	256	0.5293	0.6871	0.770
g-SpMM	4	city-roads-M	fb	copy_u/min	256	0.5343	0.6872	0.777
g-SpMM	4	city-roads-M	fb	copy_u/sum	256	0.5010	0.7925	0.632
g-SpMM	4	city-roads-M	fb	div/max	256	1.1426	1.3884	0.823
g-SpMM	4	city-roads-M	fb	div/min	256	1.1448	1.3898	0.824
g-SpMM	4	city-roads-M	fb	div/sum	256	1.2073	1.7991	0.671
g-SpMM	4	city-roads-M	fb	mul/max	256	1.1318	1.4021	0.807
g-SpMM	4	city-roads-M	fb	mul/min	256	1.1329	1.3977	0.811
g-SpMM	4	city-roads-M	fb	mul/sum	256	1.0793	1.5518	0.695
g-SpMM	4	city-roads-M	fb	sub/max	256	0.9553	1.2507	0.764
g-SpMM	4	city-roads-M	fb	sub/min	256	0.9558	1.2518	0.764
g-SpMM	4	city-roads-M	fb	sub/sum	256	0.7953	1.0718	0.742
g-SpMM	4	city-roads-M	fwd	add/max	256	0.3573	0.5683	0.629
g-SpMM	4	city-roads-M	fwd	add/min	256	0.4632	0.5641	0.821
g-SpMM	4	city-roads-M	fwd	add/sum	256	0.3570	0.4925	0.725
g-SpMM	4	city-roads-M	fwd	copy_e/max	256	0.2999	0.3201	0.937
g-SpMM	4	city-roads-M	fwd	copy_e/min	256	0.3872	0.2740	1.413
g-SpMM	4	city-roads-M	fwd	copy_e/sum	256	0.2489	0.2469	1.008
g-SpMM	4	city-roads-M	fwd	copy_u/max	256	0.2878	0.4488	0.641
g-SpMM	4	city-roads-M	fwd	copy_u/min	256	0.7273	0.4405	1.651
g-SpMM	4	city-roads-M	fwd	copy_u/sum	256	0.2489	0.3935	0.632
g-SpMM	4	city-roads-M	fwd	div/max	256	0.5287	0.5724	0.924
g-SpMM	4	city-roads-M	fwd	div/min	256	0.3870	0.5703	0.679
g-SpMM	4	city-roads-M	fwd	div/sum	256	0.3653	0.5174	0.706
g-SpMM	4	city-roads-M	fwd	mul/max	256	0.3916	0.5655	0.692
g-SpMM	4	city-roads-M	fwd	mul/min	256	0.3781	0.5674	0.666
g-SpMM	4	city-roads-M	fwd	mul/sum	256	0.3541	0.5087	0.696
g-SpMM	4	city-roads-M	fwd	sub/max	256	0.3531	0.5673	0.622
g-SpMM	4	city-roads-M	fwd	sub/min	256	0.3284	0.5618	0.584
g-SpMM	4	city-roads-M	fwd	sub/sum	256	0.3572	0.4918	0.726
g-SpMM	4	city-roads-M	bwd	add/max	512	1.0694	1.1906	0.898
g-SpMM	4	city-roads-M	bwd	add/min	512	1.0697	1.1873	0.901
g-SpMM	4	city-roads-M	bwd	add/sum	512	0.6981	1.0015	0.697
g-SpMM	4	city-roads-M	bwd	copy_e/max	512	0.8022	1.0351	0.775
g-SpMM	4	city-roads-M	bwd	copy_e/min	512	0.8075	1.0391	0.777
g-SpMM	4	city-roads-M	bwd	copy_e/sum	512	0.3066	0.3071	0.998
g-SpMM	4	city-roads-M	bwd	copy_u/max	512	0.4786	0.4790	0.999
g-SpMM	4	city-roads-M	bwd	copy_u/min	512	0.4790	0.4821	0.994
g-SpMM	4	city-roads-M	bwd	copy_u/sum	512	0.3928	0.6959	0.564
g-SpMM	4	city-roads-M	bwd	div/max	512	1.4911	1.4524	1.027
g-SpMM	4	city-roads-M	bwd	div/min	512	1.4928	1.4477	1.031
g-SpMM	4	city-roads-M	bwd	div/sum	512	1.4740	2.2564	0.653
g-SpMM	4	city-roads-M	bwd	mul/max	512	1.4740	1.4706	1.002
g-SpMM	4	city-roads-M	bwd	mul/min	512	1.4770	1.4582	1.013
g-SpMM	4	city-roads-M	bwd	mul/sum	512	1.2003	1.8091	0.663
g-SpMM	4	city-roads-M	bwd	sub/max	512	1.0811	1.1872	0.911
g-SpMM	4	city-roads-M	bwd	sub/min	512	1.0818	1.1856	0.912
g-SpMM	4	city-roads-M	bwd	sub/sum	512	0.6998	1.0035	0.697
g-SpMM	4	city-roads-M	fb	add/max	512	1.6148	2.1895	0.738
g-SpMM	4	city-roads-M	fb	add/min	512	1.6165	2.1919	0.737
g-SpMM	4	city-roads-M	fb	add/sum	512	1.2986	1.8762	0.692
g-SpMM	4	city-roads-M	fb	copy_e/max	512	1.2629	1.4924	0.846
g-SpMM	4	city-roads-M	fb	copy_e/min	512	1.2622	1.4915	0.846
g-SpMM	4	city-roads-M	fb	copy_e/sum	512	0.7194	0.6991	1.029
g-SpMM	4	city-roads-M	fb	copy_u/max	512	0.9348	1.2659	0.738
g-SpMM	4	city-roads-M	fb	copy_u/min	512	0.9350	1.2646	0.739
g-SpMM	4	city-roads-M	fb	copy_u/sum	512	0.7846	1.3975	0.561
g-SpMM	4	city-roads-M	fb	div/max	512	2.0406	2.4647	0.828
g-SpMM	4	city-roads-M	fb	div/min	512	2.0398	2.4599	0.829
g-SpMM	4	city-roads-M	fb	div/sum	512	2.0806	3.1741	0.655
g-SpMM	4	city-roads-M	fb	mul/max	512	2.0223	2.4677	0.819
g-SpMM	4	city-roads-M	fb	mul/min	512	2.0219	2.4630	0.821
g-SpMM	4	city-roads-M	fb	mul/sum	512	1.7994	2.7119	0.664

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	city-roads-M	fb	sub/max	512	1.6261	2.1908	0.742
g-SpMM	4	city-roads-M	fb	sub/min	512	1.6279	2.1908	0.743
g-SpMM	4	city-roads-M	fb	sub/sum	512	1.3026	1.8779	0.694
g-SpMM	4	city-roads-M	fwd	add/max	512	0.7871	1.1899	0.661
g-SpMM	4	city-roads-M	fwd	add/min	512	0.7957	1.0216	0.779
g-SpMM	4	city-roads-M	fwd	add/sum	512	0.6144	0.8891	0.691
g-SpMM	4	city-roads-M	fwd	copy_e/max	512	0.6451	0.7050	0.915
g-SpMM	4	city-roads-M	fwd	copy_e/min	512	0.7195	0.4649	1.548
g-SpMM	4	city-roads-M	fwd	copy_e/sum	512	0.4073	0.4766	0.855
g-SpMM	4	city-roads-M	fwd	copy_u/max	512	0.4620	0.8572	0.539
g-SpMM	4	city-roads-M	fwd	copy_u/min	512	0.5247	0.7858	0.668
g-SpMM	4	city-roads-M	fwd	copy_u/sum	512	0.3908	0.6957	0.562
g-SpMM	4	city-roads-M	fwd	div/max	512	0.7283	1.0274	0.709
g-SpMM	4	city-roads-M	fwd	div/min	512	0.7608	1.0256	0.742
g-SpMM	4	city-roads-M	fwd	div/sum	512	0.6206	0.9306	0.667
g-SpMM	4	city-roads-M	fwd	mul/max	512	0.7415	1.0163	0.730
g-SpMM	4	city-roads-M	fwd	mul/min	512	0.5545	1.0114	0.548
g-SpMM	4	city-roads-M	fwd	mul/sum	512	0.6144	0.9249	0.664
g-SpMM	4	city-roads-M	fwd	sub/max	512	0.7708	1.0163	0.758
g-SpMM	4	city-roads-M	fwd	sub/min	512	0.7796	1.0142	0.769
g-SpMM	4	city-roads-M	fwd	sub/sum	512	0.6264	0.8887	0.705
g-SpMM	4	cora	bwd	add/max	64	0.2107	0.1958	1.076
g-SpMM	4	cora	bwd	add/min	64	0.2068	0.1964	1.053
g-SpMM	4	cora	bwd	add/sum	64	0.2606	0.2483	1.049
g-SpMM	4	cora	bwd	copy_e/max	64	0.1823	0.1859	0.981
g-SpMM	4	cora	bwd	copy_e/min	64	0.1940	0.1859	1.044
g-SpMM	4	cora	bwd	copy_e/sum	64	0.1833	0.1702	1.077
g-SpMM	4	cora	bwd	copy_u/max	64	0.1769	0.1768	1.000
g-SpMM	4	cora	bwd	copy_u/min	64	0.1827	0.1769	1.033
g-SpMM	4	cora	bwd	copy_u/sum	64	0.2075	0.1977	1.050
g-SpMM	4	cora	bwd	div/max	64	0.2159	0.1977	1.092
g-SpMM	4	cora	bwd	div/min	64	0.2057	0.1946	1.057
g-SpMM	4	cora	bwd	div/sum	64	0.2707	0.2328	1.163
g-SpMM	4	cora	bwd	mul/max	64	0.2180	0.2000	1.090
g-SpMM	4	cora	bwd	mul/min	64	0.2280	0.1932	1.181
g-SpMM	4	cora	bwd	mul/sum	64	0.2466	0.2214	1.114
g-SpMM	4	cora	bwd	sub/max	64	0.2159	0.1992	1.084
g-SpMM	4	cora	bwd	sub/min	64	0.2161	0.1877	1.151
g-SpMM	4	cora	bwd	sub/sum	64	0.2947	0.2676	1.101
g-SpMM	4	cora	fb	add/max	64	0.4254	0.4203	1.012
g-SpMM	4	cora	fb	add/min	64	0.4364	0.4012	1.088
g-SpMM	4	cora	fb	add/sum	64	0.5032	0.5059	0.995
g-SpMM	4	cora	fb	copy_e/max	64	0.4120	0.3869	1.065
g-SpMM	4	cora	fb	copy_e/min	64	0.4183	0.3878	1.079
g-SpMM	4	cora	fb	copy_e/sum	64	0.4162	0.3610	1.153
g-SpMM	4	cora	fb	copy_u/max	64	0.4104	0.3869	1.061
g-SpMM	4	cora	fb	copy_u/min	64	0.4411	0.3870	1.140
g-SpMM	4	cora	fb	copy_u/sum	64	0.4104	0.3952	1.039
g-SpMM	4	cora	fb	div/max	64	0.4196	0.4059	1.034
g-SpMM	4	cora	fb	div/min	64	0.4462	0.4117	1.084
g-SpMM	4	cora	fb	div/sum	64	0.4859	0.4220	1.152
g-SpMM	4	cora	fb	mul/max	64	0.4651	0.4057	1.146
g-SpMM	4	cora	fb	mul/min	64	0.4482	0.4039	1.110
g-SpMM	4	cora	fb	mul/sum	64	0.5049	0.4247	1.189
g-SpMM	4	cora	fb	sub/max	64	0.5294	0.3908	1.355
g-SpMM	4	cora	fb	sub/min	64	0.4468	0.4157	1.075
g-SpMM	4	cora	fb	sub/sum	64	0.4889	0.4636	1.054
g-SpMM	4	cora	fwd	add/max	64	0.0941	0.0863	1.090
g-SpMM	4	cora	fwd	add/min	64	0.0890	0.0853	1.043
g-SpMM	4	cora	fwd	add/sum	64	0.0809	0.0790	1.023
g-SpMM	4	cora	fwd	copy_e/max	64	0.0854	0.0931	0.918
g-SpMM	4	cora	fwd	copy_e/min	64	0.0861	0.0861	0.999
g-SpMM	4	cora	fwd	copy_e/sum	64	0.0799	0.0782	1.022
g-SpMM	4	cora	fwd	copy_u/max	64	0.0854	0.0848	1.007
g-SpMM	4	cora	fwd	copy_u/min	64	0.0882	0.0841	1.048
g-SpMM	4	cora	fwd	copy_u/sum	64	0.0809	0.0776	1.043
g-SpMM	4	cora	fwd	div/max	64	0.0866	0.0848	1.021
g-SpMM	4	cora	fwd	div/min	64	0.0860	0.0852	1.010
g-SpMM	4	cora	fwd	div/sum	64	0.0791	0.0787	1.005
g-SpMM	4	cora	fwd	mul/max	64	0.0881	0.0853	1.033
g-SpMM	4	cora	fwd	mul/min	64	0.0861	0.0859	1.002
g-SpMM	4	cora	fwd	mul/sum	64	0.0816	0.0785	1.040
g-SpMM	4	cora	fwd	sub/max	64	0.0875	0.0852	1.026
g-SpMM	4	cora	fwd	sub/min	64	0.0891	0.0865	1.030
g-SpMM	4	cora	fwd	sub/sum	64	0.0809	0.0788	1.027
g-SpMM	4	cora	bwd	add/max	128	0.2198	0.1956	1.124
g-SpMM	4	cora	bwd	add/min	128	0.2207	0.2182	1.011
g-SpMM	4	cora	bwd	add/sum	128	0.2813	0.2593	1.084

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	cora	bwd	copy_e/max	128	0.2093	0.1793	1.168
g-SpMM	4	cora	bwd	copy_e/min	128	0.1907	0.1796	1.062
g-SpMM	4	cora	bwd	copy_e/sum	128	0.3437	0.1718	2.001
g-SpMM	4	cora	bwd	copy_u/max	128	0.2249	0.1727	1.302
g-SpMM	4	cora	bwd	copy_u/min	128	0.1980	0.1764	1.122
g-SpMM	4	cora	bwd	copy_u/sum	128	0.2240	0.2058	1.088
g-SpMM	4	cora	bwd	div/max	128	0.2237	0.1991	1.124
g-SpMM	4	cora	bwd	div/min	128	0.2218	0.1995	1.112
g-SpMM	4	cora	bwd	div/sum	128	0.2513	0.3383	0.743
g-SpMM	4	cora	bwd	mul/max	128	0.2216	0.2040	1.086
g-SpMM	4	cora	bwd	mul/min	128	0.2251	0.2038	1.105
g-SpMM	4	cora	bwd	mul/sum	128	0.2645	0.2298	1.151
g-SpMM	4	cora	bwd	sub/max	128	0.2355	0.1924	1.224
g-SpMM	4	cora	bwd	sub/min	128	0.2173	0.1996	1.088
g-SpMM	4	cora	bwd	sub/sum	128	0.2938	0.2665	1.102
g-SpMM	4	cora	fb	add/max	128	0.4517	0.4140	1.091
g-SpMM	4	cora	fb	add/min	128	0.4355	0.4085	1.066
g-SpMM	4	cora	fb	add/sum	128	0.4995	0.4762	1.049
g-SpMM	4	cora	fb	copy_e/max	128	0.4205	0.3869	1.087
g-SpMM	4	cora	fb	copy_e/min	128	0.4128	0.3856	1.071
g-SpMM	4	cora	fb	copy_e/sum	128	0.5725	0.3712	1.542
g-SpMM	4	cora	fb	copy_u/max	128	0.4254	0.3915	1.087
g-SpMM	4	cora	fb	copy_u/min	128	0.4268	0.3870	1.103
g-SpMM	4	cora	fb	copy_u/sum	128	0.4719	0.4017	1.175
g-SpMM	4	cora	fb	div/max	128	0.4726	0.4118	1.148
g-SpMM	4	cora	fb	div/min	128	0.4588	0.5047	0.909
g-SpMM	4	cora	fb	div/sum	128	0.4865	0.4409	1.104
g-SpMM	4	cora	fb	mul/max	128	0.4739	0.4509	1.051
g-SpMM	4	cora	fb	mul/min	128	0.4600	0.4122	1.116
g-SpMM	4	cora	fb	mul/sum	128	0.5004	0.4417	1.133
g-SpMM	4	cora	fb	sub/max	128	0.4460	0.3975	1.122
g-SpMM	4	cora	fb	sub/min	128	0.4511	0.4165	1.083
g-SpMM	4	cora	fb	sub/sum	128	0.5074	0.4758	1.066
g-SpMM	4	cora	fwd	add/max	128	0.0884	0.0848	1.042
g-SpMM	4	cora	fwd	add/min	128	0.0869	0.0845	1.028
g-SpMM	4	cora	fwd	add/sum	128	0.0818	0.0792	1.032
g-SpMM	4	cora	fwd	copy_e/max	128	0.0866	0.0858	1.010
g-SpMM	4	cora	fwd	copy_e/min	128	0.0882	0.0843	1.047
g-SpMM	4	cora	fwd	copy_e/sum	128	0.0799	0.0781	1.024
g-SpMM	4	cora	fwd	copy_u/max	128	0.0882	0.0948	0.931
g-SpMM	4	cora	fwd	copy_u/min	128	0.0867	0.0840	1.033
g-SpMM	4	cora	fwd	copy_u/sum	128	0.0781	0.0775	1.007
g-SpMM	4	cora	fwd	div/max	128	0.0910	0.0864	1.054
g-SpMM	4	cora	fwd	div/min	128	0.0899	0.0855	1.052
g-SpMM	4	cora	fwd	div/sum	128	0.0801	0.0784	1.022
g-SpMM	4	cora	fwd	mul/max	128	0.0908	0.0870	1.044
g-SpMM	4	cora	fwd	mul/min	128	0.0875	0.0871	1.004
g-SpMM	4	cora	fwd	mul/sum	128	0.0847	0.0796	1.063
g-SpMM	4	cora	fwd	sub/max	128	0.0874	0.0861	1.015
g-SpMM	4	cora	fwd	sub/min	128	0.0873	0.0858	1.018
g-SpMM	4	cora	fwd	sub/sum	128	0.0807	0.0802	1.006
g-SpMM	4	cora	bwd	add/max	256	0.2217	0.1957	1.133
g-SpMM	4	cora	bwd	add/min	256	0.2264	0.1969	1.150
g-SpMM	4	cora	bwd	add/sum	256	0.2910	0.2492	1.168
g-SpMM	4	cora	bwd	copy_e/max	256	0.2016	0.1779	1.133
g-SpMM	4	cora	bwd	copy_e/min	256	0.1993	0.1844	1.081
g-SpMM	4	cora	bwd	copy_e/sum	256	0.2152	0.1735	1.241
g-SpMM	4	cora	bwd	copy_u/max	256	0.1963	0.1721	1.141
g-SpMM	4	cora	bwd	copy_u/min	256	0.1971	0.1740	1.133
g-SpMM	4	cora	bwd	copy_u/sum	256	0.2272	0.2007	1.132
g-SpMM	4	cora	bwd	div/max	256	0.2193	0.2122	1.033
g-SpMM	4	cora	bwd	div/min	256	0.2249	0.2394	0.939
g-SpMM	4	cora	bwd	div/sum	256	0.2566	0.2892	0.887
g-SpMM	4	cora	bwd	mul/max	256	0.2286	0.2441	0.936
g-SpMM	4	cora	bwd	mul/min	256	0.2206	0.2285	0.965
g-SpMM	4	cora	bwd	mul/sum	256	0.2779	0.2669	1.041
g-SpMM	4	cora	bwd	sub/max	256	0.2276	0.2265	1.005
g-SpMM	4	cora	bwd	sub/min	256	0.2213	0.2056	1.076
g-SpMM	4	cora	bwd	sub/sum	256	0.2890	0.2632	1.098
g-SpMM	4	cora	fb	add/max	256	0.4894	0.4062	1.205
g-SpMM	4	cora	fb	add/min	256	0.4617	0.4022	1.148
g-SpMM	4	cora	fb	add/sum	256	0.5123	0.4624	1.108
g-SpMM	4	cora	fb	copy_e/max	256	0.4271	0.3851	1.109
g-SpMM	4	cora	fb	copy_e/min	256	0.4259	0.3850	1.106
g-SpMM	4	cora	fb	copy_e/sum	256	0.4154	0.3608	1.151
g-SpMM	4	cora	fb	copy_u/max	256	0.4228	0.3825	1.105
g-SpMM	4	cora	fb	copy_u/min	256	0.5021	0.3884	1.293
g-SpMM	4	cora	fb	copy_u/sum	256	0.4524	0.4565	0.991

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	cora	fb	div/max	256	0.4534	0.4752	0.954
g-SpMM	4	cora	fb	div/min	256	0.4649	0.4863	0.956
g-SpMM	4	cora	fb	div/sum	256	0.4893	0.5047	0.969
g-SpMM	4	cora	fb	mul/max	256	0.4675	0.4928	0.949
g-SpMM	4	cora	fb	mul/min	256	0.4555	0.4944	0.921
g-SpMM	4	cora	fb	mul/sum	256	0.4944	0.4992	0.990
g-SpMM	4	cora	fb	sub/max	256	0.4521	0.4075	1.110
g-SpMM	4	cora	fb	sub/min	256	0.4671	0.4128	1.132
g-SpMM	4	cora	fb	sub/sum	256	0.5104	0.4616	1.106
g-SpMM	4	cora	fwd	add/max	256	0.0968	0.0907	1.067
g-SpMM	4	cora	fwd	add/min	256	0.0882	0.0893	0.987
g-SpMM	4	cora	fwd	add/sum	256	0.0887	0.0834	1.064
g-SpMM	4	cora	fwd	copy_e/max	256	0.0877	0.0845	1.038
g-SpMM	4	cora	fwd	copy_e/min	256	0.0874	0.0862	1.015
g-SpMM	4	cora	fwd	copy_e/sum	256	0.0788	0.0787	1.002
g-SpMM	4	cora	fwd	copy_u/max	256	0.0833	0.0857	0.971
g-SpMM	4	cora	fwd	copy_u/min	256	0.0842	0.0887	0.950
g-SpMM	4	cora	fwd	copy_u/sum	256	0.0811	0.0794	1.021
g-SpMM	4	cora	fwd	div/max	256	0.0926	0.0897	1.032
g-SpMM	4	cora	fwd	div/min	256	0.0865	0.0915	0.945
g-SpMM	4	cora	fwd	div/sum	256	0.0797	0.0896	0.889
g-SpMM	4	cora	fwd	mul/max	256	0.0850	0.0942	0.902
g-SpMM	4	cora	fwd	mul/min	256	0.0868	0.0969	0.895
g-SpMM	4	cora	fwd	mul/sum	256	0.0807	0.0855	0.943
g-SpMM	4	cora	fwd	sub/max	256	0.0851	0.0899	0.946
g-SpMM	4	cora	fwd	sub/min	256	0.0871	0.0878	0.991
g-SpMM	4	cora	fwd	sub/sum	256	0.0824	0.0827	0.997
g-SpMM	4	cora	bwd	add/max	512	0.2398	0.2094	1.145
g-SpMM	4	cora	bwd	add/min	512	0.2310	0.2032	1.137
g-SpMM	4	cora	bwd	add/sum	512	0.3007	0.2539	1.184
g-SpMM	4	cora	bwd	copy_e/max	512	0.1963	0.1863	1.054
g-SpMM	4	cora	bwd	copy_e/min	512	0.2052	0.1911	1.074
g-SpMM	4	cora	bwd	copy_e/sum	512	0.1985	0.1704	1.164
g-SpMM	4	cora	bwd	copy_u/max	512	0.1962	0.1730	1.134
g-SpMM	4	cora	bwd	copy_u/min	512	0.1907	0.1799	1.060
g-SpMM	4	cora	bwd	copy_u/sum	512	0.2165	0.2110	1.026
g-SpMM	4	cora	bwd	div/max	512	0.4314	0.3416	1.263
g-SpMM	4	cora	bwd	div/min	512	0.4316	0.4800	0.899
g-SpMM	4	cora	bwd	div/sum	512	0.3362	0.4759	0.707
g-SpMM	4	cora	bwd	mul/max	512	0.4152	0.3333	1.246
g-SpMM	4	cora	bwd	mul/min	512	0.4161	0.3325	1.251
g-SpMM	4	cora	bwd	mul/sum	512	0.2376	0.3114	0.763
g-SpMM	4	cora	bwd	sub/max	512	0.2063	0.2087	0.989
g-SpMM	4	cora	bwd	sub/min	512	0.2066	0.2071	0.998
g-SpMM	4	cora	bwd	sub/sum	512	0.3056	0.2639	1.158
g-SpMM	4	cora	fb	add/max	512	0.4781	0.4196	1.139
g-SpMM	4	cora	fb	add/min	512	0.4804	0.4185	1.148
g-SpMM	4	cora	fb	add/sum	512	0.5511	0.4684	1.177
g-SpMM	4	cora	fb	copy_e/max	512	0.4247	0.3995	1.063
g-SpMM	4	cora	fb	copy_e/min	512	0.4357	0.4139	1.053
g-SpMM	4	cora	fb	copy_e/sum	512	0.4110	0.3654	1.125
g-SpMM	4	cora	fb	copy_u/max	512	0.4347	0.4250	1.023
g-SpMM	4	cora	fb	copy_u/min	512	0.4162	0.3962	1.050
g-SpMM	4	cora	fb	copy_u/sum	512	0.4472	0.4137	1.081
g-SpMM	4	cora	fb	div/max	512	0.6031	0.5575	1.082
g-SpMM	4	cora	fb	div/min	512	0.6110	0.5569	1.097
g-SpMM	4	cora	fb	div/sum	512	0.5285	0.7366	0.717
g-SpMM	4	cora	fb	mul/max	512	0.5912	0.5499	1.075
g-SpMM	4	cora	fb	mul/min	512	0.5896	0.5438	1.084
g-SpMM	4	cora	fb	mul/sum	512	0.3811	0.5696	0.669
g-SpMM	4	cora	fb	sub/max	512	0.3851	0.4247	0.907
g-SpMM	4	cora	fb	sub/min	512	0.4734	0.4308	1.099
g-SpMM	4	cora	fb	sub/sum	512	0.5079	0.4741	1.071
g-SpMM	4	cora	fwd	add/max	512	0.1555	0.2131	0.730
g-SpMM	4	cora	fwd	add/min	512	0.1558	0.2167	0.719
g-SpMM	4	cora	fwd	add/sum	512	0.1158	0.2328	0.498
g-SpMM	4	cora	fwd	copy_e/max	512	0.0929	0.0923	1.007
g-SpMM	4	cora	fwd	copy_e/min	512	0.0914	0.0904	1.011
g-SpMM	4	cora	fwd	copy_e/sum	512	0.0934	0.0931	1.003
g-SpMM	4	cora	fwd	copy_u/max	512	0.0895	0.1169	0.765
g-SpMM	4	cora	fwd	copy_u/min	512	0.0902	0.1168	0.772
g-SpMM	4	cora	fwd	copy_u/sum	512	0.0866	0.0926	0.935
g-SpMM	4	cora	fwd	div/max	512	0.1557	0.2155	0.723
g-SpMM	4	cora	fwd	div/min	512	0.1573	0.2162	0.728
g-SpMM	4	cora	fwd	div/sum	512	0.1227	0.2353	0.521
g-SpMM	4	cora	fwd	mul/max	512	0.1546	0.2163	0.715
g-SpMM	4	cora	fwd	mul/min	512	0.1541	0.2143	0.719
g-SpMM	4	cora	fwd	mul/sum	512	0.1012	0.2319	0.436

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	cora	fwd	sub/max	512	0.1587	0.2128	0.746
g-SpMM	4	cora	fwd	sub/min	512	0.1548	0.2156	0.718
g-SpMM	4	cora	fwd	sub/sum	512	0.1154	0.2341	0.493
g-SpMM	4	hm-categories	bwd	copy_u/max	64	0.1891	0.2109	0.897
g-SpMM	4	hm-categories	bwd	copy_u/min	64	0.1840	0.2000	0.920
g-SpMM	4	hm-categories	bwd	copy_u/sum	64	2.2221	3.4258	0.649
g-SpMM	4	hm-categories	fb	copy_u/max	64	2.1660	4.0660	0.533
g-SpMM	4	hm-categories	fb	copy_u/min	64	2.1381	4.0964	0.522
g-SpMM	4	hm-categories	fb	copy_u/sum	64	4.5294	6.9569	0.651
g-SpMM	4	hm-categories	fwd	copy_u/max	64	1.9096	3.9034	0.489
g-SpMM	4	hm-categories	fwd	copy_u/min	64	1.9039	3.8139	0.499
g-SpMM	4	hm-categories	fwd	copy_u/sum	64	2.2186	3.4037	0.652
g-SpMM	4	hm-categories	bwd	copy_u/max	128	0.2520	0.2515	1.002
g-SpMM	4	hm-categories	bwd	copy_u/min	128	0.2481	0.2576	0.963
g-SpMM	4	hm-categories	bwd	copy_u/sum	128	4.2229	6.6963	0.631
g-SpMM	4	hm-categories	fb	copy_u/max	128	3.7514	7.8856	0.476
g-SpMM	4	hm-categories	fb	copy_u/min	128	3.8477	7.9201	0.486
g-SpMM	4	hm-categories	fb	copy_u/sum	128	8.5041	13.6474	0.623
g-SpMM	4	hm-categories	fwd	copy_u/max	128	3.6437	7.8541	0.464
g-SpMM	4	hm-categories	fwd	copy_u/min	128	3.6275	7.8197	0.464
g-SpMM	4	hm-categories	fwd	copy_u/sum	128	4.1597	6.7309	0.618
g-SpMM	4	hm-categories	bwd	copy_u/max	256	0.4226	0.4190	1.009
g-SpMM	4	hm-categories	bwd	copy_u/min	256	0.4555	0.4548	1.002
g-SpMM	4	hm-categories	bwd	copy_u/sum	256	8.7640	13.9981	0.626
g-SpMM	4	hm-categories	fb	copy_u/max	256	7.4696	16.9723	0.440
g-SpMM	4	hm-categories	fb	copy_u/min	256	7.6801	16.9281	0.454
g-SpMM	4	hm-categories	fb	copy_u/sum	256	17.9019	28.6121	0.626
g-SpMM	4	hm-categories	fwd	copy_u/max	256	7.2628	16.6411	0.436
g-SpMM	4	hm-categories	fwd	copy_u/min	256	7.3107	16.5781	0.441
g-SpMM	4	hm-categories	fwd	copy_u/sum	256	8.8532	14.0297	0.631
g-SpMM	4	hm-categories	bwd	copy_u/max	512	0.7180	0.7148	1.004
g-SpMM	4	hm-categories	bwd	copy_u/min	512	0.7583	0.7206	1.052
g-SpMM	4	hm-categories	bwd	copy_u/sum	512	19.0305	29.9134	0.636
g-SpMM	4	hm-categories	fb	copy_u/max	512	16.1316	36.4878	0.442
g-SpMM	4	hm-categories	fb	copy_u/min	512	15.9780	36.6368	0.436
g-SpMM	4	hm-categories	fb	copy_u/sum	512	39.3782	61.5809	0.639
g-SpMM	4	hm-categories	fwd	copy_u/max	512	15.5890	36.1642	0.431
g-SpMM	4	hm-categories	fwd	copy_u/min	512	15.6775	35.7831	0.438
g-SpMM	4	hm-categories	fwd	copy_u/sum	512	19.5086	29.6456	0.658
g-SpMM	4	ogbn-arxiv	bwd	add/max	64	0.9456	0.8273	1.143
g-SpMM	4	ogbn-arxiv	bwd	add/min	64	0.9459	0.8279	1.142
g-SpMM	4	ogbn-arxiv	bwd	add/sum	64	0.5812	0.7318	0.794
g-SpMM	4	ogbn-arxiv	bwd	copy_e/max	64	0.6667	0.7811	0.854
g-SpMM	4	ogbn-arxiv	bwd	copy_e/min	64	0.6673	0.7831	0.852
g-SpMM	4	ogbn-arxiv	bwd	copy_e/sum	64	0.4247	0.4326	0.982
g-SpMM	4	ogbn-arxiv	bwd	copy_u/max	64	0.2280	0.2296	0.993
g-SpMM	4	ogbn-arxiv	bwd	copy_u/min	64	0.2264	0.2312	0.979
g-SpMM	4	ogbn-arxiv	bwd	copy_u/sum	64	0.2649	0.4084	0.649
g-SpMM	4	ogbn-arxiv	bwd	div/max	64	1.1226	0.9770	1.149
g-SpMM	4	ogbn-arxiv	bwd	div/min	64	1.1192	0.9739	1.149
g-SpMM	4	ogbn-arxiv	bwd	div/sum	64	1.2971	1.9768	0.656
g-SpMM	4	ogbn-arxiv	bwd	mul/max	64	1.1025	0.9807	1.124
g-SpMM	4	ogbn-arxiv	bwd	mul/min	64	1.1039	0.9741	1.133
g-SpMM	4	ogbn-arxiv	bwd	mul/sum	64	1.0688	1.5131	0.706
g-SpMM	4	ogbn-arxiv	bwd	sub/max	64	0.9575	0.8208	1.167
g-SpMM	4	ogbn-arxiv	bwd	sub/min	64	0.9570	0.8213	1.165
g-SpMM	4	ogbn-arxiv	bwd	sub/sum	64	0.5805	0.7345	0.790
g-SpMM	4	ogbn-arxiv	fb	add/max	64	2.5991	2.8820	0.902
g-SpMM	4	ogbn-arxiv	fb	add/min	64	2.5856	2.8818	0.897
g-SpMM	4	ogbn-arxiv	fb	add/sum	64	2.5467	3.4359	0.741
g-SpMM	4	ogbn-arxiv	fb	copy_e/max	64	1.2854	1.3828	0.930
g-SpMM	4	ogbn-arxiv	fb	copy_e/min	64	1.2845	1.4157	0.907
g-SpMM	4	ogbn-arxiv	fb	copy_e/sum	64	1.9990	2.0100	0.995
g-SpMM	4	ogbn-arxiv	fb	copy_u/max	64	0.8940	1.6065	0.556
g-SpMM	4	ogbn-arxiv	fb	copy_u/min	64	0.8947	1.6351	0.547
g-SpMM	4	ogbn-arxiv	fb	copy_u/sum	64	1.0832	1.5616	0.694
g-SpMM	4	ogbn-arxiv	fb	div/max	64	2.7760	3.0555	0.909
g-SpMM	4	ogbn-arxiv	fb	div/min	64	2.7910	3.0241	0.923
g-SpMM	4	ogbn-arxiv	fb	div/sum	64	3.2960	4.7155	0.699
g-SpMM	4	ogbn-arxiv	fb	mul/max	64	2.7396	3.0437	0.900
g-SpMM	4	ogbn-arxiv	fb	mul/min	64	2.7445	3.0413	0.902
g-SpMM	4	ogbn-arxiv	fb	mul/sum	64	2.6955	4.2213	0.639
g-SpMM	4	ogbn-arxiv	fb	sub/max	64	2.5852	2.8927	0.894
g-SpMM	4	ogbn-arxiv	fb	sub/min	64	2.5883	2.8848	0.897
g-SpMM	4	ogbn-arxiv	fb	sub/sum	64	2.5599	3.4228	0.748
g-SpMM	4	ogbn-arxiv	fwd	add/max	64	1.6874	2.0628	0.818
g-SpMM	4	ogbn-arxiv	fwd	add/min	64	1.6450	2.0653	0.796
g-SpMM	4	ogbn-arxiv	fwd	add/sum	64	1.9632	2.6722	0.735

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	ogbn-arxiv	fwd	copy_e/max	64	0.6195	0.6461	0.959
g-SpMM	4	ogbn-arxiv	fwd	copy_e/min	64	0.6410	0.6379	1.005
g-SpMM	4	ogbn-arxiv	fwd	copy_e/sum	64	1.6642	1.6756	0.993
g-SpMM	4	ogbn-arxiv	fwd	copy_u/max	64	0.6641	1.4064	0.472
g-SpMM	4	ogbn-arxiv	fwd	copy_u/min	64	0.6596	1.4079	0.468
g-SpMM	4	ogbn-arxiv	fwd	copy_u/sum	64	0.7919	1.1426	0.693
g-SpMM	4	ogbn-arxiv	fwd	div/max	64	1.6944	2.0253	0.837
g-SpMM	4	ogbn-arxiv	fwd	div/min	64	1.6967	2.0637	0.822
g-SpMM	4	ogbn-arxiv	fwd	div/sum	64	1.9678	2.7097	0.726
g-SpMM	4	ogbn-arxiv	fwd	mul/max	64	1.6933	2.0889	0.811
g-SpMM	4	ogbn-arxiv	fwd	mul/min	64	1.6341	2.0759	0.787
g-SpMM	4	ogbn-arxiv	fwd	mul/sum	64	1.6680	2.6826	0.622
g-SpMM	4	ogbn-arxiv	fwd	sub/max	64	1.6771	2.0654	0.812
g-SpMM	4	ogbn-arxiv	fwd	sub/min	64	1.6608	2.0341	0.816
g-SpMM	4	ogbn-arxiv	fwd	sub/sum	64	1.9980	2.6702	0.748
g-SpMM	4	ogbn-arxiv	bwd	add/max	128	1.7240	1.5450	1.116
g-SpMM	4	ogbn-arxiv	bwd	add/min	128	1.7189	1.5417	1.115
g-SpMM	4	ogbn-arxiv	bwd	add/sum	128	0.9683	1.2448	0.778
g-SpMM	4	ogbn-arxiv	bwd	copy_e/max	128	1.2372	1.4429	0.857
g-SpMM	4	ogbn-arxiv	bwd	copy_e/min	128	1.2405	1.4378	0.863
g-SpMM	4	ogbn-arxiv	bwd	copy_e/sum	128	0.4564	0.4591	0.994
g-SpMM	4	ogbn-arxiv	bwd	copy_u/max	128	0.5141	0.5147	0.999
g-SpMM	4	ogbn-arxiv	bwd	copy_u/min	128	0.5217	0.5144	1.014
g-SpMM	4	ogbn-arxiv	bwd	copy_u/sum	128	0.4895	0.7671	0.638
g-SpMM	4	ogbn-arxiv	bwd	div/max	128	2.0532	1.8263	1.124
g-SpMM	4	ogbn-arxiv	bwd	div/min	128	2.0507	1.8196	1.127
g-SpMM	4	ogbn-arxiv	bwd	div/sum	128	2.3194	3.5608	0.651
g-SpMM	4	ogbn-arxiv	bwd	mul/max	128	2.0312	1.8379	1.105
g-SpMM	4	ogbn-arxiv	bwd	mul/min	128	2.0315	1.8326	1.109
g-SpMM	4	ogbn-arxiv	bwd	mul/sum	128	1.8695	2.7045	0.691
g-SpMM	4	ogbn-arxiv	bwd	sub/max	128	1.7425	1.5379	1.133
g-SpMM	4	ogbn-arxiv	bwd	sub/min	128	1.7383	1.5347	1.133
g-SpMM	4	ogbn-arxiv	bwd	sub/sum	128	0.9697	1.2459	0.778
g-SpMM	4	ogbn-arxiv	fb	add/max	128	5.0470	5.6519	0.893
g-SpMM	4	ogbn-arxiv	fb	add/min	128	5.0310	5.6867	0.885
g-SpMM	4	ogbn-arxiv	fb	add/sum	128	4.8919	6.6758	0.733
g-SpMM	4	ogbn-arxiv	fb	copy_e/max	128	2.4760	2.6764	0.925
g-SpMM	4	ogbn-arxiv	fb	copy_e/min	128	2.4768	2.6773	0.925
g-SpMM	4	ogbn-arxiv	fb	copy_e/sum	128	3.7835	3.7780	1.001
g-SpMM	4	ogbn-arxiv	fb	copy_u/max	128	1.9023	3.5093	0.542
g-SpMM	4	ogbn-arxiv	fb	copy_u/min	128	1.8961	3.5019	0.541
g-SpMM	4	ogbn-arxiv	fb	copy_u/sum	128	2.2655	3.2619	0.695
g-SpMM	4	ogbn-arxiv	fb	div/max	128	5.4006	5.9507	0.908
g-SpMM	4	ogbn-arxiv	fb	div/min	128	5.4378	5.9412	0.915
g-SpMM	4	ogbn-arxiv	fb	div/sum	128	6.3285	9.0435	0.700
g-SpMM	4	ogbn-arxiv	fb	mul/max	128	5.3497	5.9483	0.899
g-SpMM	4	ogbn-arxiv	fb	mul/min	128	5.3610	5.9532	0.901
g-SpMM	4	ogbn-arxiv	fb	mul/sum	128	5.1149	8.1650	0.626
g-SpMM	4	ogbn-arxiv	fb	sub/max	128	5.0330	5.6817	0.886
g-SpMM	4	ogbn-arxiv	fb	sub/min	128	5.0914	5.6617	0.899
g-SpMM	4	ogbn-arxiv	fb	sub/sum	128	4.9152	6.7238	0.731
g-SpMM	4	ogbn-arxiv	fwd	add/max	128	3.3659	4.1827	0.805
g-SpMM	4	ogbn-arxiv	fwd	add/min	128	3.3448	4.1463	0.807
g-SpMM	4	ogbn-arxiv	fwd	add/sum	128	3.9308	5.4348	0.723
g-SpMM	4	ogbn-arxiv	fwd	copy_e/max	128	1.2822	1.2530	1.023
g-SpMM	4	ogbn-arxiv	fwd	copy_e/min	128	1.2645	1.2851	0.984
g-SpMM	4	ogbn-arxiv	fwd	copy_e/sum	128	3.3058	3.3096	0.999
g-SpMM	4	ogbn-arxiv	fwd	copy_u/max	128	1.3941	3.0190	0.462
g-SpMM	4	ogbn-arxiv	fwd	copy_u/min	128	1.3951	3.0011	0.465
g-SpMM	4	ogbn-arxiv	fwd	copy_u/sum	128	1.7787	2.5013	0.711
g-SpMM	4	ogbn-arxiv	fwd	div/max	128	3.4148	4.1396	0.825
g-SpMM	4	ogbn-arxiv	fwd	div/min	128	3.4164	4.2135	0.811
g-SpMM	4	ogbn-arxiv	fwd	div/sum	128	4.0336	5.4560	0.739
g-SpMM	4	ogbn-arxiv	fwd	mul/max	128	3.3867	4.2035	0.806
g-SpMM	4	ogbn-arxiv	fwd	mul/min	128	3.3477	4.1411	0.808
g-SpMM	4	ogbn-arxiv	fwd	mul/sum	128	3.3512	5.4568	0.614
g-SpMM	4	ogbn-arxiv	fwd	sub/max	128	3.4631	4.2052	0.824
g-SpMM	4	ogbn-arxiv	fwd	sub/min	128	3.3440	4.1588	0.804
g-SpMM	4	ogbn-arxiv	fwd	sub/sum	128	3.9948	5.4415	0.734
g-SpMM	4	ogbn-arxiv	bwd	add/max	256	3.2709	2.9820	1.097
g-SpMM	4	ogbn-arxiv	bwd	add/min	256	3.2813	2.9870	1.099
g-SpMM	4	ogbn-arxiv	bwd	add/sum	256	1.8017	2.3430	0.769
g-SpMM	4	ogbn-arxiv	bwd	copy_e/max	256	2.4019	2.7498	0.873
g-SpMM	4	ogbn-arxiv	bwd	copy_e/min	256	2.4076	2.7571	0.873
g-SpMM	4	ogbn-arxiv	bwd	copy_e/sum	256	0.8437	0.8433	1.000
g-SpMM	4	ogbn-arxiv	bwd	copy_u/max	256	1.1058	1.1059	1.000
g-SpMM	4	ogbn-arxiv	bwd	copy_u/min	256	1.1059	1.1064	1.000
g-SpMM	4	ogbn-arxiv	bwd	copy_u/sum	256	0.9396	1.4911	0.630

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	ogbn-arxiv	bwd	div/max	256	3.9687	3.5149	1.129
g-SpMM	4	ogbn-arxiv	bwd	div/min	256	3.9628	3.5438	1.118
g-SpMM	4	ogbn-arxiv	bwd	div/sum	256	4.3375	6.5940	0.658
g-SpMM	4	ogbn-arxiv	bwd	mul/max	256	3.9212	3.5604	1.101
g-SpMM	4	ogbn-arxiv	bwd	mul/min	256	3.9253	3.5726	1.099
g-SpMM	4	ogbn-arxiv	bwd	mul/sum	256	3.4578	5.0456	0.685
g-SpMM	4	ogbn-arxiv	bwd	sub/max	256	3.3259	2.9889	1.113
g-SpMM	4	ogbn-arxiv	bwd	sub/min	256	3.3188	2.9791	1.114
g-SpMM	4	ogbn-arxiv	bwd	sub/sum	256	1.7901	2.3480	0.762
g-SpMM	4	ogbn-arxiv	fb	add/max	256	9.9519	11.2924	0.881
g-SpMM	4	ogbn-arxiv	fb	add/min	256	9.9587	11.3320	0.879
g-SpMM	4	ogbn-arxiv	fb	add/sum	256	9.7537	13.3693	0.730
g-SpMM	4	ogbn-arxiv	fb	copy_e/max	256	4.8729	5.2087	0.936
g-SpMM	4	ogbn-arxiv	fb	copy_e/min	256	4.8248	5.2007	0.928
g-SpMM	4	ogbn-arxiv	fb	copy_e/sum	256	7.3806	7.3617	1.003
g-SpMM	4	ogbn-arxiv	fb	copy_u/max	256	4.0360	7.5483	0.535
g-SpMM	4	ogbn-arxiv	fb	copy_u/min	256	4.0530	7.5177	0.539
g-SpMM	4	ogbn-arxiv	fb	copy_u/sum	256	4.9199	6.8830	0.715
g-SpMM	4	ogbn-arxiv	fb	div/max	256	10.7123	11.8726	0.902
g-SpMM	4	ogbn-arxiv	fb	div/min	256	10.7335	11.8742	0.904
g-SpMM	4	ogbn-arxiv	fb	div/sum	256	12.3551	17.7158	0.697
g-SpMM	4	ogbn-arxiv	fb	mul/max	256	10.5515	11.8577	0.890
g-SpMM	4	ogbn-arxiv	fb	mul/min	256	10.6142	11.8912	0.893
g-SpMM	4	ogbn-arxiv	fb	mul/sum	256	10.1125	16.0952	0.628
g-SpMM	4	ogbn-arxiv	fb	sub/max	256	9.9968	11.2671	0.887
g-SpMM	4	ogbn-arxiv	fb	sub/min	256	10.0364	11.3554	0.884
g-SpMM	4	ogbn-arxiv	fb	sub/sum	256	9.7548	13.4812	0.724
g-SpMM	4	ogbn-arxiv	fwd	add/max	256	6.8843	8.5215	0.808
g-SpMM	4	ogbn-arxiv	fwd	add/min	256	6.9045	8.5828	0.804
g-SpMM	4	ogbn-arxiv	fwd	add/sum	256	8.0230	11.0229	0.728
g-SpMM	4	ogbn-arxiv	fwd	copy_e/max	256	2.5132	2.5071	1.002
g-SpMM	4	ogbn-arxiv	fwd	copy_e/min	256	2.4973	2.4807	1.007
g-SpMM	4	ogbn-arxiv	fwd	copy_e/sum	256	6.4325	6.5044	0.989
g-SpMM	4	ogbn-arxiv	fwd	copy_u/max	256	2.9820	6.4487	0.462
g-SpMM	4	ogbn-arxiv	fwd	copy_u/min	256	2.9909	6.4211	0.466
g-SpMM	4	ogbn-arxiv	fwd	copy_u/sum	256	3.9717	5.3666	0.740
g-SpMM	4	ogbn-arxiv	fwd	div/max	256	7.0291	8.4771	0.829
g-SpMM	4	ogbn-arxiv	fwd	div/min	256	6.9703	8.3061	0.839
g-SpMM	4	ogbn-arxiv	fwd	div/sum	256	8.1353	11.0702	0.735
g-SpMM	4	ogbn-arxiv	fwd	mul/max	256	6.9037	8.4019	0.822
g-SpMM	4	ogbn-arxiv	fwd	mul/min	256	6.8764	8.4471	0.814
g-SpMM	4	ogbn-arxiv	fwd	mul/sum	256	6.7623	10.9663	0.617
g-SpMM	4	ogbn-arxiv	fwd	sub/max	256	6.9181	8.5194	0.812
g-SpMM	4	ogbn-arxiv	fwd	sub/min	256	6.7608	8.4473	0.800
g-SpMM	4	ogbn-arxiv	fwd	sub/sum	256	8.1937	11.0659	0.740
g-SpMM	4	ogbn-arxiv	bwd	add/max	512	6.0940	5.3967	1.129
g-SpMM	4	ogbn-arxiv	bwd	add/min	512	6.1023	5.3781	1.135
g-SpMM	4	ogbn-arxiv	bwd	add/sum	512	3.1461	4.2872	0.734
g-SpMM	4	ogbn-arxiv	bwd	copy_e/max	512	4.5920	4.9465	0.928
g-SpMM	4	ogbn-arxiv	bwd	copy_e/min	512	4.6135	4.9444	0.933
g-SpMM	4	ogbn-arxiv	bwd	copy_e/sum	512	1.5267	1.5287	0.999
g-SpMM	4	ogbn-arxiv	bwd	copy_u/max	512	2.2650	2.2603	1.002
g-SpMM	4	ogbn-arxiv	bwd	copy_u/min	512	2.2647	2.2627	1.001
g-SpMM	4	ogbn-arxiv	bwd	copy_u/sum	512	1.6186	2.7379	0.591
g-SpMM	4	ogbn-arxiv	bwd	div/max	512	7.5105	6.4762	1.160
g-SpMM	4	ogbn-arxiv	bwd	div/min	512	7.5535	6.4905	1.164
g-SpMM	4	ogbn-arxiv	bwd	div/sum	512	8.1347	12.3128	0.661
g-SpMM	4	ogbn-arxiv	bwd	mul/max	512	7.5075	6.5284	1.150
g-SpMM	4	ogbn-arxiv	bwd	mul/min	512	7.5019	6.4872	1.156
g-SpMM	4	ogbn-arxiv	bwd	mul/sum	512	6.2707	9.4110	0.666
g-SpMM	4	ogbn-arxiv	bwd	sub/max	512	6.1502	5.3564	1.148
g-SpMM	4	ogbn-arxiv	bwd	sub/min	512	6.1501	5.3563	1.148
g-SpMM	4	ogbn-arxiv	bwd	sub/sum	512	3.1591	4.2933	0.736
g-SpMM	4	ogbn-arxiv	fb	add/max	512	19.6261	22.0936	0.888
g-SpMM	4	ogbn-arxiv	fb	add/min	512	19.4889	22.1604	0.879
g-SpMM	4	ogbn-arxiv	fb	add/sum	512	18.9156	26.5686	0.712
g-SpMM	4	ogbn-arxiv	fb	copy_e/max	512	9.6217	10.0413	0.958
g-SpMM	4	ogbn-arxiv	fb	copy_e/min	512	9.6936	9.8486	0.984
g-SpMM	4	ogbn-arxiv	fb	copy_e/sum	512	14.4278	14.4652	0.997
g-SpMM	4	ogbn-arxiv	fb	copy_u/max	512	8.3144	15.8905	0.523
g-SpMM	4	ogbn-arxiv	fb	copy_u/min	512	8.3529	15.8292	0.528
g-SpMM	4	ogbn-arxiv	fb	copy_u/sum	512	10.1110	14.2091	0.712
g-SpMM	4	ogbn-arxiv	fb	div/max	512	21.2377	23.3292	0.910
g-SpMM	4	ogbn-arxiv	fb	div/min	512	21.2331	23.2663	0.913
g-SpMM	4	ogbn-arxiv	fb	div/sum	512	24.2653	34.7561	0.698
g-SpMM	4	ogbn-arxiv	fb	mul/max	512	20.9334	23.2837	0.899
g-SpMM	4	ogbn-arxiv	fb	mul/min	512	21.0824	23.2629	0.906
g-SpMM	4	ogbn-arxiv	fb	mul/sum	512	19.3992	31.8704	0.609

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	ogbn-arxiv	fb	sub/max	512	19.6816	21.9469	0.897
g-SpMM	4	ogbn-arxiv	fb	sub/min	512	19.6196	21.9344	0.894
g-SpMM	4	ogbn-arxiv	fb	sub/sum	512	19.1975	26.5952	0.722
g-SpMM	4	ogbn-arxiv	fwd	add/max	512	14.0076	17.1032	0.819
g-SpMM	4	ogbn-arxiv	fwd	add/min	512	13.6259	16.8560	0.808
g-SpMM	4	ogbn-arxiv	fwd	add/sum	512	16.0676	22.3151	0.720
g-SpMM	4	ogbn-arxiv	fwd	copy_e/max	512	5.1131	5.1510	0.993
g-SpMM	4	ogbn-arxiv	fwd	copy_e/min	512	5.1870	5.1762	1.002
g-SpMM	4	ogbn-arxiv	fwd	copy_e/sum	512	12.8759	12.9445	0.995
g-SpMM	4	ogbn-arxiv	fwd	copy_u/max	512	6.1267	13.6019	0.450
g-SpMM	4	ogbn-arxiv	fwd	copy_u/min	512	6.1151	13.6915	0.447
g-SpMM	4	ogbn-arxiv	fwd	copy_u/sum	512	8.4831	11.3916	0.745
g-SpMM	4	ogbn-arxiv	fwd	div/max	512	14.0726	17.1636	0.820
g-SpMM	4	ogbn-arxiv	fwd	div/min	512	13.8942	16.8404	0.825
g-SpMM	4	ogbn-arxiv	fwd	div/sum	512	16.5794	22.5010	0.737
g-SpMM	4	ogbn-arxiv	fwd	mul/max	512	13.8496	16.9894	0.815
g-SpMM	4	ogbn-arxiv	fwd	mul/min	512	13.7838	16.8643	0.817
g-SpMM	4	ogbn-arxiv	fwd	mul/sum	512	13.5287	22.4628	0.602
g-SpMM	4	ogbn-arxiv	fwd	sub/max	512	13.9384	17.1715	0.812
g-SpMM	4	ogbn-arxiv	fwd	sub/min	512	13.8048	16.9621	0.814
g-SpMM	4	ogbn-arxiv	fwd	sub/sum	512	16.4284	22.1855	0.741
g-SpMM	4	ogbn-products	bwd	copy_u/max	64	13.7501	13.7384	1.001
g-SpMM	4	ogbn-products	bwd	copy_u/min	64	13.7391	13.7277	1.001
g-SpMM	4	ogbn-products	bwd	copy_u/sum	64	16.5686	28.6875	0.578
g-SpMM	4	ogbn-products	fb	copy_u/max	64	30.7156	44.7896	0.686
g-SpMM	4	ogbn-products	fb	copy_u/min	64	30.7266	44.7640	0.686
g-SpMM	4	ogbn-products	fb	copy_u/sum	64	33.1601	57.3968	0.578
g-SpMM	4	ogbn-products	fwd	copy_u/max	64	17.0203	31.0919	0.547
g-SpMM	4	ogbn-products	fwd	copy_u/min	64	16.9978	31.0832	0.547
g-SpMM	4	ogbn-products	fwd	copy_u/sum	64	16.5551	28.6229	0.578
g-SpMM	4	ogbn-products	bwd	copy_u/max	128	29.6977	29.6986	1.000
g-SpMM	4	ogbn-products	bwd	copy_u/min	128	29.6818	29.6821	1.000
g-SpMM	4	ogbn-products	bwd	copy_u/sum	128	30.8622	53.2030	0.580
g-SpMM	4	ogbn-products	fb	copy_u/max	128	61.2342	87.4518	0.700
g-SpMM	4	ogbn-products	fb	copy_u/min	128	61.2311	87.6080	0.699
g-SpMM	4	ogbn-products	fb	copy_u/sum	128	61.8012	106.4247	0.581
g-SpMM	4	ogbn-products	fwd	copy_u/max	128	31.5998	57.9124	0.546
g-SpMM	4	ogbn-products	fwd	copy_u/min	128	31.5408	57.8331	0.545
g-SpMM	4	ogbn-products	fwd	copy_u/sum	128	30.8180	53.1662	0.580
g-SpMM	4	ogbn-products	bwd	copy_u/max	256	58.9270	62.2595	0.946
g-SpMM	4	ogbn-products	bwd	copy_u/min	256	58.9533	59.1270	0.997
g-SpMM	4	ogbn-products	bwd	copy_u/sum	256	61.2247	103.6038	0.591
g-SpMM	4	ogbn-products	fb	copy_u/max	256	149.2710	206.2040	0.724
g-SpMM	4	ogbn-products	fb	copy_u/min	256	153.2847	201.5958	0.760
g-SpMM	4	ogbn-products	fb	copy_u/sum	256	122.5419	207.4287	0.591
g-SpMM	4	ogbn-products	fwd	copy_u/max	256	90.4307	141.5879	0.639
g-SpMM	4	ogbn-products	fwd	copy_u/min	256	63.1958	144.0183	0.439
g-SpMM	4	ogbn-products	fwd	copy_u/sum	256	61.1012	103.4697	0.591
g-SpMM	4	ogbn-products	bwd	copy_u/max	512	123.1265	123.0830	1.000
g-SpMM	4	ogbn-products	bwd	copy_u/min	512	123.1409	123.0370	1.001
g-SpMM	4	ogbn-products	bwd	copy_u/sum	512	123.7424	226.8570	0.545
g-SpMM	4	ogbn-products	fb	copy_u/max	512	304.3282	405.7270	0.750
g-SpMM	4	ogbn-products	fb	copy_u/min	512	303.6015	403.6076	0.752
g-SpMM	4	ogbn-products	fb	copy_u/sum	512	269.3409	433.8520	0.621
g-SpMM	4	ogbn-products	fwd	copy_u/max	512	171.5782	300.4832	0.571
g-SpMM	4	ogbn-products	fwd	copy_u/min	512	158.8181	304.0576	0.522
g-SpMM	4	ogbn-products	fwd	copy_u/sum	512	120.6923	203.4632	0.593
g-SpMM	4	ogbn-proteins	bwd	copy_u/max	64	0.3365	0.3395	0.991
g-SpMM	4	ogbn-proteins	bwd	copy_u/min	64	0.3369	0.3437	0.980
g-SpMM	4	ogbn-proteins	bwd	copy_u/sum	64	5.2808	10.0881	0.523
g-SpMM	4	ogbn-proteins	fb	copy_u/max	64	6.4688	11.4388	0.566
g-SpMM	4	ogbn-proteins	fb	copy_u/min	64	6.4630	11.4499	0.564
g-SpMM	4	ogbn-proteins	fb	copy_u/sum	64	10.4929	20.1335	0.521
g-SpMM	4	ogbn-proteins	fwd	copy_u/max	64	6.1327	11.0852	0.553
g-SpMM	4	ogbn-proteins	fwd	copy_u/min	64	6.1331	11.0904	0.553
g-SpMM	4	ogbn-proteins	fwd	copy_u/sum	64	5.2516	10.0695	0.522
g-SpMM	4	ogbn-proteins	bwd	copy_u/max	128	0.5705	0.5710	0.999
g-SpMM	4	ogbn-proteins	bwd	copy_u/min	128	0.5705	0.5677	1.005
g-SpMM	4	ogbn-proteins	bwd	copy_u/sum	128	9.6071	18.6041	0.516
g-SpMM	4	ogbn-proteins	fb	copy_u/max	128	12.0288	21.2259	0.567
g-SpMM	4	ogbn-proteins	fb	copy_u/min	128	12.0092	21.2283	0.566
g-SpMM	4	ogbn-proteins	fb	copy_u/sum	128	19.1858	37.1834	0.516
g-SpMM	4	ogbn-proteins	fwd	copy_u/max	128	11.4427	20.6550	0.554
g-SpMM	4	ogbn-proteins	fwd	copy_u/min	128	11.4472	20.6508	0.554
g-SpMM	4	ogbn-proteins	fwd	copy_u/sum	128	9.5946	18.5860	0.516
g-SpMM	4	ogbn-proteins	bwd	copy_u/max	256	1.0172	1.0254	0.992
g-SpMM	4	ogbn-proteins	bwd	copy_u/min	256	1.0214	1.0213	1.000
g-SpMM	4	ogbn-proteins	bwd	copy_u/sum	256	19.2390	37.3601	0.515

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	ogbn-proteins	fb	copy_u/max	256	23.5973	42.9866	0.549
g-SpMM	4	ogbn-proteins	fb	copy_u/min	256	23.6102	42.9526	0.550
g-SpMM	4	ogbn-proteins	fb	copy_u/sum	256	38.3152	74.6970	0.513
g-SpMM	4	ogbn-proteins	fwd	copy_u/max	256	22.5803	41.9432	0.538
g-SpMM	4	ogbn-proteins	fwd	copy_u/min	256	22.5778	41.8669	0.539
g-SpMM	4	ogbn-proteins	fwd	copy_u/sum	256	19.0995	37.2564	0.513
g-SpMM	4	ogbn-proteins	bwd	copy_u/max	512	2.0967	2.0740	1.011
g-SpMM	4	ogbn-proteins	bwd	copy_u/min	512	2.0749	2.0694	1.003
g-SpMM	4	ogbn-proteins	bwd	copy_u/sum	512	40.8700	78.8644	0.518
g-SpMM	4	ogbn-proteins	fb	copy_u/max	512	48.0453	90.9518	0.528
g-SpMM	4	ogbn-proteins	fb	copy_u/min	512	48.0589	90.7735	0.529
g-SpMM	4	ogbn-proteins	fb	copy_u/sum	512	81.9283	157.5624	0.520
g-SpMM	4	ogbn-proteins	fwd	copy_u/max	512	45.9952	88.7277	0.518
g-SpMM	4	ogbn-proteins	fwd	copy_u/min	512	45.9558	88.7790	0.518
g-SpMM	4	ogbn-proteins	fwd	copy_u/sum	512	40.7025	78.7625	0.517
g-SpMM	4	pokec-regions	bwd	copy_u/max	64	5.1667	5.1515	1.003
g-SpMM	4	pokec-regions	bwd	copy_u/min	64	5.1547	5.1600	0.999
g-SpMM	4	pokec-regions	bwd	copy_u/sum	64	4.7302	7.7522	0.610
g-SpMM	4	pokec-regions	fb	copy_u/max	64	10.1908	13.6474	0.747
g-SpMM	4	pokec-regions	fb	copy_u/min	64	10.1960	13.6462	0.747
g-SpMM	4	pokec-regions	fb	copy_u/sum	64	9.4634	15.4731	0.612
g-SpMM	4	pokec-regions	fwd	copy_u/max	64	5.0708	8.5040	0.596
g-SpMM	4	pokec-regions	fwd	copy_u/min	64	5.0499	8.5026	0.594
g-SpMM	4	pokec-regions	fwd	copy_u/sum	64	4.7386	7.7313	0.613
g-SpMM	4	pokec-regions	bwd	copy_u/max	128	11.1779	11.1646	1.001
g-SpMM	4	pokec-regions	bwd	copy_u/min	128	11.1667	11.1652	1.000
g-SpMM	4	pokec-regions	bwd	copy_u/sum	128	8.7691	14.5146	0.604
g-SpMM	4	pokec-regions	fb	copy_u/max	128	20.4596	27.0220	0.757
g-SpMM	4	pokec-regions	fb	copy_u/min	128	20.4620	27.0281	0.757
g-SpMM	4	pokec-regions	fb	copy_u/sum	128	17.6538	28.9420	0.610
g-SpMM	4	pokec-regions	fwd	copy_u/max	128	9.3695	15.8922	0.590
g-SpMM	4	pokec-regions	fwd	copy_u/min	128	9.3288	15.9008	0.587
g-SpMM	4	pokec-regions	fwd	copy_u/sum	128	8.8878	14.4565	0.615
g-SpMM	4	pokec-regions	bwd	copy_u/max	256	21.8430	21.8565	0.999
g-SpMM	4	pokec-regions	bwd	copy_u/min	256	23.5766	21.8517	1.079
g-SpMM	4	pokec-regions	bwd	copy_u/sum	256	17.0448	28.1492	0.606
g-SpMM	4	pokec-regions	fb	copy_u/max	256	40.7090	53.6127	0.759
g-SpMM	4	pokec-regions	fb	copy_u/min	256	40.7338	53.6183	0.760
g-SpMM	4	pokec-regions	fb	copy_u/sum	256	34.4201	56.1670	0.613
g-SpMM	4	pokec-regions	fwd	copy_u/max	256	18.2178	30.9202	0.589
g-SpMM	4	pokec-regions	fwd	copy_u/min	256	18.0694	30.9201	0.584
g-SpMM	4	pokec-regions	fwd	copy_u/sum	256	17.4521	28.0410	0.622
g-SpMM	4	pokec-regions	bwd	copy_u/max	512	46.1982	46.1776	1.000
g-SpMM	4	pokec-regions	bwd	copy_u/min	512	46.2444	46.1808	1.001
g-SpMM	4	pokec-regions	bwd	copy_u/sum	512	31.9027	53.9283	0.592
g-SpMM	4	pokec-regions	fb	copy_u/max	512	104.5971	127.4308	0.821
g-SpMM	4	pokec-regions	fb	copy_u/min	512	104.1012	127.3826	0.817
g-SpMM	4	pokec-regions	fb	copy_u/sum	512	91.7780	132.3027	0.694
g-SpMM	4	pokec-regions	fwd	copy_u/max	512	65.2315	97.3959	0.670
g-SpMM	4	pokec-regions	fwd	copy_u/min	512	66.6299	90.2414	0.738
g-SpMM	4	pokec-regions	fwd	copy_u/sum	512	32.9303	53.7443	0.613
g-SpMM	4	pubmed	bwd	add/max	64	0.2279	0.1944	1.172
g-SpMM	4	pubmed	bwd	add/min	64	0.2148	0.1945	1.104
g-SpMM	4	pubmed	bwd	add/sum	64	0.2889	0.2722	1.061
g-SpMM	4	pubmed	bwd	copy_e/max	64	0.2116	0.1844	1.148
g-SpMM	4	pubmed	bwd	copy_e/min	64	0.2054	0.1830	1.123
g-SpMM	4	pubmed	bwd	copy_e/sum	64	0.1987	0.1800	1.104
g-SpMM	4	pubmed	bwd	copy_u/max	64	0.2008	0.1737	1.156
g-SpMM	4	pubmed	bwd	copy_u/min	64	0.1919	0.1760	1.090
g-SpMM	4	pubmed	bwd	copy_u/sum	64	0.2211	0.1982	1.116
g-SpMM	4	pubmed	bwd	div/max	64	0.2222	0.1943	1.144
g-SpMM	4	pubmed	bwd	div/min	64	0.2300	0.1968	1.169
g-SpMM	4	pubmed	bwd	div/sum	64	0.2500	0.2313	1.081
g-SpMM	4	pubmed	bwd	mul/max	64	0.2167	0.1983	1.093
g-SpMM	4	pubmed	bwd	mul/min	64	0.2275	0.1942	1.171
g-SpMM	4	pubmed	bwd	mul/sum	64	0.2482	0.2261	1.098
g-SpMM	4	pubmed	bwd	sub/max	64	0.2280	0.2004	1.138
g-SpMM	4	pubmed	bwd	sub/min	64	0.2150	0.1943	1.106
g-SpMM	4	pubmed	bwd	sub/sum	64	0.2866	0.2684	1.068
g-SpMM	4	pubmed	fb	add/max	64	0.4660	0.4054	1.150
g-SpMM	4	pubmed	fb	add/min	64	0.4615	0.4043	1.141
g-SpMM	4	pubmed	fb	add/sum	64	0.5171	0.4752	1.088
g-SpMM	4	pubmed	fb	copy_e/max	64	0.4328	0.4097	1.056
g-SpMM	4	pubmed	fb	copy_e/min	64	0.4357	0.3929	1.109
g-SpMM	4	pubmed	fb	copy_e/sum	64	0.4075	0.3730	1.092
g-SpMM	4	pubmed	fb	copy_u/max	64	0.4147	0.3802	1.090
g-SpMM	4	pubmed	fb	copy_u/min	64	0.4276	0.3896	1.097
g-SpMM	4	pubmed	fb	copy_u/sum	64	0.4354	0.3924	1.109

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	pubmed	fb	div/max	64	0.4693	0.3892	1.206
g-SpMM	4	pubmed	fb	div/min	64	0.4393	0.4157	1.057
g-SpMM	4	pubmed	fb	div/sum	64	0.4918	0.4335	1.134
g-SpMM	4	pubmed	fb	mul/max	64	0.4427	0.4087	1.083
g-SpMM	4	pubmed	fb	mul/min	64	0.4428	0.4094	1.082
g-SpMM	4	pubmed	fb	mul/sum	64	0.4897	0.4237	1.156
g-SpMM	4	pubmed	fb	sub/max	64	0.4453	0.4015	1.109
g-SpMM	4	pubmed	fb	sub/min	64	0.4408	0.4029	1.094
g-SpMM	4	pubmed	fb	sub/sum	64	0.5046	0.4661	1.083
g-SpMM	4	pubmed	fwd	add/max	64	0.0868	0.0911	0.953
g-SpMM	4	pubmed	fwd	add/min	64	0.0888	0.0907	0.979
g-SpMM	4	pubmed	fwd	add/sum	64	0.0787	0.0828	0.951
g-SpMM	4	pubmed	fwd	copy_e/max	64	0.0870	0.0848	1.026
g-SpMM	4	pubmed	fwd	copy_e/min	64	0.0850	0.0858	0.991
g-SpMM	4	pubmed	fwd	copy_e/sum	64	0.0770	0.0799	0.964
g-SpMM	4	pubmed	fwd	copy_u/max	64	0.0841	0.0913	0.921
g-SpMM	4	pubmed	fwd	copy_u/min	64	0.0873	0.0851	1.026
g-SpMM	4	pubmed	fwd	copy_u/sum	64	0.0864	0.0786	1.099
g-SpMM	4	pubmed	fwd	div/max	64	0.0877	0.0905	0.969
g-SpMM	4	pubmed	fwd	div/min	64	0.0869	0.0893	0.972
g-SpMM	4	pubmed	fwd	div/sum	64	0.0784	0.0834	0.941
g-SpMM	4	pubmed	fwd	mul/max	64	0.0847	0.0921	0.919
g-SpMM	4	pubmed	fwd	mul/min	64	0.0858	0.0891	0.963
g-SpMM	4	pubmed	fwd	mul/sum	64	0.0817	0.0835	0.979
g-SpMM	4	pubmed	fwd	sub/max	64	0.0858	0.0898	0.956
g-SpMM	4	pubmed	fwd	sub/min	64	0.0863	0.0908	0.950
g-SpMM	4	pubmed	fwd	sub/sum	64	0.0858	0.0823	1.043
g-SpMM	4	pubmed	bwd	add/max	128	0.1884	0.2024	0.931
g-SpMM	4	pubmed	bwd	add/min	128	0.2251	0.1997	1.127
g-SpMM	4	pubmed	bwd	add/sum	128	0.2956	0.2688	1.100
g-SpMM	4	pubmed	bwd	copy_e/max	128	0.2125	0.1921	1.106
g-SpMM	4	pubmed	bwd	copy_e/min	128	0.2091	0.1792	1.167
g-SpMM	4	pubmed	bwd	copy_e/sum	128	0.1969	0.1713	1.149
g-SpMM	4	pubmed	bwd	copy_u/max	128	0.2076	0.1797	1.155
g-SpMM	4	pubmed	bwd	copy_u/min	128	0.2075	0.1715	1.210
g-SpMM	4	pubmed	bwd	copy_u/sum	128	0.2489	0.1958	1.271
g-SpMM	4	pubmed	bwd	div/max	128	0.3523	0.2225	1.583
g-SpMM	4	pubmed	bwd	div/min	128	0.2568	0.2341	1.097
g-SpMM	4	pubmed	bwd	div/sum	128	0.2668	0.3558	0.750
g-SpMM	4	pubmed	bwd	mul/max	128	0.2464	0.2223	1.109
g-SpMM	4	pubmed	bwd	mul/min	128	0.2544	0.2233	1.139
g-SpMM	4	pubmed	bwd	mul/sum	128	0.2357	0.2717	0.868
g-SpMM	4	pubmed	bwd	sub/max	128	0.1925	0.2129	0.904
g-SpMM	4	pubmed	bwd	sub/min	128	0.1852	0.2025	0.915
g-SpMM	4	pubmed	bwd	sub/sum	128	0.2384	0.2598	0.918
g-SpMM	4	pubmed	fb	add/max	128	0.3901	0.4224	0.924
g-SpMM	4	pubmed	fb	add/min	128	0.4762	0.4061	1.173
g-SpMM	4	pubmed	fb	add/sum	128	0.5211	0.4634	1.124
g-SpMM	4	pubmed	fb	copy_e/max	128	0.5001	0.3780	1.323
g-SpMM	4	pubmed	fb	copy_e/min	128	0.4812	0.3831	1.256
g-SpMM	4	pubmed	fb	copy_e/sum	128	0.4425	0.3620	1.222
g-SpMM	4	pubmed	fb	copy_u/max	128	0.4613	0.3835	1.203
g-SpMM	4	pubmed	fb	copy_u/min	128	0.4641	0.3815	1.216
g-SpMM	4	pubmed	fb	copy_u/sum	128	0.4726	0.3904	1.211
g-SpMM	4	pubmed	fb	div/max	128	0.4647	0.4006	1.160
g-SpMM	4	pubmed	fb	div/min	128	0.5023	0.4206	1.194
g-SpMM	4	pubmed	fb	div/sum	128	0.5244	0.4917	1.067
g-SpMM	4	pubmed	fb	mul/max	128	0.4090	0.4259	0.960
g-SpMM	4	pubmed	fb	mul/min	128	0.3942	0.4654	0.847
g-SpMM	4	pubmed	fb	mul/sum	128	0.4210	0.4583	0.918
g-SpMM	4	pubmed	fb	sub/max	128	0.3931	0.4119	0.954
g-SpMM	4	pubmed	fb	sub/min	128	0.3810	0.4125	0.924
g-SpMM	4	pubmed	fb	sub/sum	128	0.4510	0.4631	0.974
g-SpMM	4	pubmed	fwd	add/max	128	0.1156	0.1445	0.800
g-SpMM	4	pubmed	fwd	add/min	128	0.1076	0.1453	0.741
g-SpMM	4	pubmed	fwd	add/sum	128	0.1049	0.1365	0.769
g-SpMM	4	pubmed	fwd	copy_e/max	128	0.0985	0.0892	1.105
g-SpMM	4	pubmed	fwd	copy_e/min	128	0.0961	0.0873	1.100
g-SpMM	4	pubmed	fwd	copy_e/sum	128	0.1005	0.0816	1.231
g-SpMM	4	pubmed	fwd	copy_u/max	128	0.0957	0.0919	1.042
g-SpMM	4	pubmed	fwd	copy_u/min	128	0.0964	0.0928	1.039
g-SpMM	4	pubmed	fwd	copy_u/sum	128	0.0866	0.0811	1.068
g-SpMM	4	pubmed	fwd	div/max	128	0.2470	0.1490	1.657
g-SpMM	4	pubmed	fwd	div/min	128	0.1012	0.1504	0.673
g-SpMM	4	pubmed	fwd	div/sum	128	0.1075	0.1465	0.734
g-SpMM	4	pubmed	fwd	mul/max	128	0.0994	0.1485	0.669
g-SpMM	4	pubmed	fwd	mul/min	128	0.1007	0.1435	0.701
g-SpMM	4	pubmed	fwd	mul/sum	128	0.1041	0.1406	0.741

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	pubmed	fwd	sub/max	128	0.1003	0.1499	0.669
g-SpMM	4	pubmed	fwd	sub/min	128	0.1020	0.1456	0.700
g-SpMM	4	pubmed	fwd	sub/sum	128	0.1075	0.1351	0.796
g-SpMM	4	pubmed	bwd	add/max	256	0.3638	0.3423	1.063
g-SpMM	4	pubmed	bwd	add/min	256	0.3600	0.3353	1.074
g-SpMM	4	pubmed	bwd	add/sum	256	0.3170	0.2756	1.150
g-SpMM	4	pubmed	bwd	copy_e/max	256	0.2641	0.3147	0.839
g-SpMM	4	pubmed	bwd	copy_e/min	256	0.2636	0.3206	0.822
g-SpMM	4	pubmed	bwd	copy_e/sum	256	0.2003	0.1712	1.170
g-SpMM	4	pubmed	bwd	copy_u/max	256	0.2076	0.1706	1.217
g-SpMM	4	pubmed	bwd	copy_u/min	256	0.1935	0.1701	1.138
g-SpMM	4	pubmed	bwd	copy_u/sum	256	0.2279	0.2167	1.052
g-SpMM	4	pubmed	bwd	div/max	256	0.4500	0.4208	1.069
g-SpMM	4	pubmed	bwd	div/min	256	0.4514	0.4217	1.070
g-SpMM	4	pubmed	bwd	div/sum	256	0.4479	0.6609	0.678
g-SpMM	4	pubmed	bwd	mul/max	256	0.4572	0.4206	1.087
g-SpMM	4	pubmed	bwd	mul/min	256	0.4507	0.4175	1.080
g-SpMM	4	pubmed	bwd	mul/sum	256	0.3584	0.5096	0.703
g-SpMM	4	pubmed	bwd	sub/max	256	0.3640	0.3400	1.071
g-SpMM	4	pubmed	bwd	sub/min	256	0.3579	0.3456	1.036
g-SpMM	4	pubmed	bwd	sub/sum	256	0.3370	0.2784	1.210
g-SpMM	4	pubmed	fb	add/max	256	0.5485	0.6038	0.909
g-SpMM	4	pubmed	fb	add/min	256	0.5403	0.6101	0.886
g-SpMM	4	pubmed	fb	add/sum	256	0.5558	0.5037	1.103
g-SpMM	4	pubmed	fb	copy_e/max	256	0.4746	0.4354	1.090
g-SpMM	4	pubmed	fb	copy_e/min	256	0.4569	0.4421	1.034
g-SpMM	4	pubmed	fb	copy_e/sum	256	0.4181	0.3641	1.148
g-SpMM	4	pubmed	fb	copy_u/max	256	0.4565	0.3821	1.195
g-SpMM	4	pubmed	fb	copy_u/min	256	0.4294	0.3785	1.134
g-SpMM	4	pubmed	fb	copy_u/sum	256	0.4670	0.3930	1.188
g-SpMM	4	pubmed	fb	div/max	256	0.6276	0.6989	0.898
g-SpMM	4	pubmed	fb	div/min	256	0.6396	0.6963	0.919
g-SpMM	4	pubmed	fb	div/sum	256	0.6392	0.9275	0.689
g-SpMM	4	pubmed	fb	mul/max	256	0.6440	0.6798	0.947
g-SpMM	4	pubmed	fb	mul/min	256	0.6231	0.6877	0.906
g-SpMM	4	pubmed	fb	mul/sum	256	0.5504	0.7617	0.723
g-SpMM	4	pubmed	fb	sub/max	256	0.5566	0.6187	0.900
g-SpMM	4	pubmed	fb	sub/min	256	0.5362	0.6129	0.875
g-SpMM	4	pubmed	fb	sub/sum	256	0.5855	0.5046	1.160
g-SpMM	4	pubmed	fwd	add/max	256	0.1834	0.2735	0.670
g-SpMM	4	pubmed	fwd	add/min	256	0.1825	0.2743	0.665
g-SpMM	4	pubmed	fwd	add/sum	256	0.2078	0.2664	0.780
g-SpMM	4	pubmed	fwd	copy_e/max	256	0.1220	0.1247	0.978
g-SpMM	4	pubmed	fwd	copy_e/min	256	0.1235	0.1222	1.010
g-SpMM	4	pubmed	fwd	copy_e/sum	256	0.1428	0.1478	0.966
g-SpMM	4	pubmed	fwd	copy_u/max	256	0.1178	0.1862	0.633
g-SpMM	4	pubmed	fwd	copy_u/min	256	0.1177	0.1845	0.638
g-SpMM	4	pubmed	fwd	copy_u/sum	256	0.0916	0.1588	0.577
g-SpMM	4	pubmed	fwd	div/max	256	0.1986	0.2841	0.699
g-SpMM	4	pubmed	fwd	div/min	256	0.1846	0.2826	0.653
g-SpMM	4	pubmed	fwd	div/sum	256	0.2095	0.2691	0.779
g-SpMM	4	pubmed	fwd	mul/max	256	0.1839	0.2885	0.638
g-SpMM	4	pubmed	fwd	mul/min	256	0.1798	0.2728	0.659
g-SpMM	4	pubmed	fwd	mul/sum	256	0.1862	0.2636	0.706
g-SpMM	4	pubmed	fwd	sub/max	256	0.1819	0.2785	0.653
g-SpMM	4	pubmed	fwd	sub/min	256	0.1865	0.2778	0.671
g-SpMM	4	pubmed	fwd	sub/sum	256	0.1932	0.2572	0.751
g-SpMM	4	pubmed	bwd	add/max	512	0.7140	0.6088	1.173
g-SpMM	4	pubmed	bwd	add/min	512	0.6823	0.6085	1.121
g-SpMM	4	pubmed	bwd	add/sum	512	0.3124	0.4388	0.712
g-SpMM	4	pubmed	bwd	copy_e/max	512	0.5020	0.5635	0.891
g-SpMM	4	pubmed	bwd	copy_e/min	512	0.4988	0.5633	0.885
g-SpMM	4	pubmed	bwd	copy_e/sum	512	0.2080	0.1710	1.216
g-SpMM	4	pubmed	bwd	copy_u/max	512	0.2185	0.2034	1.074
g-SpMM	4	pubmed	bwd	copy_u/min	512	0.2328	0.2039	1.141
g-SpMM	4	pubmed	bwd	copy_u/sum	512	0.2732	0.3123	0.875
g-SpMM	4	pubmed	bwd	div/max	512	0.8638	0.7613	1.135
g-SpMM	4	pubmed	bwd	div/min	512	0.8616	0.7613	1.132
g-SpMM	4	pubmed	bwd	div/sum	512	0.8007	1.2104	0.661
g-SpMM	4	pubmed	bwd	mul/max	512	0.8515	0.7708	1.105
g-SpMM	4	pubmed	bwd	mul/min	512	0.8684	0.7658	1.134
g-SpMM	4	pubmed	bwd	mul/sum	512	0.6127	0.9081	0.675
g-SpMM	4	pubmed	bwd	sub/max	512	0.6722	0.6168	1.090
g-SpMM	4	pubmed	bwd	sub/min	512	0.6844	0.6242	1.096
g-SpMM	4	pubmed	bwd	sub/sum	512	0.3180	0.4382	0.726
g-SpMM	4	pubmed	fb	add/max	512	0.9942	1.1241	0.884
g-SpMM	4	pubmed	fb	add/min	512	1.0117	1.1203	0.903
g-SpMM	4	pubmed	fb	add/sum	512	0.6821	0.9262	0.736

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	pubmed	fb	copy_e/max	512	0.7095	0.7689	0.923
g-SpMM	4	pubmed	fb	copy_e/min	512	0.7233	0.7702	0.939
g-SpMM	4	pubmed	fb	copy_e/sum	512	0.4310	0.4194	1.028
g-SpMM	4	pubmed	fb	copy_u/max	512	0.4356	0.5501	0.792
g-SpMM	4	pubmed	fb	copy_u/min	512	0.4987	0.5460	0.913
g-SpMM	4	pubmed	fb	copy_u/sum	512	0.4835	0.6066	0.797
g-SpMM	4	pubmed	fb	div/max	512	1.1970	1.2860	0.931
g-SpMM	4	pubmed	fb	div/min	512	1.1626	1.2644	0.919
g-SpMM	4	pubmed	fb	div/sum	512	1.1549	1.7403	0.664
g-SpMM	4	pubmed	fb	mul/max	512	1.1788	1.2586	0.937
g-SpMM	4	pubmed	fb	mul/min	512	1.1450	1.2678	0.903
g-SpMM	4	pubmed	fb	mul/sum	512	0.9583	1.4282	0.671
g-SpMM	4	pubmed	fb	sub/max	512	1.0002	1.1339	0.882
g-SpMM	4	pubmed	fb	sub/min	512	0.9825	1.1274	0.871
g-SpMM	4	pubmed	fb	sub/sum	512	0.6790	0.9190	0.739
g-SpMM	4	pubmed	fwd	add/max	512	0.3266	0.5158	0.633
g-SpMM	4	pubmed	fwd	add/min	512	0.3327	0.5139	0.647
g-SpMM	4	pubmed	fwd	add/sum	512	0.3760	0.4918	0.765
g-SpMM	4	pubmed	fwd	copy_e/max	512	0.2214	0.2865	0.773
g-SpMM	4	pubmed	fwd	copy_e/min	512	0.2190	0.2198	0.996
g-SpMM	4	pubmed	fwd	copy_e/sum	512	0.2764	0.2818	0.981
g-SpMM	4	pubmed	fwd	copy_u/max	512	0.2050	0.3455	0.593
g-SpMM	4	pubmed	fwd	copy_u/min	512	0.2022	0.3500	0.578
g-SpMM	4	pubmed	fwd	copy_u/sum	512	0.1779	0.2971	0.599
g-SpMM	4	pubmed	fwd	div/max	512	0.3491	0.5337	0.654
g-SpMM	4	pubmed	fwd	div/min	512	0.3216	0.5290	0.608
g-SpMM	4	pubmed	fwd	div/sum	512	0.3807	0.4932	0.772
g-SpMM	4	pubmed	fwd	mul/max	512	0.3334	0.5267	0.633
g-SpMM	4	pubmed	fwd	mul/min	512	0.3359	0.5252	0.640
g-SpMM	4	pubmed	fwd	mul/sum	512	0.3432	0.5073	0.677
g-SpMM	4	pubmed	fwd	sub/max	512	0.3427	0.5275	0.650
g-SpMM	4	pubmed	fwd	sub/min	512	0.3196	0.5247	0.609
g-SpMM	4	pubmed	fwd	sub/sum	512	0.3600	0.5086	0.708
g-SpMM	4	tolokers-2	bwd	add/max	64	0.2264	0.2159	1.049
g-SpMM	4	tolokers-2	bwd	add/min	64	0.2247	0.2202	1.021
g-SpMM	4	tolokers-2	bwd	add/sum	64	0.5024	0.4954	1.014
g-SpMM	4	tolokers-2	bwd	copy_e/max	64	0.1754	0.1722	1.019
g-SpMM	4	tolokers-2	bwd	copy_e/min	64	0.1823	0.1747	1.044
g-SpMM	4	tolokers-2	bwd	copy_e/sum	64	0.4014	0.4185	0.959
g-SpMM	4	tolokers-2	bwd	copy_u/max	64	0.1933	0.1936	0.998
g-SpMM	4	tolokers-2	bwd	copy_u/min	64	0.2011	0.1988	1.012
g-SpMM	4	tolokers-2	bwd	copy_u/sum	64	0.2216	0.2346	0.944
g-SpMM	4	tolokers-2	bwd	div/max	64	0.2030	0.2279	0.891
g-SpMM	4	tolokers-2	bwd	div/min	64	0.2159	0.2253	0.958
g-SpMM	4	tolokers-2	bwd	div/sum	64	0.8895	1.3738	0.647
g-SpMM	4	tolokers-2	bwd	mul/max	64	0.2039	0.2282	0.893
g-SpMM	4	tolokers-2	bwd	mul/min	64	0.2051	0.2266	0.905
g-SpMM	4	tolokers-2	bwd	mul/sum	64	0.6287	1.0268	0.612
g-SpMM	4	tolokers-2	bwd	sub/max	64	0.2018	0.2208	0.914
g-SpMM	4	tolokers-2	bwd	sub/min	64	0.2042	0.2149	0.950
g-SpMM	4	tolokers-2	bwd	sub/sum	64	0.5370	0.4958	1.083
g-SpMM	4	tolokers-2	fb	add/max	64	0.4946	0.6444	0.768
g-SpMM	4	tolokers-2	fb	add/min	64	0.4937	0.6391	0.773
g-SpMM	4	tolokers-2	fb	add/sum	64	0.7377	0.9487	0.778
g-SpMM	4	tolokers-2	fb	copy_e/max	64	0.4168	0.4159	1.002
g-SpMM	4	tolokers-2	fb	copy_e/min	64	0.4145	0.4158	0.997
g-SpMM	4	tolokers-2	fb	copy_e/sum	64	0.6560	0.6520	1.006
g-SpMM	4	tolokers-2	fb	copy_u/max	64	0.4289	0.4392	0.976
g-SpMM	4	tolokers-2	fb	copy_u/min	64	0.4341	0.4501	0.964
g-SpMM	4	tolokers-2	fb	copy_u/sum	64	0.4306	0.4888	0.881
g-SpMM	4	tolokers-2	fb	div/max	64	0.4978	0.6851	0.727
g-SpMM	4	tolokers-2	fb	div/min	64	0.4881	0.6871	0.710
g-SpMM	4	tolokers-2	fb	div/sum	64	1.3131	1.9515	0.673
g-SpMM	4	tolokers-2	fb	mul/max	64	0.4740	0.6602	0.718
g-SpMM	4	tolokers-2	fb	mul/min	64	0.4818	0.6554	0.735
g-SpMM	4	tolokers-2	fb	mul/sum	64	0.9970	1.6184	0.616
g-SpMM	4	tolokers-2	fb	sub/max	64	0.4634	0.6465	0.717
g-SpMM	4	tolokers-2	fb	sub/min	64	0.4613	0.6444	0.716
g-SpMM	4	tolokers-2	fb	sub/sum	64	0.7280	0.9654	0.754
g-SpMM	4	tolokers-2	fwd	add/max	64	0.3230	0.4956	0.652
g-SpMM	4	tolokers-2	fwd	add/min	64	0.3266	0.4978	0.656
g-SpMM	4	tolokers-2	fwd	add/sum	64	0.4115	0.5479	0.751
g-SpMM	4	tolokers-2	fwd	copy_e/max	64	0.1673	0.1710	0.978
g-SpMM	4	tolokers-2	fwd	copy_e/min	64	0.1685	0.1691	0.997
g-SpMM	4	tolokers-2	fwd	copy_e/sum	64	0.3229	0.3292	0.981
g-SpMM	4	tolokers-2	fwd	copy_u/max	64	0.1252	0.2232	0.561
g-SpMM	4	tolokers-2	fwd	copy_u/min	64	0.1249	0.2233	0.559
g-SpMM	4	tolokers-2	fwd	copy_u/sum	64	0.1090	0.1885	0.578

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	tolokers-2	fwd	div/max	64	0.3294	0.5271	0.625
g-SpMM	4	tolokers-2	fwd	div/min	64	0.3348	0.5346	0.626
g-SpMM	4	tolokers-2	fwd	div/sum	64	0.4190	0.5710	0.734
g-SpMM	4	tolokers-2	fwd	mul/max	64	0.3284	0.4980	0.659
g-SpMM	4	tolokers-2	fwd	mul/min	64	0.3341	0.5001	0.668
g-SpMM	4	tolokers-2	fwd	mul/sum	64	0.3762	0.5868	0.641
g-SpMM	4	tolokers-2	fwd	sub/max	64	0.3180	0.4947	0.643
g-SpMM	4	tolokers-2	fwd	sub/min	64	0.3232	0.5026	0.643
g-SpMM	4	tolokers-2	fwd	sub/sum	64	0.4214	0.5642	0.747
g-SpMM	4	tolokers-2	bwd	add/max	128	0.2815	0.2813	1.001
g-SpMM	4	tolokers-2	bwd	add/min	128	0.2835	0.2820	1.005
g-SpMM	4	tolokers-2	bwd	add/sum	128	0.5012	0.6467	0.775
g-SpMM	4	tolokers-2	bwd	copy_e/max	128	0.2573	0.2581	0.997
g-SpMM	4	tolokers-2	bwd	copy_e/min	128	0.2571	0.2577	0.998
g-SpMM	4	tolokers-2	bwd	copy_e/sum	128	0.4039	0.4123	0.980
g-SpMM	4	tolokers-2	bwd	copy_u/max	128	0.2005	0.2020	0.992
g-SpMM	4	tolokers-2	bwd	copy_u/min	128	0.1956	0.2001	0.977
g-SpMM	4	tolokers-2	bwd	copy_u/sum	128	0.2403	0.3430	0.700
g-SpMM	4	tolokers-2	bwd	div/max	128	0.3227	0.3231	0.999
g-SpMM	4	tolokers-2	bwd	div/min	128	0.3223	0.3230	0.998
g-SpMM	4	tolokers-2	bwd	div/sum	128	1.4321	2.2651	0.632
g-SpMM	4	tolokers-2	bwd	mul/max	128	0.3225	0.3231	0.998
g-SpMM	4	tolokers-2	bwd	mul/min	128	0.3218	0.3215	1.001
g-SpMM	4	tolokers-2	bwd	mul/sum	128	1.0929	1.7160	0.637
g-SpMM	4	tolokers-2	bwd	sub/max	128	0.2817	0.2837	0.993
g-SpMM	4	tolokers-2	bwd	sub/min	128	0.2823	0.2888	0.978
g-SpMM	4	tolokers-2	bwd	sub/sum	128	0.4928	0.6501	0.758
g-SpMM	4	tolokers-2	fb	add/max	128	0.9082	1.1716	0.775
g-SpMM	4	tolokers-2	fb	add/min	128	0.9044	1.1667	0.775
g-SpMM	4	tolokers-2	fb	add/sum	128	1.2803	1.7355	0.738
g-SpMM	4	tolokers-2	fb	copy_e/max	128	0.5596	0.5675	0.986
g-SpMM	4	tolokers-2	fb	copy_e/min	128	0.5480	0.5587	0.981
g-SpMM	4	tolokers-2	fb	copy_e/sum	128	0.9069	0.9084	0.998
g-SpMM	4	tolokers-2	fb	copy_u/max	128	0.4220	0.4543	0.929
g-SpMM	4	tolokers-2	fb	copy_u/min	128	0.4300	0.4528	0.950
g-SpMM	4	tolokers-2	fb	copy_u/sum	128	0.4673	0.7157	0.653
g-SpMM	4	tolokers-2	fb	div/max	128	0.9557	1.2627	0.757
g-SpMM	4	tolokers-2	fb	div/min	128	0.9541	1.2229	0.780
g-SpMM	4	tolokers-2	fb	div/sum	128	2.2397	3.3852	0.662
g-SpMM	4	tolokers-2	fb	mul/max	128	0.9425	1.1961	0.788
g-SpMM	4	tolokers-2	fb	mul/min	128	0.9568	1.2002	0.797
g-SpMM	4	tolokers-2	fb	mul/sum	128	1.7077	2.8617	0.597
g-SpMM	4	tolokers-2	fb	sub/max	128	0.9046	1.1578	0.781
g-SpMM	4	tolokers-2	fb	sub/min	128	0.9114	1.1508	0.792
g-SpMM	4	tolokers-2	fb	sub/sum	128	1.2889	1.7186	0.750
g-SpMM	4	tolokers-2	fwd	add/max	128	0.6289	0.8468	0.743
g-SpMM	4	tolokers-2	fwd	add/min	128	0.6327	0.8953	0.707
g-SpMM	4	tolokers-2	fwd	add/sum	128	0.7711	1.0602	0.727
g-SpMM	4	tolokers-2	fwd	copy_e/max	128	0.3201	0.3111	1.029
g-SpMM	4	tolokers-2	fwd	copy_e/min	128	0.3179	0.3240	0.981
g-SpMM	4	tolokers-2	fwd	copy_e/sum	128	0.6348	0.6326	1.003
g-SpMM	4	tolokers-2	fwd	copy_u/max	128	0.2164	0.3792	0.571
g-SpMM	4	tolokers-2	fwd	copy_u/min	128	0.2123	0.3772	0.563
g-SpMM	4	tolokers-2	fwd	copy_u/sum	128	0.1960	0.3349	0.585
g-SpMM	4	tolokers-2	fwd	div/max	128	0.6362	0.9071	0.701
g-SpMM	4	tolokers-2	fwd	div/min	128	0.6778	0.9420	0.719
g-SpMM	4	tolokers-2	fwd	div/sum	128	0.7636	1.0718	0.712
g-SpMM	4	tolokers-2	fwd	mul/max	128	0.6232	0.8889	0.701
g-SpMM	4	tolokers-2	fwd	mul/min	128	0.6519	0.9109	0.716
g-SpMM	4	tolokers-2	fwd	mul/sum	128	0.6604	1.1259	0.587
g-SpMM	4	tolokers-2	fwd	sub/max	128	0.6377	0.8975	0.711
g-SpMM	4	tolokers-2	fwd	sub/min	128	0.6321	0.9015	0.701
g-SpMM	4	tolokers-2	fwd	sub/sum	128	0.7493	1.0598	0.707
g-SpMM	4	tolokers-2	bwd	add/max	256	0.5429	0.5444	0.997
g-SpMM	4	tolokers-2	bwd	add/min	256	0.5427	0.5448	0.996
g-SpMM	4	tolokers-2	bwd	add/sum	256	0.8961	1.1771	0.761
g-SpMM	4	tolokers-2	bwd	copy_e/max	256	0.4938	0.4943	0.999
g-SpMM	4	tolokers-2	bwd	copy_e/min	256	0.4995	0.4964	1.006
g-SpMM	4	tolokers-2	bwd	copy_e/sum	256	0.4570	0.4542	1.006
g-SpMM	4	tolokers-2	bwd	copy_u/max	256	0.2207	0.1919	1.150
g-SpMM	4	tolokers-2	bwd	copy_u/min	256	0.2074	0.1928	1.076
g-SpMM	4	tolokers-2	bwd	copy_u/sum	256	0.3743	0.6913	0.541
g-SpMM	4	tolokers-2	bwd	div/max	256	0.6359	0.6354	1.001
g-SpMM	4	tolokers-2	bwd	div/min	256	0.6458	0.6366	1.014
g-SpMM	4	tolokers-2	bwd	div/sum	256	2.6638	4.1974	0.635
g-SpMM	4	tolokers-2	bwd	mul/max	256	0.6344	0.6351	0.999
g-SpMM	4	tolokers-2	bwd	mul/min	256	0.6357	0.6365	0.999
g-SpMM	4	tolokers-2	bwd	mul/sum	256	1.9952	3.2141	0.621

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	tolokers-2	bwd	sub/max	256	0.5453	0.5458	0.999
g-SpMM	4	tolokers-2	bwd	sub/min	256	0.5468	0.5453	1.003
g-SpMM	4	tolokers-2	bwd	sub/sum	256	0.8955	1.1792	0.759
g-SpMM	4	tolokers-2	fb	add/max	256	1.7738	2.2581	0.786
g-SpMM	4	tolokers-2	fb	add/min	256	1.7639	2.2781	0.774
g-SpMM	4	tolokers-2	fb	add/sum	256	2.3937	3.3316	0.718
g-SpMM	4	tolokers-2	fb	copy_e/max	256	1.0869	1.0780	1.008
g-SpMM	4	tolokers-2	fb	copy_e/min	256	1.0868	1.0781	1.008
g-SpMM	4	tolokers-2	fb	copy_e/sum	256	1.7149	1.7144	1.000
g-SpMM	4	tolokers-2	fb	copy_u/max	256	0.5172	0.8865	0.583
g-SpMM	4	tolokers-2	fb	copy_u/min	256	0.5017	0.9105	0.551
g-SpMM	4	tolokers-2	fb	copy_u/sum	256	0.8388	1.4162	0.592
g-SpMM	4	tolokers-2	fb	div/max	256	1.9000	2.3823	0.798
g-SpMM	4	tolokers-2	fb	div/min	256	1.9071	2.4238	0.787
g-SpMM	4	tolokers-2	fb	div/sum	256	4.1856	6.4041	0.654
g-SpMM	4	tolokers-2	fb	mul/max	256	1.8797	2.3102	0.814
g-SpMM	4	tolokers-2	fb	mul/min	256	1.9137	2.4104	0.794
g-SpMM	4	tolokers-2	fb	mul/sum	256	3.3428	5.4973	0.608
g-SpMM	4	tolokers-2	fb	sub/max	256	1.7963	2.2614	0.794
g-SpMM	4	tolokers-2	fb	sub/min	256	1.7877	2.2732	0.786
g-SpMM	4	tolokers-2	fb	sub/sum	256	2.4232	3.3206	0.730
g-SpMM	4	tolokers-2	fwd	add/max	256	1.2258	1.7370	0.706
g-SpMM	4	tolokers-2	fwd	add/min	256	1.2963	1.7278	0.750
g-SpMM	4	tolokers-2	fwd	add/sum	256	1.4908	2.0842	0.715
g-SpMM	4	tolokers-2	fwd	copy_e/max	256	0.5853	0.5897	0.992
g-SpMM	4	tolokers-2	fwd	copy_e/min	256	0.6127	0.5973	1.026
g-SpMM	4	tolokers-2	fwd	copy_e/sum	256	1.2606	1.2460	1.012
g-SpMM	4	tolokers-2	fwd	copy_u/max	256	0.4245	0.7917	0.536
g-SpMM	4	tolokers-2	fwd	copy_u/min	256	0.4096	0.7818	0.524
g-SpMM	4	tolokers-2	fwd	copy_u/sum	256	0.3720	0.6873	0.541
g-SpMM	4	tolokers-2	fwd	div/max	256	1.2754	1.7055	0.748
g-SpMM	4	tolokers-2	fwd	div/min	256	1.2993	1.8281	0.711
g-SpMM	4	tolokers-2	fwd	div/sum	256	1.4938	2.1491	0.695
g-SpMM	4	tolokers-2	fwd	mul/max	256	1.2387	1.6440	0.753
g-SpMM	4	tolokers-2	fwd	mul/min	256	1.2913	1.7354	0.744
g-SpMM	4	tolokers-2	fwd	mul/sum	256	1.2765	2.1638	0.590
g-SpMM	4	tolokers-2	fwd	sub/max	256	1.2383	1.7179	0.721
g-SpMM	4	tolokers-2	fwd	sub/min	256	1.2964	1.7645	0.735
g-SpMM	4	tolokers-2	fwd	sub/sum	256	1.4471	2.0990	0.689
g-SpMM	4	tolokers-2	bwd	add/max	512	1.1677	1.1685	0.999
g-SpMM	4	tolokers-2	bwd	add/min	512	1.1728	1.1677	1.004
g-SpMM	4	tolokers-2	bwd	add/sum	512	1.8691	2.4579	0.760
g-SpMM	4	tolokers-2	bwd	copy_e/max	512	1.0095	1.0081	1.001
g-SpMM	4	tolokers-2	bwd	copy_e/min	512	1.0115	1.0093	1.002
g-SpMM	4	tolokers-2	bwd	copy_e/sum	512	1.0489	1.0366	1.012
g-SpMM	4	tolokers-2	bwd	copy_u/max	512	0.3788	0.1881	2.014
g-SpMM	4	tolokers-2	bwd	copy_u/min	512	0.3411	0.1875	1.819
g-SpMM	4	tolokers-2	bwd	copy_u/sum	512	0.7808	1.3867	0.563
g-SpMM	4	tolokers-2	bwd	div/max	512	1.4310	1.4313	1.000
g-SpMM	4	tolokers-2	bwd	div/min	512	1.4290	1.4300	0.999
g-SpMM	4	tolokers-2	bwd	div/sum	512	5.5165	8.5670	0.644
g-SpMM	4	tolokers-2	bwd	mul/max	512	1.4257	1.4267	0.999
g-SpMM	4	tolokers-2	bwd	mul/min	512	1.4292	1.4259	1.002
g-SpMM	4	tolokers-2	bwd	mul/sum	512	4.1841	6.7905	0.616
g-SpMM	4	tolokers-2	bwd	sub/max	512	1.1717	1.1717	1.000
g-SpMM	4	tolokers-2	bwd	sub/min	512	1.1719	1.1686	1.003
g-SpMM	4	tolokers-2	bwd	sub/sum	512	1.8538	2.5004	0.741
g-SpMM	4	tolokers-2	fb	add/max	512	3.7250	4.6483	0.801
g-SpMM	4	tolokers-2	fb	add/min	512	3.7341	4.6277	0.807
g-SpMM	4	tolokers-2	fb	add/sum	512	4.8762	6.8392	0.713
g-SpMM	4	tolokers-2	fb	copy_e/max	512	2.2922	2.2721	1.009
g-SpMM	4	tolokers-2	fb	copy_e/min	512	2.3017	2.3027	1.000
g-SpMM	4	tolokers-2	fb	copy_e/sum	512	3.5529	3.5421	1.003
g-SpMM	4	tolokers-2	fb	copy_u/max	512	0.9828	1.7749	0.554
g-SpMM	4	tolokers-2	fb	copy_u/min	512	0.9654	1.7572	0.549
g-SpMM	4	tolokers-2	fb	copy_u/sum	512	1.6124	2.8701	0.562
g-SpMM	4	tolokers-2	fb	div/max	512	3.9723	5.0294	0.790
g-SpMM	4	tolokers-2	fb	div/min	512	4.0569	4.9980	0.812
g-SpMM	4	tolokers-2	fb	div/sum	512	8.7206	13.0678	0.667
g-SpMM	4	tolokers-2	fb	mul/max	512	3.9626	4.9152	0.806
g-SpMM	4	tolokers-2	fb	mul/min	512	3.9854	4.9832	0.800
g-SpMM	4	tolokers-2	fb	mul/sum	512	6.7903	11.3817	0.597
g-SpMM	4	tolokers-2	fb	sub/max	512	3.6813	4.6670	0.789
g-SpMM	4	tolokers-2	fb	sub/min	512	3.7149	4.6852	0.793
g-SpMM	4	tolokers-2	fb	sub/sum	512	4.9470	6.8558	0.722
g-SpMM	4	tolokers-2	fwd	add/max	512	2.5364	3.4797	0.729
g-SpMM	4	tolokers-2	fwd	add/min	512	2.6799	3.7065	0.723
g-SpMM	4	tolokers-2	fwd	add/sum	512	3.0445	4.3602	0.698

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	tolokers-2	fwd	copy_e/max	512	1.2708	1.3076	0.972
g-SpMM	4	tolokers-2	fwd	copy_e/min	512	1.3470	1.3528	0.996
g-SpMM	4	tolokers-2	fwd	copy_e/sum	512	2.5364	2.5207	1.006
g-SpMM	4	tolokers-2	fwd	copy_u/max	512	0.8223	1.6019	0.513
g-SpMM	4	tolokers-2	fwd	copy_u/min	512	0.8392	1.6413	0.511
g-SpMM	4	tolokers-2	fwd	copy_u/sum	512	0.7729	1.3793	0.560
g-SpMM	4	tolokers-2	fwd	div/max	512	2.6065	3.5565	0.733
g-SpMM	4	tolokers-2	fwd	div/min	512	2.7021	3.7224	0.726
g-SpMM	4	tolokers-2	fwd	div/sum	512	3.0601	4.3009	0.711
g-SpMM	4	tolokers-2	fwd	mul/max	512	2.5060	3.4538	0.726
g-SpMM	4	tolokers-2	fwd	mul/min	512	2.6662	3.5474	0.752
g-SpMM	4	tolokers-2	fwd	mul/sum	512	2.5715	4.4911	0.573
g-SpMM	4	tolokers-2	fwd	sub/max	512	2.5367	3.5590	0.713
g-SpMM	4	tolokers-2	fwd	sub/min	512	2.7148	3.6229	0.749
g-SpMM	4	tolokers-2	fwd	sub/sum	512	3.0496	4.3002	0.709
g-SpMM	4	twitch-views	bwd	copy_u/max	64	0.3624	0.3643	0.995
g-SpMM	4	twitch-views	bwd	copy_u/min	64	0.3692	0.3682	1.003
g-SpMM	4	twitch-views	bwd	copy_u/sum	64	2.5204	3.8800	0.650
g-SpMM	4	twitch-views	fb	copy_u/max	64	2.4715	4.8810	0.506
g-SpMM	4	twitch-views	fb	copy_u/min	64	2.4543	4.8491	0.506
g-SpMM	4	twitch-views	fb	copy_u/sum	64	5.0314	7.7327	0.651
g-SpMM	4	twitch-views	fwd	copy_u/max	64	2.0971	4.4816	0.468
g-SpMM	4	twitch-views	fwd	copy_u/min	64	2.1017	4.4904	0.468
g-SpMM	4	twitch-views	fwd	copy_u/sum	64	2.5053	3.8130	0.657
g-SpMM	4	twitch-views	bwd	copy_u/max	128	0.7855	0.7871	0.998
g-SpMM	4	twitch-views	bwd	copy_u/min	128	0.7921	0.7924	1.000
g-SpMM	4	twitch-views	bwd	copy_u/sum	128	5.7285	8.3385	0.687
g-SpMM	4	twitch-views	fb	copy_u/max	128	5.2889	10.6152	0.498
g-SpMM	4	twitch-views	fb	copy_u/min	128	5.2459	10.6292	0.494
g-SpMM	4	twitch-views	fb	copy_u/sum	128	11.5131	17.1206	0.672
g-SpMM	4	twitch-views	fwd	copy_u/max	128	4.4401	9.9117	0.448
g-SpMM	4	twitch-views	fwd	copy_u/min	128	4.4394	9.9377	0.447
g-SpMM	4	twitch-views	fwd	copy_u/sum	128	5.7618	8.4094	0.685
g-SpMM	4	twitch-views	bwd	copy_u/max	256	2.1162	2.1080	1.004
g-SpMM	4	twitch-views	bwd	copy_u/min	256	2.1203	2.1053	1.007
g-SpMM	4	twitch-views	bwd	copy_u/sum	256	12.7565	17.9699	0.710
g-SpMM	4	twitch-views	fb	copy_u/max	256	11.7507	23.3687	0.503
g-SpMM	4	twitch-views	fb	copy_u/min	256	11.7189	23.6232	0.496
g-SpMM	4	twitch-views	fb	copy_u/sum	256	25.5881	36.5649	0.700
g-SpMM	4	twitch-views	fwd	copy_u/max	256	9.6130	21.4383	0.448
g-SpMM	4	twitch-views	fwd	copy_u/min	256	9.5850	21.3743	0.448
g-SpMM	4	twitch-views	fwd	copy_u/sum	256	12.5033	18.0879	0.691
g-SpMM	4	twitch-views	bwd	copy_u/max	512	5.4141	5.4120	1.000
g-SpMM	4	twitch-views	bwd	copy_u/min	512	5.4572	5.4514	1.001
g-SpMM	4	twitch-views	bwd	copy_u/sum	512	26.6411	37.7994	0.705
g-SpMM	4	twitch-views	fb	copy_u/max	512	25.4791	50.9100	0.500
g-SpMM	4	twitch-views	fb	copy_u/min	512	25.3114	50.5453	0.501
g-SpMM	4	twitch-views	fb	copy_u/sum	512	53.9893	77.3205	0.698
g-SpMM	4	twitch-views	fwd	copy_u/max	512	20.4989	45.3031	0.452
g-SpMM	4	twitch-views	fwd	copy_u/min	512	20.1041	45.3868	0.443
g-SpMM	4	twitch-views	fwd	copy_u/sum	512	26.5513	37.9507	0.700
g-SpMM	4	web-fraud	bwd	copy_u/max	64	12.6533	12.6678	0.999
g-SpMM	4	web-fraud	bwd	copy_u/min	64	12.7784	12.7500	1.002
g-SpMM	4	web-fraud	bwd	copy_u/sum	64	74.5888	96.3848	0.774
g-SpMM	4	web-fraud	fb	copy_u/max	64	26.2978	42.8084	0.614
g-SpMM	4	web-fraud	fb	copy_u/min	64	26.3815	43.6144	0.605
g-SpMM	4	web-fraud	fb	copy_u/sum	64	92.8230	121.1665	0.766
g-SpMM	4	web-fraud	fwd	copy_u/max	64	13.6663	30.3950	0.450
g-SpMM	4	web-fraud	fwd	copy_u/min	64	13.5791	30.5452	0.445
g-SpMM	4	web-fraud	fwd	copy_u/sum	64	17.5692	24.2026	0.726
g-SpMM	4	web-fraud	bwd	copy_u/max	128	16.2701	16.2547	1.001
g-SpMM	4	web-fraud	bwd	copy_u/min	128	16.6026	16.6040	1.000
g-SpMM	4	web-fraud	bwd	copy_u/sum	128	149.9857	192.0305	0.781
g-SpMM	4	web-fraud	fb	copy_u/max	128	42.7517	76.9564	0.556
g-SpMM	4	web-fraud	fb	copy_u/min	128	43.3043	77.8476	0.556
g-SpMM	4	web-fraud	fb	copy_u/sum	128	185.2705	243.5783	0.761
g-SpMM	4	web-fraud	fwd	copy_u/max	128	27.1672	60.8758	0.446
g-SpMM	4	web-fraud	fwd	copy_u/min	128	27.0870	61.1357	0.443
g-SpMM	4	web-fraud	fwd	copy_u/sum	128	35.7578	48.9003	0.731
g-SpMM	4	web-fraud	bwd	copy_u/max	256	32.3781	32.7434	0.989
g-SpMM	4	web-fraud	bwd	copy_u/min	256	31.9456	32.8973	0.971
g-SpMM	4	web-fraud	bwd	copy_u/sum	256	301.7913	387.2490	0.779
g-SpMM	4	web-fraud	fb	copy_u/max	256	103.8889	175.4710	0.592
g-SpMM	4	web-fraud	fb	copy_u/min	256	104.8676	174.0476	0.603
g-SpMM	4	web-fraud	fb	copy_u/sum	256	400.3877	513.0902	0.780
g-SpMM	4	web-fraud	fwd	copy_u/max	256	55.7480	157.4354	0.354
g-SpMM	4	web-fraud	fwd	copy_u/min	256	88.1386	156.3187	0.564
g-SpMM	4	web-fraud	fwd	copy_u/sum	256	70.1338	98.0993	0.715

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SpMM	4	web-fraud	bwd	copy_u/max	512	45.5700	45.5745	1.000
g-SpMM	4	web-fraud	bwd	copy_u/min	512	44.8344	46.0137	0.974
g-SpMM	4	web-fraud	bwd	copy_u/sum	512	623.9840	803.1107	0.777
g-SpMM	4	web-fraud	fb	copy_u/max	512	226.4346	357.3916	0.634
g-SpMM	4	web-fraud	fb	copy_u/min	512	219.5975	389.6657	0.564
g-SpMM	4	web-fraud	fb	copy_u/sum	512	792.9253	1027.2576	0.772
g-SpMM	4	web-fraud	fwd	copy_u/max	512	188.2454	332.0708	0.567
g-SpMM	4	web-fraud	fwd	copy_u/min	512	190.1446	330.8135	0.575
g-SpMM	4	web-fraud	fwd	copy_u/sum	512	166.4348	219.6735	0.758
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw1	32	0.1745	0.2390	0.730
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw1	32	0.1745	0.2447	0.713
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw4	32	0.0866	0.1269	0.683
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw4	32	0.0866	0.1120	0.773
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw8	32	0.0699	0.1053	0.664
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw8	32	0.0699	0.0876	0.798
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw16	32	0.0624	0.0961	0.649
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw16	32	0.0624	0.0788	0.791
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw1	64	0.1779	0.2465	0.722
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw1	64	0.1779	0.2603	0.684
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw4	64	0.0912	0.1281	0.712
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw4	64	0.0912	0.1152	0.792
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw8	64	0.0855	0.1076	0.795
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw8	64	0.0855	0.0908	0.941
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw16	64	0.0865	0.0980	0.883
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw16	64	0.0865	0.0850	1.018
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw1	128	0.2053	0.2692	0.762
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw1	128	0.2053	0.2797	0.734
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw4	128	0.1482	0.1490	0.994
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw4	128	0.1482	0.1478	1.002
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw8	128	0.1510	0.1500	1.007
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw8	128	0.1510	0.1488	1.015
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw16	128	0.1520	0.1517	1.003
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw16	128	0.1520	0.1517	1.002
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw1	256	0.2770	0.3067	0.903
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw1	256	0.2770	0.3096	0.895
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw4	256	0.2831	0.2812	1.007
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw4	256	0.2831	0.2818	1.005
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw8	256	0.2861	0.2847	1.005
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw8	256	0.2861	0.2847	1.005
g-SDDMM	2	artnet-exp	fwd	src_copy_edge/epw16	256	0.2912	0.2887	1.009
g-SDDMM	3	artnet-exp	fwd	src_copy_edge/epw16	256	0.2912	0.2880	1.011
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw1	32	0.1901	0.2156	0.882
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw1	32	0.1901	0.2214	0.859
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw4	32	0.0977	0.1378	0.709
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw4	32	0.0977	0.1382	0.707
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw8	32	0.0821	0.1247	0.658
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw8	32	0.0821	0.1241	0.661
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw16	32	0.0779	0.1190	0.654
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw16	32	0.0779	0.1185	0.657
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw1	64	0.1787	0.1898	0.941
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw1	64	0.1787	0.1956	0.914
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw4	64	0.0933	0.1318	0.708
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw4	64	0.0933	0.1453	0.642
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw8	64	0.0788	0.1233	0.639
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw8	64	0.0788	0.1337	0.589
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw16	64	0.0770	0.1200	0.642
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw16	64	0.0770	0.1223	0.630
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw1	128	0.1891	0.2043	0.926
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw1	128	0.1891	0.2083	0.908
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw4	128	0.1051	0.1358	0.774
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw4	128	0.1051	0.1378	0.763
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw8	128	0.0993	0.1266	0.785
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw8	128	0.0993	0.1269	0.783
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw16	128	0.0843	0.1220	0.692
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw16	128	0.0843	0.1230	0.686
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw1	256	0.2080	0.2751	0.756
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw1	256	0.2080	0.3141	0.662
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw4	256	0.1204	0.1718	0.701
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw4	256	0.1204	0.1855	0.649
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw8	256	0.1077	0.1616	0.667
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw8	256	0.1077	0.1694	0.636
g-SDDMM	2	artnet-exp	fwd	src_dot_dst/epw16	256	0.1042	0.1575	0.662
g-SDDMM	3	artnet-exp	fwd	src_dot_dst/epw16	256	0.1042	0.1611	0.647
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw1	32	0.1880	0.2211	0.850
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw1	32	0.1880	0.2257	0.833
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw4	32	0.0836	0.1325	0.631
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw4	32	0.0836	0.1339	0.624
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw8	32	0.0661	0.1117	0.592

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw8	32	0.0661	0.1102	0.600
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw16	32	0.0594	0.1025	0.579
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw16	32	0.0594	0.1009	0.588
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw1	64	0.1926	0.2549	0.755
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw1	64	0.1926	0.2341	0.823
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw4	64	0.0874	0.1403	0.623
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw4	64	0.0874	0.1360	0.642
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw8	64	0.0790	0.1156	0.683
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw8	64	0.0790	0.1129	0.700
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw16	64	0.0800	0.1058	0.756
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw16	64	0.0800	0.1039	0.770
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw1	128	0.2157	0.2608	0.827
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw1	128	0.2157	0.2641	0.817
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw4	128	0.1428	0.1569	0.910
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw4	128	0.1428	0.1552	0.920
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw8	128	0.1439	0.1430	1.006
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw8	128	0.1439	0.1428	1.007
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw16	128	0.1453	0.1453	0.999
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw16	128	0.1453	0.1445	1.005
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw1	256	0.2736	0.3200	0.855
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw1	256	0.2736	0.3660	0.748
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw4	256	0.2821	0.2785	1.013
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw4	256	0.2821	0.2724	1.036
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw8	256	0.2856	0.2809	1.017
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw8	256	0.2856	0.2754	1.037
g-SDDMM	2	artnet-exp	fwd	src_mul_dst/epw16	256	0.2957	0.2825	1.047
g-SDDMM	3	artnet-exp	fwd	src_mul_dst/epw16	256	0.2957	0.2821	1.048
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw1	32	0.2032	0.2657	0.765
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw1	32	0.2032	0.2792	0.728
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw4	32	0.0907	0.1363	0.666
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw4	32	0.0907	0.1534	0.591
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw8	32	0.0845	0.1197	0.706
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw8	32	0.0845	0.1278	0.661
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw16	32	0.0838	0.1140	0.736
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw16	32	0.0838	0.1100	0.762
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw1	64	0.2051	0.2759	0.744
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw1	64	0.2051	0.2809	0.730
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw4	64	0.1314	0.1495	0.879
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw4	64	0.1314	0.1473	0.892
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw8	64	0.1310	0.1408	0.930
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw8	64	0.1310	0.1369	0.957
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw16	64	0.1331	0.1374	0.969
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw16	64	0.1331	0.1357	0.981
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw1	128	0.2612	0.3327	0.785
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw1	128	0.2612	0.3033	0.861
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw4	128	0.2371	0.2448	0.969
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw4	128	0.2371	0.2418	0.980
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw8	128	0.2355	0.2381	0.989
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw8	128	0.2355	0.2340	1.006
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw16	128	0.2383	0.2377	1.003
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw16	128	0.2383	0.2331	1.023
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw1	256	0.4732	0.4760	0.994
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw1	256	0.4732	0.4957	0.955
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw4	256	0.4417	0.4427	0.998
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw4	256	0.4417	0.4481	0.986
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw8	256	0.4459	0.4523	0.986
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw8	256	0.4459	0.4446	1.003
g-SDDMM	2	artnet-exp	fwd	src_mul_edge/epw16	256	0.4503	0.4544	0.991
g-SDDMM	3	artnet-exp	fwd	src_mul_edge/epw16	256	0.4503	0.4492	1.002
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw1	32	0.0319	0.0320	0.994
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw1	32	0.0319	0.0325	0.981
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw4	32	0.0320	0.0321	0.996
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw4	32	0.0320	0.0306	1.044
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw8	32	0.0317	0.0316	1.003
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw8	32	0.0317	0.0304	1.043
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw16	32	0.0316	0.0316	1.000
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw16	32	0.0316	0.0307	1.029
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw1	64	0.0317	0.0408	0.777
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw1	64	0.0317	0.0324	0.978
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw4	64	0.0316	0.0317	0.997
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw4	64	0.0316	0.0319	0.990
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw8	64	0.0311	0.0316	0.984
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw8	64	0.0311	0.0311	1.000
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw16	64	0.0318	0.0314	1.013
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw16	64	0.0318	0.0311	1.024
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw1	128	0.0322	0.0320	1.007
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw1	128	0.0322	0.0325	0.991
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw4	128	0.0321	0.0317	1.012

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw4	128	0.0321	0.0316	1.014
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw8	128	0.0322	0.0316	1.018
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw8	128	0.0322	0.0318	1.010
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw16	128	0.0316	0.0324	0.975
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw16	128	0.0316	0.0315	1.004
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw1	256	0.0327	0.0364	0.900
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw1	256	0.0327	0.0337	0.970
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw4	256	0.0324	0.0330	0.984
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw4	256	0.0324	0.0332	0.976
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw8	256	0.0320	0.0328	0.977
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw8	256	0.0320	0.0329	0.973
g-SDDMM	2	citeseer	fwd	src_copy_edge/epw16	256	0.0324	0.0333	0.972
g-SDDMM	3	citeseer	fwd	src_copy_edge/epw16	256	0.0324	0.0333	0.973
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw1	32	0.0246	0.0248	0.996
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw1	32	0.0246	0.0251	0.981
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw4	32	0.0234	0.0242	0.964
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw4	32	0.0234	0.0242	0.968
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw8	32	0.0240	0.0242	0.994
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw8	32	0.0240	0.0243	0.988
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw16	32	0.0267	0.0265	1.004
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw16	32	0.0267	0.0265	1.007
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw1	64	0.0248	0.0247	1.007
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw1	64	0.0248	0.0251	0.992
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw4	64	0.0233	0.0240	0.972
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw4	64	0.0233	0.0242	0.966
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw8	64	0.0243	0.0244	0.995
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw8	64	0.0243	0.0243	1.000
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw16	64	0.0272	0.0267	1.017
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw16	64	0.0272	0.0268	1.015
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw1	128	0.0251	0.0252	0.996
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw1	128	0.0251	0.0254	0.990
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw4	128	0.0235	0.0246	0.958
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw4	128	0.0235	0.0245	0.963
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw8	128	0.0246	0.0250	0.983
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw8	128	0.0246	0.0248	0.993
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw16	128	0.0274	0.0272	1.008
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw16	128	0.0274	0.0268	1.024
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw1	256	0.0247	0.0269	0.918
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw1	256	0.0247	0.0266	0.928
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw4	256	0.0238	0.0251	0.950
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw4	256	0.0238	0.0255	0.935
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw8	256	0.0252	0.0253	0.994
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw8	256	0.0252	0.0253	0.996
g-SDDMM	2	citeseer	fwd	src_dot_dst/epw16	256	0.0277	0.0275	1.009
g-SDDMM	3	citeseer	fwd	src_dot_dst/epw16	256	0.0277	0.0274	1.014
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw1	32	0.0239	0.0245	0.979
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw1	32	0.0239	0.0243	0.983
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw4	32	0.0235	0.0235	0.999
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw4	32	0.0235	0.0235	0.998
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw8	32	0.0228	0.0237	0.962
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw8	32	0.0228	0.0234	0.976
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw16	32	0.0234	0.0245	0.956
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw16	32	0.0234	0.0242	0.965
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw1	64	0.0237	0.0241	0.985
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw1	64	0.0237	0.0239	0.992
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw4	64	0.0223	0.0230	0.969
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw4	64	0.0223	0.0232	0.959
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw8	64	0.0224	0.0229	0.977
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw8	64	0.0224	0.0231	0.972
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw16	64	0.0227	0.0241	0.945
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw16	64	0.0227	0.0243	0.937
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw1	128	0.0245	0.0247	0.991
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw1	128	0.0245	0.0250	0.979
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw4	128	0.0232	0.0242	0.957
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw4	128	0.0232	0.0240	0.966
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw8	128	0.0236	0.0240	0.986
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw8	128	0.0236	0.0239	0.988
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw16	128	0.0249	0.0250	0.994
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw16	128	0.0249	0.0249	1.000
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw1	256	0.0256	0.0265	0.964
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw1	256	0.0256	0.0268	0.954
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw4	256	0.0251	0.0362	0.692
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw4	256	0.0251	0.0263	0.954
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw8	256	0.0256	0.0260	0.984
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw8	256	0.0256	0.0262	0.977
g-SDDMM	2	citeseer	fwd	src_mul_dst/epw16	256	0.0264	0.0261	1.009
g-SDDMM	3	citeseer	fwd	src_mul_dst/epw16	256	0.0264	0.0261	1.011
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw1	32	0.0241	0.0245	0.984

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw1	32	0.0241	0.0246	0.978
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw4	32	0.0228	0.0237	0.959
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw4	32	0.0228	0.0237	0.960
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw8	32	0.0230	0.0235	0.980
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw8	32	0.0230	0.0236	0.973
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw16	32	0.0238	0.0244	0.975
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw16	32	0.0238	0.0247	0.966
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw1	64	0.0239	0.0246	0.971
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw1	64	0.0239	0.0245	0.977
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw4	64	0.0230	0.0234	0.983
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw4	64	0.0230	0.0234	0.985
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw8	64	0.0232	0.0232	0.998
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw8	64	0.0232	0.0233	0.992
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw16	64	0.0234	0.0247	0.947
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw16	64	0.0234	0.0242	0.965
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw1	128	0.0249	0.0254	0.980
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw1	128	0.0249	0.0254	0.980
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw4	128	0.0241	0.0244	0.986
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw4	128	0.0241	0.0249	0.969
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw8	128	0.0242	0.0246	0.982
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw8	128	0.0242	0.0241	1.002
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw16	128	0.0257	0.0255	1.010
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw16	128	0.0257	0.0250	1.031
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw1	256	0.0270	0.0277	0.977
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw1	256	0.0270	0.0286	0.945
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw4	256	0.0266	0.0269	0.989
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw4	256	0.0266	0.0270	0.985
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw8	256	0.0271	0.0271	1.002
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw8	256	0.0271	0.0275	0.986
g-SDDMM	2	citeseer	fwd	src_mul_edge/epw16	256	0.0275	0.0269	1.022
g-SDDMM	3	citeseer	fwd	src_mul_edge/epw16	256	0.0275	0.0272	1.008
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw1	32	0.6198	0.8981	0.690
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw1	32	0.6198	0.9163	0.676
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw4	32	0.2725	0.4229	0.644
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw4	32	0.2725	0.3723	0.732
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw8	32	0.2103	0.3384	0.622
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw8	32	0.2103	0.2711	0.776
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw16	32	0.1885	0.2989	0.631
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw16	32	0.1885	0.2328	0.810
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw1	64	0.6598	0.9883	0.668
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw1	64	0.6598	1.0023	0.658
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw4	64	0.3158	0.4494	0.703
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw4	64	0.3158	0.4091	0.772
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw8	64	0.3020	0.3695	0.817
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw8	64	0.3020	0.3186	0.948
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw16	64	0.3128	0.3307	0.946
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw16	64	0.3128	0.3017	1.037
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw1	128	0.7789	1.0711	0.727
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw1	128	0.7789	1.0867	0.717
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw4	128	0.5883	0.5845	1.007
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw4	128	0.5883	0.5870	1.002
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw8	128	0.6001	0.5935	1.011
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw8	128	0.6001	0.5894	1.018
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw16	128	0.5986	0.5976	1.002
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw16	128	0.5986	0.5928	1.010
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw1	256	1.2098	1.3112	0.923
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw1	256	1.2098	1.3155	0.920
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw4	256	1.2165	1.2076	1.007
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw4	256	1.2165	1.2083	1.007
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw8	256	1.2249	1.2144	1.009
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw8	256	1.2249	1.2148	1.008
g-SDDMM	2	city-reviews	fwd	src_copy_edge/epw16	256	1.2335	1.2276	1.005
g-SDDMM	3	city-reviews	fwd	src_copy_edge/epw16	256	1.2335	1.2293	1.003
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw1	32	0.7176	0.8240	0.871
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw1	32	0.7176	0.8422	0.852
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw4	32	0.3434	0.4969	0.691
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw4	32	0.3434	0.4953	0.693
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw8	32	0.2820	0.4384	0.643
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw8	32	0.2820	0.4334	0.651
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw16	32	0.2568	0.4106	0.625
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw16	32	0.2568	0.4052	0.634
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw1	64	0.7081	0.7645	0.926
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw1	64	0.7081	0.7720	0.917
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw4	64	0.3559	0.4754	0.749
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw4	64	0.3559	0.4749	0.749
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw8	64	0.2985	0.4349	0.686
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw8	64	0.2985	0.4360	0.685
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw16	64	0.2739	0.4158	0.659

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw16	64	0.2739	0.4167	0.657
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw1	128	0.7489	0.8425	0.889
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw1	128	0.7489	0.8653	0.865
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw4	128	0.3935	0.4993	0.788
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw4	128	0.3935	0.5124	0.768
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw8	128	0.3395	0.4518	0.751
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw8	128	0.3395	0.4561	0.744
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw16	128	0.3168	0.4295	0.738
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw16	128	0.3168	0.4316	0.734
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw1	256	0.8299	1.1358	0.731
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw1	256	0.8299	1.3204	0.629
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw4	256	0.4636	0.6612	0.701
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw4	256	0.4636	0.7307	0.634
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw8	256	0.4096	0.6064	0.675
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw8	256	0.4096	0.6300	0.650
g-SDDMM	2	city-reviews	fwd	src_dot_dst/epw16	256	0.3909	0.6120	0.639
g-SDDMM	3	city-reviews	fwd	src_dot_dst/epw16	256	0.3909	0.5919	0.660
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw1	32	0.7023	0.8701	0.807
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw1	32	0.7023	0.8796	0.798
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw4	32	0.2794	0.4713	0.593
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw4	32	0.2794	0.4721	0.592
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw8	32	0.2131	0.3853	0.553
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw8	32	0.2131	0.3792	0.562
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw16	32	0.1897	0.3472	0.547
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw16	32	0.1897	0.3413	0.556
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw1	64	0.7374	1.1066	0.666
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw1	64	0.7374	0.9916	0.744
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw4	64	0.3166	0.5185	0.611
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw4	64	0.3166	0.4897	0.647
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw8	64	0.2931	0.4208	0.697
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw8	64	0.2931	0.3948	0.742
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw16	64	0.3046	0.3718	0.819
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw16	64	0.3046	0.3526	0.864
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw1	128	0.8412	1.0921	0.770
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw1	128	0.8412	1.1047	0.761
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw4	128	0.5878	0.6144	0.957
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw4	128	0.5878	0.6069	0.969
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw8	128	0.5891	0.5863	1.005
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw8	128	0.5891	0.5840	1.009
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw16	128	0.5946	0.5905	1.007
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw16	128	0.5946	0.5882	1.011
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw1	256	1.2406	1.3760	0.902
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw1	256	1.2406	1.5612	0.795
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw4	256	1.2252	1.2134	1.010
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw4	256	1.2252	1.2112	1.012
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw8	256	1.2452	1.2146	1.025
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw8	256	1.2452	1.2114	1.028
g-SDDMM	2	city-reviews	fwd	src_mul_dst/epw16	256	1.2612	1.2262	1.028
g-SDDMM	3	city-reviews	fwd	src_mul_dst/epw16	256	1.2612	1.2205	1.033
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw1	32	0.7555	1.0035	0.753
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw1	32	0.7555	1.0167	0.743
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw4	32	0.3141	0.4902	0.641
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw4	32	0.3141	0.4824	0.651
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw8	32	0.2961	0.4104	0.722
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw8	32	0.2961	0.4012	0.738
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw16	32	0.2893	0.3740	0.774
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw16	32	0.2893	0.3674	0.787
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw1	64	0.7775	1.0554	0.737
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw1	64	0.7775	1.0694	0.727
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw4	64	0.5088	0.5808	0.876
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw4	64	0.5088	0.5662	0.899
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw8	64	0.4982	0.5299	0.940
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw8	64	0.4982	0.5182	0.961
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw16	64	0.4956	0.5209	0.951
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw16	64	0.4956	0.5043	0.983
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw1	128	1.0755	1.3031	0.825
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw1	128	1.0755	1.1961	0.899
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw4	128	0.9643	1.0040	0.960
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw4	128	0.9643	0.9968	0.967
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw8	128	0.9515	0.9772	0.974
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw8	128	0.9515	0.9419	1.010
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw16	128	0.9575	0.9665	0.991
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw16	128	0.9575	0.9329	1.026
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw1	256	2.0282	2.0370	0.996
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw1	256	2.0282	2.0846	0.973
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw4	256	1.8790	1.8880	0.995
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw4	256	1.8790	1.8939	0.992
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw8	256	1.8923	1.8944	0.999

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw8	256	1.8923	1.8878	1.002
g-SDDMM	2	city-reviews	fwd	src_mul_edge/epw16	256	1.9073	1.9099	0.999
g-SDDMM	3	city-reviews	fwd	src_mul_edge/epw16	256	1.9073	1.9023	1.003
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw1	32	0.1284	0.1724	0.745
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw1	32	0.1284	0.1762	0.729
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw4	32	0.0647	0.0949	0.682
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw4	32	0.0647	0.0856	0.756
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw8	32	0.0547	0.0808	0.678
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw8	32	0.0547	0.0691	0.792
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw16	32	0.0519	0.0749	0.694
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw16	32	0.0519	0.0629	0.825
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw1	64	0.1390	0.1960	0.709
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw1	64	0.1390	0.1990	0.698
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw4	64	0.0749	0.1008	0.743
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw4	64	0.0749	0.0937	0.799
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw8	64	0.0782	0.0895	0.874
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw8	64	0.0782	0.0808	0.968
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw16	64	0.0804	0.0855	0.940
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw16	64	0.0804	0.0790	1.017
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw1	128	0.1572	0.2066	0.761
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw1	128	0.1572	0.2100	0.749
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw4	128	0.1256	0.1254	1.002
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw4	128	0.1256	0.1238	1.014
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw8	128	0.1274	0.1394	0.913
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw8	128	0.1274	0.1267	1.005
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw16	128	0.1297	0.1437	0.902
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw16	128	0.1297	0.1284	1.010
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw1	256	0.2154	0.2331	0.924
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw1	256	0.2154	0.2355	0.915
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw4	256	0.2213	0.2173	1.018
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw4	256	0.2213	0.2189	1.011
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw8	256	0.2232	0.2203	1.013
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw8	256	0.2232	0.2202	1.014
g-SDDMM	2	city-roads-L	fwd	src_copy_edge/epw16	256	0.2281	0.2246	1.016
g-SDDMM	3	city-roads-L	fwd	src_copy_edge/epw16	256	0.2281	0.2246	1.016
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw1	32	0.1296	0.1383	0.937
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw1	32	0.1296	0.1432	0.905
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw4	32	0.0711	0.1006	0.707
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw4	32	0.0711	0.1010	0.704
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw8	32	0.0618	0.0919	0.672
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw8	32	0.0618	0.0915	0.675
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw16	32	0.0609	0.0883	0.690
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw16	32	0.0609	0.0879	0.693
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw1	64	0.1352	0.1441	0.938
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw1	64	0.1352	0.1466	0.922
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw4	64	0.0762	0.0980	0.777
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw4	64	0.0762	0.0985	0.773
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw8	64	0.0669	0.0920	0.727
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw8	64	0.0669	0.0921	0.726
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw16	64	0.0638	0.0901	0.708
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw16	64	0.0638	0.0902	0.708
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw1	128	0.1487	0.1559	0.954
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw1	128	0.1487	0.1597	0.931
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw4	128	0.0827	0.1005	0.823
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw4	128	0.0827	0.1016	0.814
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw8	128	0.0738	0.0940	0.785
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw8	128	0.0738	0.0945	0.781
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw16	128	0.0716	0.0930	0.770
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw16	128	0.0716	0.0927	0.772
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw1	256	0.1581	0.2052	0.771
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw1	256	0.1581	0.2388	0.662
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw4	256	0.0925	0.1217	0.760
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw4	256	0.0925	0.1316	0.703
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw8	256	0.0870	0.1143	0.761
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw8	256	0.0870	0.1160	0.750
g-SDDMM	2	city-roads-L	fwd	src_dot_dst/epw16	256	0.0880	0.1148	0.766
g-SDDMM	3	city-roads-L	fwd	src_dot_dst/epw16	256	0.0880	0.1149	0.766
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw1	32	0.1347	0.1629	0.827
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw1	32	0.1347	0.1650	0.816
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw4	32	0.0652	0.0979	0.666
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw4	32	0.0652	0.0976	0.668
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw8	32	0.0535	0.0836	0.640
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw8	32	0.0535	0.0826	0.648
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw16	32	0.0502	0.0785	0.640
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw16	32	0.0502	0.0766	0.656
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw1	64	0.1446	0.2092	0.691
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw1	64	0.1446	0.1889	0.765
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw4	64	0.0715	0.1069	0.669

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw4	64	0.0715	0.1004	0.712
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw8	64	0.0699	0.0910	0.768
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw8	64	0.0699	0.0854	0.818
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw16	64	0.0735	0.0853	0.861
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw16	64	0.0735	0.0800	0.918
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw1	128	0.1598	0.2000	0.799
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw1	128	0.1598	0.2023	0.790
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw4	128	0.1195	0.1205	0.991
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw4	128	0.1195	0.1202	0.994
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw8	128	0.1218	0.1203	1.013
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw8	128	0.1218	0.1198	1.016
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw16	128	0.1237	0.1229	1.007
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw16	128	0.1237	0.1219	1.015
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw1	256	0.2097	0.2394	0.876
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw1	256	0.2097	0.2751	0.762
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw4	256	0.2187	0.2134	1.025
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw4	256	0.2187	0.2113	1.035
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw8	256	0.2258	0.2164	1.043
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw8	256	0.2258	0.2125	1.062
g-SDDMM	2	city-roads-L	fwd	src_mul_dst/epw16	256	0.2333	0.2211	1.055
g-SDDMM	3	city-roads-L	fwd	src_mul_dst/epw16	256	0.2333	0.2188	1.066
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw1	32	0.1466	0.1895	0.774
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw1	32	0.1466	0.1915	0.766
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw4	32	0.0708	0.1014	0.698
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw4	32	0.0708	0.0999	0.708
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw8	32	0.0671	0.0889	0.755
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw8	32	0.0671	0.0867	0.774
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw16	32	0.0666	0.0844	0.789
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw16	32	0.0666	0.0820	0.812
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw1	64	0.1497	0.1972	0.759
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw1	64	0.1497	0.1992	0.751
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw4	64	0.1032	0.1137	0.908
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw4	64	0.1032	0.1128	0.915
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw8	64	0.1029	0.1078	0.954
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw8	64	0.1029	0.1064	0.967
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw16	64	0.1040	0.1065	0.977
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw16	64	0.1040	0.1066	0.976
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw1	128	0.1906	0.2388	0.798
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw1	128	0.1906	0.2187	0.872
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw4	128	0.1756	0.1827	0.961
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw4	128	0.1756	0.1860	0.944
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw8	128	0.1759	0.1785	0.985
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw8	128	0.1759	0.1770	0.994
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw16	128	0.1792	0.1787	1.003
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw16	128	0.1792	0.1787	1.003
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw1	256	0.3348	0.3386	0.989
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw1	256	0.3348	0.3507	0.954
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw4	256	0.3143	0.3161	0.994
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw4	256	0.3143	0.3163	0.994
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw8	256	0.3193	0.3212	0.994
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw8	256	0.3193	0.3157	1.011
g-SDDMM	2	city-roads-L	fwd	src_mul_edge/epw16	256	0.3241	0.3311	0.979
g-SDDMM	3	city-roads-L	fwd	src_mul_edge/epw16	256	0.3241	0.3227	1.004
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw1	32	0.0717	0.0901	0.796
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw1	32	0.0717	0.0923	0.777
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw4	32	0.0442	0.0573	0.772
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw4	32	0.0442	0.0525	0.842
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw8	32	0.0394	0.0514	0.765
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw8	32	0.0394	0.0457	0.862
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw16	32	0.0371	0.0496	0.747
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw16	32	0.0371	0.0441	0.840
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw1	64	0.0730	0.0939	0.778
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw1	64	0.0730	0.0958	0.762
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw4	64	0.0450	0.0589	0.764
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw4	64	0.0450	0.0547	0.823
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw8	64	0.0410	0.0529	0.775
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw8	64	0.0410	0.0478	0.858
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw16	64	0.0402	0.0502	0.800
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw16	64	0.0402	0.0454	0.886
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw1	128	0.0855	0.1075	0.795
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw1	128	0.0855	0.1096	0.780
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw4	128	0.0695	0.0682	1.019
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw4	128	0.0695	0.0679	1.024
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw8	128	0.0701	0.0708	0.990
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw8	128	0.0701	0.0688	1.019
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw16	128	0.0710	0.0707	1.003
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw16	128	0.0710	0.0704	1.008
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw1	256	0.1083	0.1193	0.908

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw1	256	0.1083	0.1195	0.906
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw4	256	0.1125	0.1102	1.020
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw4	256	0.1125	0.1104	1.019
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw8	256	0.1129	0.1116	1.011
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw8	256	0.1129	0.1122	1.006
g-SDDMM	2	city-roads-M	fwd	src_copy_edge/epw16	256	0.1157	0.1151	1.005
g-SDDMM	3	city-roads-M	fwd	src_copy_edge/epw16	256	0.1157	0.1146	1.010
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw1	32	0.0704	0.0751	0.938
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw1	32	0.0704	0.0774	0.909
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw4	32	0.0442	0.0570	0.774
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw4	32	0.0442	0.0571	0.773
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw8	32	0.0403	0.0534	0.755
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw8	32	0.0403	0.0530	0.759
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw16	32	0.0404	0.0533	0.758
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw16	32	0.0404	0.0523	0.772
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw1	64	0.0685	0.0722	0.948
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw1	64	0.0685	0.0736	0.931
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw4	64	0.0445	0.0556	0.800
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw4	64	0.0445	0.0553	0.805
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw8	64	0.0408	0.0528	0.772
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw8	64	0.0408	0.0528	0.771
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw16	64	0.0407	0.0529	0.770
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw16	64	0.0407	0.0529	0.770
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw1	128	0.0716	0.0747	0.958
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw1	128	0.0716	0.0768	0.932
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw4	128	0.0466	0.0560	0.833
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw4	128	0.0466	0.0570	0.819
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw8	128	0.0433	0.0538	0.805
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw8	128	0.0433	0.0541	0.800
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw16	128	0.0427	0.0539	0.793
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw16	128	0.0427	0.0539	0.792
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw1	256	0.0817	0.1030	0.793
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw1	256	0.0817	0.1177	0.694
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw4	256	0.0527	0.0684	0.770
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw4	256	0.0527	0.0707	0.745
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw8	256	0.0501	0.0653	0.768
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw8	256	0.0501	0.0653	0.768
g-SDDMM	2	city-roads-M	fwd	src_dot_dst/epw16	256	0.0499	0.0674	0.742
g-SDDMM	3	city-roads-M	fwd	src_dot_dst/epw16	256	0.0499	0.0654	0.763
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw1	32	0.0720	0.0801	0.899
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw1	32	0.0720	0.0819	0.880
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw4	32	0.0405	0.0550	0.736
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw4	32	0.0405	0.0549	0.738
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw8	32	0.0355	0.0492	0.720
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw8	32	0.0355	0.0488	0.726
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw16	32	0.0338	0.0472	0.716
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw16	32	0.0338	0.0468	0.721
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw1	64	0.0732	0.0905	0.809
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw1	64	0.0732	0.0854	0.857
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw4	64	0.0414	0.0575	0.720
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw4	64	0.0414	0.0565	0.733
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw8	64	0.0359	0.0502	0.714
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw8	64	0.0359	0.0499	0.719
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw16	64	0.0346	0.0479	0.723
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw16	64	0.0346	0.0475	0.729
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw1	128	0.0832	0.1009	0.824
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw1	128	0.0832	0.1021	0.815
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw4	128	0.0623	0.0645	0.966
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw4	128	0.0623	0.0641	0.972
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw8	128	0.0627	0.0624	1.004
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw8	128	0.0627	0.0619	1.013
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw16	128	0.0634	0.0629	1.007
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw16	128	0.0634	0.0634	1.000
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw1	256	0.1015	0.1183	0.858
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw1	256	0.1015	0.1350	0.752
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw4	256	0.1075	0.1045	1.029
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw4	256	0.1075	0.1033	1.041
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw8	256	0.1096	0.1053	1.041
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw8	256	0.1096	0.1037	1.057
g-SDDMM	2	city-roads-M	fwd	src_mul_dst/epw16	256	0.1137	0.1107	1.028
g-SDDMM	3	city-roads-M	fwd	src_mul_dst/epw16	256	0.1137	0.1073	1.060
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw1	32	0.0701	0.0848	0.826
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw1	32	0.0701	0.0854	0.821
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw4	32	0.0385	0.0546	0.704
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw4	32	0.0385	0.0547	0.704
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw8	32	0.0351	0.0501	0.701
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw8	32	0.0351	0.0501	0.700
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw16	32	0.0341	0.0486	0.702

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw16	32	0.0341	0.0487	0.701
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw1	64	0.0794	0.1007	0.788
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw1	64	0.0794	0.1015	0.782
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw4	64	0.0589	0.0629	0.936
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw4	64	0.0589	0.0620	0.950
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw8	64	0.0571	0.0592	0.965
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw8	64	0.0571	0.0578	0.988
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw16	64	0.0580	0.0604	0.960
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw16	64	0.0580	0.0594	0.976
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw1	128	0.0949	0.1194	0.795
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw1	128	0.0949	0.1109	0.856
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw4	128	0.0921	0.0939	0.981
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw4	128	0.0921	0.0926	0.995
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw8	128	0.0918	0.0935	0.982
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw8	128	0.0918	0.0923	0.995
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw16	128	0.0944	0.0931	1.014
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw16	128	0.0944	0.0941	1.003
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw1	256	0.1598	0.1618	0.988
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw1	256	0.1598	0.1665	0.959
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw4	256	0.1534	0.1531	1.002
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw4	256	0.1534	0.1541	0.996
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw8	256	0.1559	0.1575	0.990
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw8	256	0.1559	0.1543	1.011
g-SDDMM	2	city-roads-M	fwd	src_mul_edge/epw16	256	0.1589	0.1598	0.994
g-SDDMM	3	city-roads-M	fwd	src_mul_edge/epw16	256	0.1589	0.1577	1.008
g-SDDMM	2	cora	fwd	src_copy_edge/epw1	32	0.0326	0.0325	1.004
g-SDDMM	3	cora	fwd	src_copy_edge/epw1	32	0.0326	0.0329	0.989
g-SDDMM	2	cora	fwd	src_copy_edge/epw4	32	0.0322	0.0322	1.001
g-SDDMM	3	cora	fwd	src_copy_edge/epw4	32	0.0322	0.0323	0.998
g-SDDMM	2	cora	fwd	src_copy_edge/epw8	32	0.0317	0.0323	0.983
g-SDDMM	3	cora	fwd	src_copy_edge/epw8	32	0.0317	0.0320	0.993
g-SDDMM	2	cora	fwd	src_copy_edge/epw16	32	0.0318	0.0321	0.991
g-SDDMM	3	cora	fwd	src_copy_edge/epw16	32	0.0318	0.0322	0.985
g-SDDMM	2	cora	fwd	src_copy_edge/epw1	64	0.0313	0.0314	0.997
g-SDDMM	3	cora	fwd	src_copy_edge/epw1	64	0.0313	0.0317	0.990
g-SDDMM	2	cora	fwd	src_copy_edge/epw4	64	0.0309	0.0308	1.004
g-SDDMM	3	cora	fwd	src_copy_edge/epw4	64	0.0309	0.0303	1.020
g-SDDMM	2	cora	fwd	src_copy_edge/epw8	64	0.0306	0.0304	1.006
g-SDDMM	3	cora	fwd	src_copy_edge/epw8	64	0.0306	0.0307	0.996
g-SDDMM	2	cora	fwd	src_copy_edge/epw16	64	0.0305	0.0306	0.997
g-SDDMM	3	cora	fwd	src_copy_edge/epw16	64	0.0305	0.0306	0.995
g-SDDMM	2	cora	fwd	src_copy_edge/epw1	128	0.0314	0.0323	0.972
g-SDDMM	3	cora	fwd	src_copy_edge/epw1	128	0.0314	0.0321	0.977
g-SDDMM	2	cora	fwd	src_copy_edge/epw4	128	0.0309	0.0312	0.990
g-SDDMM	3	cora	fwd	src_copy_edge/epw4	128	0.0309	0.0316	0.978
g-SDDMM	2	cora	fwd	src_copy_edge/epw8	128	0.0312	0.0307	1.017
g-SDDMM	3	cora	fwd	src_copy_edge/epw8	128	0.0312	0.0315	0.992
g-SDDMM	2	cora	fwd	src_copy_edge/epw16	128	0.0314	0.0317	0.990
g-SDDMM	3	cora	fwd	src_copy_edge/epw16	128	0.0314	0.0312	1.006
g-SDDMM	2	cora	fwd	src_copy_edge/epw1	256	0.0332	0.0332	1.000
g-SDDMM	3	cora	fwd	src_copy_edge/epw1	256	0.0332	0.0333	0.999
g-SDDMM	2	cora	fwd	src_copy_edge/epw4	256	0.0325	0.0325	0.997
g-SDDMM	3	cora	fwd	src_copy_edge/epw4	256	0.0325	0.0327	0.994
g-SDDMM	2	cora	fwd	src_copy_edge/epw8	256	0.0323	0.0323	1.001
g-SDDMM	3	cora	fwd	src_copy_edge/epw8	256	0.0323	0.0325	0.994
g-SDDMM	2	cora	fwd	src_copy_edge/epw16	256	0.0329	0.0326	1.011
g-SDDMM	3	cora	fwd	src_copy_edge/epw16	256	0.0329	0.0327	1.007
g-SDDMM	2	cora	fwd	src_dot_dst/epw1	32	0.0251	0.0252	0.996
g-SDDMM	3	cora	fwd	src_dot_dst/epw1	32	0.0251	0.0255	0.984
g-SDDMM	2	cora	fwd	src_dot_dst/epw4	32	0.0239	0.0244	0.979
g-SDDMM	3	cora	fwd	src_dot_dst/epw4	32	0.0239	0.0242	0.986
g-SDDMM	2	cora	fwd	src_dot_dst/epw8	32	0.0243	0.0245	0.992
g-SDDMM	3	cora	fwd	src_dot_dst/epw8	32	0.0243	0.0245	0.993
g-SDDMM	2	cora	fwd	src_dot_dst/epw16	32	0.0270	0.0268	1.008
g-SDDMM	3	cora	fwd	src_dot_dst/epw16	32	0.0270	0.0273	0.989
g-SDDMM	2	cora	fwd	src_dot_dst/epw1	64	0.0251	0.0253	0.992
g-SDDMM	3	cora	fwd	src_dot_dst/epw1	64	0.0251	0.0254	0.985
g-SDDMM	2	cora	fwd	src_dot_dst/epw4	64	0.0236	0.0240	0.982
g-SDDMM	3	cora	fwd	src_dot_dst/epw4	64	0.0236	0.0240	0.981
g-SDDMM	2	cora	fwd	src_dot_dst/epw8	64	0.0245	0.0245	1.002
g-SDDMM	3	cora	fwd	src_dot_dst/epw8	64	0.0245	0.0241	1.016
g-SDDMM	2	cora	fwd	src_dot_dst/epw16	64	0.0272	0.0268	1.015
g-SDDMM	3	cora	fwd	src_dot_dst/epw16	64	0.0272	0.0266	1.022
g-SDDMM	2	cora	fwd	src_dot_dst/epw1	128	0.0249	0.0250	0.999
g-SDDMM	3	cora	fwd	src_dot_dst/epw1	128	0.0249	0.0251	0.993
g-SDDMM	2	cora	fwd	src_dot_dst/epw4	128	0.0233	0.0238	0.980
g-SDDMM	3	cora	fwd	src_dot_dst/epw4	128	0.0233	0.0241	0.970
g-SDDMM	2	cora	fwd	src_dot_dst/epw8	128	0.0240	0.0246	0.975

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	cora	fwd	src_dot_dst/epw8	128	0.0240	0.0245	0.977
g-SDDMM	2	cora	fwd	src_dot_dst/epw16	128	0.0273	0.0266	1.025
g-SDDMM	3	cora	fwd	src_dot_dst/epw16	128	0.0273	0.0264	1.031
g-SDDMM	2	cora	fwd	src_dot_dst/epw1	256	0.0260	0.0271	0.961
g-SDDMM	3	cora	fwd	src_dot_dst/epw1	256	0.0260	0.0274	0.950
g-SDDMM	2	cora	fwd	src_dot_dst/epw4	256	0.0246	0.0258	0.951
g-SDDMM	3	cora	fwd	src_dot_dst/epw4	256	0.0246	0.0263	0.935
g-SDDMM	2	cora	fwd	src_dot_dst/epw8	256	0.0250	0.0260	0.964
g-SDDMM	3	cora	fwd	src_dot_dst/epw8	256	0.0250	0.0264	0.947
g-SDDMM	2	cora	fwd	src_dot_dst/epw16	256	0.0283	0.0279	1.011
g-SDDMM	3	cora	fwd	src_dot_dst/epw16	256	0.0283	0.0280	1.010
g-SDDMM	2	cora	fwd	src_mul_dst/epw1	32	0.0248	0.0249	0.995
g-SDDMM	3	cora	fwd	src_mul_dst/epw1	32	0.0248	0.0247	1.003
g-SDDMM	2	cora	fwd	src_mul_dst/epw4	32	0.0233	0.0238	0.982
g-SDDMM	3	cora	fwd	src_mul_dst/epw4	32	0.0233	0.0235	0.994
g-SDDMM	2	cora	fwd	src_mul_dst/epw8	32	0.0234	0.0234	1.001
g-SDDMM	3	cora	fwd	src_mul_dst/epw8	32	0.0234	0.0235	0.996
g-SDDMM	2	cora	fwd	src_mul_dst/epw16	32	0.0235	0.0246	0.953
g-SDDMM	3	cora	fwd	src_mul_dst/epw16	32	0.0235	0.0244	0.962
g-SDDMM	2	cora	fwd	src_mul_dst/epw1	64	0.0245	0.0248	0.990
g-SDDMM	3	cora	fwd	src_mul_dst/epw1	64	0.0245	0.0249	0.986
g-SDDMM	2	cora	fwd	src_mul_dst/epw4	64	0.0228	0.0236	0.968
g-SDDMM	3	cora	fwd	src_mul_dst/epw4	64	0.0228	0.0237	0.963
g-SDDMM	2	cora	fwd	src_mul_dst/epw8	64	0.0226	0.0235	0.963
g-SDDMM	3	cora	fwd	src_mul_dst/epw8	64	0.0226	0.0235	0.962
g-SDDMM	2	cora	fwd	src_mul_dst/epw16	64	0.0232	0.0244	0.951
g-SDDMM	3	cora	fwd	src_mul_dst/epw16	64	0.0232	0.0246	0.942
g-SDDMM	2	cora	fwd	src_mul_dst/epw1	128	0.0246	0.0250	0.984
g-SDDMM	3	cora	fwd	src_mul_dst/epw1	128	0.0246	0.0250	0.984
g-SDDMM	2	cora	fwd	src_mul_dst/epw4	128	0.0233	0.0236	0.985
g-SDDMM	3	cora	fwd	src_mul_dst/epw4	128	0.0233	0.0238	0.979
g-SDDMM	2	cora	fwd	src_mul_dst/epw8	128	0.0232	0.0236	0.981
g-SDDMM	3	cora	fwd	src_mul_dst/epw8	128	0.0232	0.0238	0.975
g-SDDMM	2	cora	fwd	src_mul_dst/epw16	128	0.0245	0.0247	0.991
g-SDDMM	3	cora	fwd	src_mul_dst/epw16	128	0.0245	0.0246	0.998
g-SDDMM	2	cora	fwd	src_mul_dst/epw1	256	0.0259	0.0270	0.960
g-SDDMM	3	cora	fwd	src_mul_dst/epw1	256	0.0259	0.0277	0.935
g-SDDMM	2	cora	fwd	src_mul_dst/epw4	256	0.0253	0.0266	0.949
g-SDDMM	3	cora	fwd	src_mul_dst/epw4	256	0.0253	0.0275	0.919
g-SDDMM	2	cora	fwd	src_mul_dst/epw8	256	0.0254	0.0263	0.968
g-SDDMM	3	cora	fwd	src_mul_dst/epw8	256	0.0254	0.0272	0.935
g-SDDMM	2	cora	fwd	src_mul_dst/epw16	256	0.0265	0.0265	1.002
g-SDDMM	3	cora	fwd	src_mul_dst/epw16	256	0.0265	0.0266	0.998
g-SDDMM	2	cora	fwd	src_mul_edge/epw1	32	0.0247	0.0253	0.975
g-SDDMM	3	cora	fwd	src_mul_edge/epw1	32	0.0247	0.0248	0.995
g-SDDMM	2	cora	fwd	src_mul_edge/epw4	32	0.0238	0.0238	1.002
g-SDDMM	3	cora	fwd	src_mul_edge/epw4	32	0.0238	0.0236	1.009
g-SDDMM	2	cora	fwd	src_mul_edge/epw8	32	0.0234	0.0235	0.994
g-SDDMM	3	cora	fwd	src_mul_edge/epw8	32	0.0234	0.0235	0.995
g-SDDMM	2	cora	fwd	src_mul_edge/epw16	32	0.0238	0.0246	0.965
g-SDDMM	3	cora	fwd	src_mul_edge/epw16	32	0.0238	0.0247	0.963
g-SDDMM	2	cora	fwd	src_mul_edge/epw1	64	0.0242	0.0247	0.981
g-SDDMM	3	cora	fwd	src_mul_edge/epw1	64	0.0242	0.0248	0.978
g-SDDMM	2	cora	fwd	src_mul_edge/epw4	64	0.0226	0.0235	0.961
g-SDDMM	3	cora	fwd	src_mul_edge/epw4	64	0.0226	0.0235	0.961
g-SDDMM	2	cora	fwd	src_mul_edge/epw8	64	0.0230	0.0232	0.992
g-SDDMM	3	cora	fwd	src_mul_edge/epw8	64	0.0230	0.0232	0.995
g-SDDMM	2	cora	fwd	src_mul_edge/epw16	64	0.0235	0.0246	0.954
g-SDDMM	3	cora	fwd	src_mul_edge/epw16	64	0.0235	0.0235	0.999
g-SDDMM	2	cora	fwd	src_mul_edge/epw1	128	0.0251	0.0255	0.985
g-SDDMM	3	cora	fwd	src_mul_edge/epw1	128	0.0251	0.0253	0.992
g-SDDMM	2	cora	fwd	src_mul_edge/epw4	128	0.0239	0.0242	0.986
g-SDDMM	3	cora	fwd	src_mul_edge/epw4	128	0.0239	0.0242	0.986
g-SDDMM	2	cora	fwd	src_mul_edge/epw8	128	0.0241	0.0245	0.984
g-SDDMM	3	cora	fwd	src_mul_edge/epw8	128	0.0241	0.0244	0.987
g-SDDMM	2	cora	fwd	src_mul_edge/epw16	128	0.0252	0.0253	0.997
g-SDDMM	3	cora	fwd	src_mul_edge/epw16	128	0.0252	0.0253	0.999
g-SDDMM	2	cora	fwd	src_mul_edge/epw1	256	0.0274	0.0277	0.989
g-SDDMM	3	cora	fwd	src_mul_edge/epw1	256	0.0274	0.0288	0.948
g-SDDMM	2	cora	fwd	src_mul_edge/epw4	256	0.0266	0.0321	0.829
g-SDDMM	3	cora	fwd	src_mul_edge/epw4	256	0.0266	0.0274	0.968
g-SDDMM	2	cora	fwd	src_mul_edge/epw8	256	0.0265	0.0270	0.982
g-SDDMM	3	cora	fwd	src_mul_edge/epw8	256	0.0265	0.0272	0.977
g-SDDMM	2	cora	fwd	src_mul_edge/epw16	256	0.0273	0.0273	0.999
g-SDDMM	3	cora	fwd	src_mul_edge/epw16	256	0.0273	0.0272	1.001
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw1	32	0.3475	0.4998	0.695
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw1	32	0.3475	0.5085	0.683
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw4	32	0.1355	0.2385	0.568

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw4	32	0.1355	0.2104	0.644
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw8	32	0.1024	0.1942	0.527
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw8	32	0.1024	0.1580	0.648
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw16	32	0.1031	0.1732	0.595
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw16	32	0.1031	0.1370	0.753
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw1	64	0.3690	0.5382	0.686
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw1	64	0.3690	0.5524	0.668
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw4	64	0.1677	0.2546	0.659
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw4	64	0.1677	0.2319	0.723
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw8	64	0.1703	0.2104	0.810
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw8	64	0.1703	0.1816	0.938
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw16	64	0.1741	0.1941	0.897
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw16	64	0.1741	0.1715	1.015
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw1	128	0.4156	0.5750	0.723
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw1	128	0.4156	0.5843	0.711
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw4	128	0.3001	0.3022	0.993
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw4	128	0.3001	0.2946	1.018
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw8	128	0.3046	0.3042	1.001
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw8	128	0.3046	0.3026	1.007
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw16	128	0.3087	0.3102	0.995
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw16	128	0.3087	0.3064	1.008
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw1	256	0.5323	0.6378	0.835
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw1	256	0.5323	0.6467	0.823
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw4	256	0.5582	0.5527	1.010
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw4	256	0.5582	0.5533	1.009
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw8	256	0.5644	0.5604	1.007
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw8	256	0.5644	0.5615	1.005
g-SDDMM	2	ogbn-arxiv	fwd	src_copy_edge/epw16	256	0.5681	0.5677	1.001
g-SDDMM	3	ogbn-arxiv	fwd	src_copy_edge/epw16	256	0.5681	0.5688	0.999
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw1	32	0.3961	0.4603	0.861
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw1	32	0.3961	0.4740	0.836
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw4	32	0.1973	0.2848	0.693
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw4	32	0.1973	0.2845	0.694
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw8	32	0.1637	0.2493	0.656
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw8	32	0.1637	0.2469	0.663
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw16	32	0.1501	0.2352	0.638
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw16	32	0.1501	0.2301	0.653
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw1	64	0.3942	0.4525	0.871
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw1	64	0.3942	0.4601	0.857
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw4	64	0.2069	0.2856	0.724
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw4	64	0.2069	0.2895	0.715
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw8	64	0.1771	0.2543	0.696
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw8	64	0.1771	0.2562	0.691
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw16	64	0.1648	0.2379	0.693
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw16	64	0.1648	0.2398	0.687
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw1	128	0.4259	0.5642	0.755
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw1	128	0.4259	0.5756	0.740
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw4	128	0.2316	0.3503	0.661
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw4	128	0.2316	0.3555	0.651
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw8	128	0.2035	0.3038	0.670
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw8	128	0.2035	0.3083	0.660
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw16	128	0.1932	0.2704	0.714
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw16	128	0.1932	0.2739	0.705
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw1	256	0.4804	0.7251	0.663
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw1	256	0.4804	0.8342	0.576
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw4	256	0.2893	0.4675	0.619
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw4	256	0.2893	0.5044	0.574
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw8	256	0.2673	0.4185	0.639
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw8	256	0.2673	0.4391	0.609
g-SDDMM	2	ogbn-arxiv	fwd	src_dot_dst/epw16	256	0.2626	0.3795	0.692
g-SDDMM	3	ogbn-arxiv	fwd	src_dot_dst/epw16	256	0.2626	0.3946	0.665
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw1	32	0.3924	0.4981	0.788
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw1	32	0.3924	0.5013	0.783
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw4	32	0.1636	0.2719	0.602
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw4	32	0.1636	0.2711	0.603
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw8	32	0.1292	0.2224	0.581
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw8	32	0.1292	0.2193	0.589
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw16	32	0.1189	0.1985	0.599
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw16	32	0.1189	0.1948	0.610
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw1	64	0.4158	0.6512	0.638
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw1	64	0.4158	0.6077	0.684
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw4	64	0.1917	0.3201	0.599
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw4	64	0.1917	0.3092	0.620
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw8	64	0.1780	0.2627	0.678
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw8	64	0.1780	0.2430	0.733
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw16	64	0.1870	0.2309	0.810
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw16	64	0.1870	0.2114	0.885
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw1	128	0.4822	0.7091	0.680

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw1	128	0.4822	0.7173	0.672
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw4	128	0.3632	0.4366	0.832
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw4	128	0.3632	0.4337	0.838
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw8	128	0.3644	0.3954	0.922
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw8	128	0.3644	0.3946	0.923
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw16	128	0.3694	0.3798	0.973
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw16	128	0.3694	0.3811	0.969
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw1	256	0.7723	0.8884	0.869
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw1	256	0.7723	0.9847	0.784
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw4	256	0.7496	0.7657	0.979
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw4	256	0.7496	0.7745	0.968
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw8	256	0.7570	0.7516	1.007
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw8	256	0.7570	0.7544	1.003
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_dst/epw16	256	0.7629	0.7470	1.021
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_dst/epw16	256	0.7629	0.7466	1.022
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw1	32	0.4142	0.5478	0.756
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw1	32	0.4142	0.5541	0.747
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw4	32	0.1621	0.2715	0.597
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw4	32	0.1621	0.2678	0.605
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw8	32	0.1580	0.2308	0.685
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw8	32	0.1580	0.2261	0.699
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw16	32	0.1585	0.2116	0.749
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw16	32	0.1585	0.2090	0.758
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw1	64	0.4205	0.5725	0.734
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw1	64	0.4205	0.5788	0.726
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw4	64	0.2596	0.3076	0.844
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw4	64	0.2596	0.3001	0.865
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw8	64	0.2575	0.2793	0.922
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw8	64	0.2575	0.2693	0.956
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw16	64	0.2596	0.2737	0.948
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw16	64	0.2596	0.2652	0.979
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw1	128	0.5272	0.6948	0.759
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw1	128	0.5272	0.6323	0.834
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw4	128	0.4639	0.4864	0.954
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw4	128	0.4639	0.4832	0.960
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw8	128	0.4686	0.4760	0.984
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw8	128	0.4686	0.4676	1.002
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw16	128	0.4743	0.4749	0.999
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw16	128	0.4743	0.4655	1.019
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw1	256	0.9343	0.9451	0.989
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw1	256	0.9343	0.9868	0.947
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw4	256	0.8809	0.8816	0.999
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw4	256	0.8809	0.8850	0.995
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw8	256	0.8873	0.8854	1.002
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw8	256	0.8873	0.8813	1.007
g-SDDMM	2	ogbn-arxiv	fwd	src_mul_edge/epw16	256	0.8932	0.8932	1.000
g-SDDMM	3	ogbn-arxiv	fwd	src_mul_edge/epw16	256	0.8932	0.8881	1.006
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw1	32	7.7404	11.5918	0.668
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw1	32	7.7404	11.7800	0.657
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw4	32	2.5410	5.1023	0.498
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw4	32	2.5410	4.4553	0.570
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw8	32	1.7967	4.0399	0.445
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw8	32	1.7967	3.2133	0.559
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw16	32	1.8143	3.5048	0.518
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw16	32	1.8143	2.6681	0.680
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw1	64	7.9670	12.0426	0.662
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw1	64	7.9670	12.2615	0.650
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw4	64	3.2126	5.3668	0.599
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw4	64	3.2126	4.8171	0.667
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw8	64	3.2808	4.2616	0.770
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw8	64	3.2808	3.5790	0.917
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw16	64	3.3539	3.7190	0.902
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw16	64	3.3539	3.3418	1.004
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw1	128	9.1000	13.1612	0.691
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw1	128	9.1000	13.2708	0.686
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw4	128	6.1079	6.4401	0.948
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw4	128	6.1079	6.1287	0.997
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw8	128	6.2300	6.1804	1.008
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw8	128	6.2300	6.1464	1.014
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw16	128	6.2649	6.2310	1.005
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw16	128	6.2649	6.2337	1.005
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw1	256	11.4946	15.0436	0.764
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw1	256	11.4946	15.1838	0.757
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw4	256	11.9756	11.6731	1.026
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw4	256	11.9756	11.7245	1.021
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw8	256	12.0085	11.8490	1.013
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw8	256	12.0085	11.9059	1.009
g-SDDMM	2	pokec-regions	fwd	src_copy_edge/epw16	256	11.9400	11.9082	1.003

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	pokec-regions	fwd	src_copy_edge/epw16	256	11.9400	11.9145	1.002
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw1	32	9.9345	11.8038	0.842
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw1	32	9.9345	12.0570	0.824
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw4	32	4.8380	6.2658	0.772
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw4	32	4.8380	6.2396	0.775
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw8	32	4.1529	5.4375	0.764
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw8	32	4.1529	5.3790	0.772
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw16	32	3.8365	5.0634	0.758
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw16	32	3.8365	5.0001	0.767
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw1	64	9.9043	10.3322	0.959
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw1	64	9.9043	10.5788	0.936
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw4	64	5.0516	5.9084	0.855
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw4	64	5.0516	5.9153	0.854
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw8	64	4.3967	5.3832	0.817
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw8	64	4.3967	5.3969	0.815
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw16	64	4.0828	5.1307	0.796
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw16	64	4.0828	5.1447	0.794
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw1	128	10.3687	10.8445	0.956
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw1	128	10.3687	11.2195	0.924
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw4	128	5.6137	6.1508	0.913
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw4	128	5.6137	6.2533	0.898
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw8	128	4.9533	5.5963	0.885
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw8	128	4.9533	5.6844	0.871
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw16	128	4.6656	5.4246	0.860
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw16	128	4.6656	5.4506	0.856
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw1	256	11.6391	14.5499	0.800
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw1	256	11.6391	17.2722	0.674
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw4	256	7.5361	8.6138	0.875
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw4	256	7.5361	9.4568	0.797
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw8	256	7.2924	7.9239	0.920
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw8	256	7.2924	8.2251	0.887
g-SDDMM	2	pokec-regions	fwd	src_dot_dst/epw16	256	7.4335	7.6748	0.969
g-SDDMM	3	pokec-regions	fwd	src_dot_dst/epw16	256	7.4335	7.8189	0.951
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw1	32	9.7150	12.8632	0.755
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw1	32	9.7150	13.0288	0.746
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw4	32	3.8543	5.9963	0.643
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw4	32	3.8543	5.9736	0.645
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw8	32	3.2321	4.8327	0.669
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw8	32	3.2321	4.6993	0.688
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw16	32	3.1200	4.2790	0.729
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw16	32	3.1200	4.1742	0.747
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw1	64	9.9658	15.3134	0.651
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw1	64	9.9658	13.6080	0.732
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw4	64	5.2390	7.1903	0.729
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw4	64	5.2390	6.4882	0.807
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw8	64	4.9492	6.0800	0.814
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw8	64	4.9492	5.5250	0.896
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw16	64	4.8891	5.6553	0.865
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw16	64	4.8891	5.0278	0.972
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw1	128	11.7856	14.5224	0.812
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw1	128	11.7856	14.6895	0.802
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw4	128	9.2311	9.8313	0.939
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw4	128	9.2311	9.7597	0.946
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw8	128	9.1239	9.4354	0.967
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw8	128	9.1239	9.2881	0.982
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw16	128	9.1651	9.2614	0.990
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw16	128	9.1651	9.1043	1.007
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw1	256	19.2811	19.9501	0.966
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw1	256	19.2811	21.6979	0.889
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw4	256	18.0839	18.0879	1.000
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw4	256	18.0839	18.2494	0.991
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw8	256	18.2573	17.9701	1.016
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw8	256	18.2573	17.9770	1.016
g-SDDMM	2	pokec-regions	fwd	src_mul_dst/epw16	256	18.5408	18.1139	1.024
g-SDDMM	3	pokec-regions	fwd	src_mul_dst/epw16	256	18.5408	18.0182	1.029
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw1	32	9.4203	12.7268	0.740
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw1	32	9.4203	12.8827	0.731
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw4	32	3.2789	5.9906	0.547
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw4	32	3.2789	5.9127	0.555
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw8	32	3.1396	4.9799	0.630
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw8	32	3.1396	4.9034	0.640
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw16	32	3.1143	4.5035	0.692
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw16	32	3.1143	4.4899	0.694
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw1	64	9.5403	13.2938	0.718
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw1	64	9.5403	13.4429	0.710
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw4	64	5.5002	6.7814	0.811
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw4	64	5.5002	6.6176	0.831
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw8	64	5.4256	6.1086	0.888

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw8	64	5.4256	5.9052	0.919
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw16	64	5.4731	5.9460	0.920
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw16	64	5.4731	5.7476	0.952
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw1	128	11.9466	16.4310	0.727
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw1	128	11.9466	14.8366	0.805
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw4	128	10.3482	10.9486	0.945
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw4	128	10.3482	10.8688	0.952
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw8	128	10.3855	10.6894	0.972
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw8	128	10.3855	10.5029	0.989
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw16	128	10.4745	10.6072	0.987
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw16	128	10.4745	10.4223	1.005
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw1	256	21.4462	21.8614	0.981
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw1	256	21.4462	22.9830	0.933
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw4	256	20.2232	20.2226	1.000
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw4	256	20.2232	20.4053	0.991
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw8	256	20.3358	20.2462	1.004
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw8	256	20.3358	20.2179	1.006
g-SDDMM	2	pokec-regions	fwd	src_mul_edge/epw16	256	20.3625	20.3152	1.002
g-SDDMM	3	pokec-regions	fwd	src_mul_edge/epw16	256	20.3625	20.2604	1.005
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw1	32	0.0546	0.0646	0.844
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw1	32	0.0546	0.0812	0.672
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw4	32	0.0391	0.0467	0.836
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw4	32	0.0391	0.0592	0.660
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw8	32	0.0363	0.0436	0.832
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw8	32	0.0363	0.0563	0.645
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw16	32	0.0350	0.0425	0.824
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw16	32	0.0350	0.0478	0.733
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw1	64	0.0567	0.0692	0.819
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw1	64	0.0567	0.0704	0.805
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw4	64	0.0396	0.0476	0.832
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw4	64	0.0396	0.0446	0.887
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw8	64	0.0371	0.0439	0.845
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw8	64	0.0371	0.0405	0.916
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw16	64	0.0368	0.0425	0.866
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw16	64	0.0368	0.0391	0.943
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw1	128	0.0621	0.0736	0.844
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw1	128	0.0621	0.0748	0.831
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw4	128	0.0478	0.0517	0.924
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw4	128	0.0478	0.0487	0.982
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw8	128	0.0469	0.0480	0.978
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw8	128	0.0469	0.0469	1.001
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw16	128	0.0470	0.0480	0.979
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw16	128	0.0470	0.0466	1.007
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw1	256	0.0693	0.0775	0.894
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw1	256	0.0693	0.0784	0.883
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw4	256	0.0697	0.0701	0.994
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw4	256	0.0697	0.0706	0.987
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw8	256	0.0717	0.0711	1.008
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw8	256	0.0717	0.0713	1.005
g-SDDMM	2	pubmed	fwd	src_copy_edge/epw16	256	0.0732	0.0713	1.026
g-SDDMM	3	pubmed	fwd	src_copy_edge/epw16	256	0.0732	0.0715	1.023
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw1	32	0.0529	0.0549	0.964
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw1	32	0.0529	0.0566	0.935
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw4	32	0.0362	0.0443	0.816
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw4	32	0.0362	0.0447	0.808
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw8	32	0.0342	0.0425	0.806
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw8	32	0.0342	0.0426	0.804
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw16	32	0.0358	0.0425	0.843
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw16	32	0.0358	0.0423	0.846
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw1	64	0.0520	0.0539	0.965
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw1	64	0.0520	0.0549	0.947
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw4	64	0.0361	0.0430	0.840
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw4	64	0.0361	0.0430	0.839
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw8	64	0.0342	0.0421	0.811
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw8	64	0.0342	0.0421	0.811
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw16	64	0.0356	0.0424	0.838
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw16	64	0.0356	0.0423	0.840
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw1	128	0.0532	0.0556	0.957
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw1	128	0.0532	0.0569	0.935
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw4	128	0.0380	0.0442	0.860
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw4	128	0.0380	0.0445	0.854
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw8	128	0.0360	0.0428	0.841
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw8	128	0.0360	0.0433	0.832
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw16	128	0.0369	0.0431	0.857
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw16	128	0.0369	0.0432	0.854
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw1	256	0.0557	0.0633	0.880
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw1	256	0.0557	0.0683	0.816
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw4	256	0.0400	0.0496	0.807

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw4	256	0.0400	0.0516	0.774
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw8	256	0.0384	0.0500	0.767
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw8	256	0.0384	0.0514	0.748
g-SDDMM	2	pubmed	fwd	src_dot_dst/epw16	256	0.0398	0.0554	0.719
g-SDDMM	3	pubmed	fwd	src_dot_dst/epw16	256	0.0398	0.0512	0.778
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw1	32	0.0509	0.0549	0.926
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw1	32	0.0509	0.0554	0.918
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw4	32	0.0330	0.0421	0.785
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw4	32	0.0330	0.0424	0.779
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw8	32	0.0303	0.0391	0.774
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw8	32	0.0303	0.0391	0.776
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw16	32	0.0299	0.0382	0.782
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw16	32	0.0299	0.0389	0.767
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw1	64	0.0545	0.0651	0.836
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw1	64	0.0545	0.0616	0.884
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw4	64	0.0343	0.0444	0.772
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw4	64	0.0343	0.0435	0.789
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw8	64	0.0313	0.0404	0.775
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw8	64	0.0313	0.0397	0.789
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw16	64	0.0309	0.0388	0.797
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw16	64	0.0309	0.0386	0.801
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw1	128	0.0588	0.0646	0.910
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw1	128	0.0588	0.0648	0.907
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw4	128	0.0399	0.0485	0.822
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw4	128	0.0399	0.0463	0.860
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw8	128	0.0401	0.0429	0.934
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw8	128	0.0401	0.0428	0.935
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw16	128	0.0395	0.0420	0.941
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw16	128	0.0395	0.0419	0.944
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw1	256	0.0647	0.0745	0.868
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw1	256	0.0647	0.0828	0.781
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw4	256	0.0649	0.0626	1.036
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw4	256	0.0649	0.0620	1.046
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw8	256	0.0665	0.0641	1.038
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw8	256	0.0665	0.0637	1.043
g-SDDMM	2	pubmed	fwd	src_mul_dst/epw16	256	0.0692	0.0649	1.067
g-SDDMM	3	pubmed	fwd	src_mul_dst/epw16	256	0.0692	0.0643	1.076
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw1	32	0.0618	0.0563	1.097
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw1	32	0.0618	0.0573	1.079
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw4	32	0.0370	0.0429	0.863
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw4	32	0.0370	0.0427	0.867
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw8	32	0.0302	0.0402	0.752
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw8	32	0.0302	0.0406	0.745
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw16	32	0.0292	0.0395	0.738
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw16	32	0.0292	0.0395	0.739
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw1	64	0.0526	0.0618	0.851
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw1	64	0.0526	0.0624	0.843
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw4	64	0.0344	0.0433	0.794
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw4	64	0.0344	0.0430	0.799
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw8	64	0.0325	0.0404	0.804
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw8	64	0.0325	0.0402	0.809
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw16	64	0.0318	0.0401	0.795
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw16	64	0.0318	0.0395	0.806
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw1	128	0.0646	0.0813	0.795
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw1	128	0.0646	0.0753	0.858
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw4	128	0.0610	0.0624	0.979
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw4	128	0.0610	0.0625	0.976
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw8	128	0.0607	0.0623	0.974
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw8	128	0.0607	0.0613	0.990
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw16	128	0.0600	0.0610	0.984
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw16	128	0.0600	0.0630	0.953
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw1	256	0.1026	0.1021	1.005
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw1	256	0.1026	0.1048	0.979
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw4	256	0.0985	0.0985	1.000
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw4	256	0.0985	0.0994	0.991
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw8	256	0.0994	0.0992	1.002
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw8	256	0.0994	0.0988	1.006
g-SDDMM	2	pubmed	fwd	src_mul_edge/epw16	256	0.1020	0.1011	1.009
g-SDDMM	3	pubmed	fwd	src_mul_edge/epw16	256	0.1020	0.1000	1.020
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw1	32	0.2761	0.3931	0.702
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw1	32	0.2761	0.4044	0.683
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw4	32	0.1271	0.1966	0.646
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw4	32	0.1271	0.1718	0.740
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw8	32	0.0980	0.1611	0.608
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw8	32	0.0980	0.1308	0.749
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw16	32	0.0853	0.1441	0.592
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw16	32	0.0853	0.1140	0.748
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw1	64	0.2835	0.4018	0.706

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw1	64	0.2835	0.4114	0.689
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw4	64	0.1336	0.2007	0.665
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw4	64	0.1336	0.1822	0.733
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw8	64	0.1275	0.1650	0.773
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw8	64	0.1275	0.1368	0.932
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw16	64	0.1275	0.1466	0.869
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw16	64	0.1275	0.1299	0.982
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw1	128	0.3181	0.4296	0.740
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw1	128	0.3181	0.4331	0.734
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw4	128	0.2129	0.2274	0.936
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw4	128	0.2129	0.2079	1.024
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw8	128	0.2107	0.2120	0.994
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw8	128	0.2107	0.2089	1.009
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw16	128	0.2124	0.2130	0.997
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw16	128	0.2124	0.2106	1.008
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw1	256	0.3732	0.4376	0.853
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw1	256	0.3732	0.4409	0.847
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw4	256	0.3833	0.3765	1.018
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw4	256	0.3833	0.3784	1.013
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw8	256	0.3841	0.3779	1.016
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw8	256	0.3841	0.3813	1.007
g-SDDMM	2	tolokers-2	fwd	src_copy_edge/epw16	256	0.3813	0.3809	1.001
g-SDDMM	3	tolokers-2	fwd	src_copy_edge/epw16	256	0.3813	0.3826	0.997
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw1	32	0.3136	0.3663	0.856
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw1	32	0.3136	0.3745	0.837
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw4	32	0.1499	0.2249	0.666
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw4	32	0.1499	0.2261	0.663
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw8	32	0.1218	0.1983	0.614
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw8	32	0.1218	0.1982	0.614
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw16	32	0.1108	0.1884	0.588
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw16	32	0.1108	0.1863	0.595
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw1	64	0.3121	0.3518	0.887
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw1	64	0.3121	0.3540	0.882
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw4	64	0.1540	0.2139	0.720
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw4	64	0.1540	0.2154	0.715
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw8	64	0.1267	0.1972	0.642
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw8	64	0.1267	0.1979	0.640
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw16	64	0.1148	0.1902	0.604
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw16	64	0.1148	0.1902	0.604
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw1	128	0.3151	0.4210	0.748
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw1	128	0.3151	0.4273	0.737
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw4	128	0.1631	0.2485	0.656
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw4	128	0.1631	0.2535	0.643
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw8	128	0.1359	0.2120	0.641
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw8	128	0.1359	0.2137	0.636
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw16	128	0.1246	0.1951	0.638
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw16	128	0.1246	0.1965	0.634
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw1	256	0.3281	0.5435	0.604
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw1	256	0.3281	0.6115	0.537
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw4	256	0.1773	0.3525	0.503
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw4	256	0.1773	0.3901	0.455
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw8	256	0.1517	0.2979	0.509
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw8	256	0.1517	0.3211	0.473
g-SDDMM	2	tolokers-2	fwd	src_dot_dst/epw16	256	0.1432	0.2737	0.523
g-SDDMM	3	tolokers-2	fwd	src_dot_dst/epw16	256	0.1432	0.2827	0.506
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw1	32	0.3049	0.3681	0.828
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw1	32	0.3049	0.3734	0.816
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw4	32	0.1253	0.2121	0.591
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw4	32	0.1253	0.2124	0.590
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw8	32	0.0939	0.1769	0.531
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw8	32	0.0939	0.1725	0.544
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw16	32	0.0804	0.1598	0.503
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw16	32	0.0804	0.1572	0.511
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw1	64	0.3121	0.4468	0.699
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw1	64	0.3121	0.4052	0.770
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw4	64	0.1309	0.2288	0.572
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw4	64	0.1309	0.2197	0.596
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw8	64	0.1221	0.1830	0.667
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw8	64	0.1221	0.1780	0.686
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw16	64	0.1216	0.1642	0.741
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw16	64	0.1216	0.1619	0.751
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw1	128	0.3494	0.4880	0.716
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw1	128	0.3494	0.4950	0.706
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw4	128	0.2072	0.2849	0.727
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw4	128	0.2072	0.2858	0.725
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw8	128	0.2042	0.2345	0.870
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw8	128	0.2042	0.2351	0.869
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw16	128	0.2054	0.2128	0.965

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw16	128	0.2054	0.2157	0.952
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw1	256	0.4134	0.5912	0.699
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw1	256	0.4134	0.6660	0.621
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw4	256	0.3882	0.3967	0.978
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw4	256	0.3882	0.4220	0.920
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw8	256	0.3875	0.3813	1.016
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw8	256	0.3875	0.3793	1.022
g-SDDMM	2	tolokers-2	fwd	src_mul_dst/epw16	256	0.3788	0.3794	0.998
g-SDDMM	3	tolokers-2	fwd	src_mul_dst/epw16	256	0.3788	0.3757	1.008
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw1	32	0.3267	0.4317	0.757
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw1	32	0.3267	0.4366	0.748
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw4	32	0.1371	0.2179	0.629
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw4	32	0.1371	0.2135	0.642
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw8	32	0.1251	0.1853	0.675
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw8	32	0.1251	0.1811	0.691
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw16	32	0.1255	0.1715	0.731
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw16	32	0.1255	0.1686	0.744
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw1	64	0.3351	0.4533	0.739
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw1	64	0.3351	0.4589	0.730
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw4	64	0.2050	0.2373	0.864
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw4	64	0.2050	0.2336	0.877
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw8	64	0.2042	0.2176	0.939
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw8	64	0.2042	0.2120	0.963
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw16	64	0.2029	0.2103	0.965
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw16	64	0.2029	0.2077	0.977
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw1	128	0.4088	0.5502	0.743
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw1	128	0.4088	0.4934	0.829
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw4	128	0.3688	0.3803	0.970
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw4	128	0.3688	0.3746	0.985
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw8	128	0.3650	0.3711	0.984
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw8	128	0.3650	0.3626	1.007
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw16	128	0.3676	0.3696	0.995
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw16	128	0.3676	0.3605	1.019
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw1	256	0.7341	0.7410	0.991
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw1	256	0.7341	0.7682	0.956
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw4	256	0.6888	0.6909	0.997
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw4	256	0.6888	0.6920	0.995
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw8	256	0.6923	0.6960	0.995
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw8	256	0.6923	0.6907	1.002
g-SDDMM	2	tolokers-2	fwd	src_mul_edge/epw16	256	0.6973	0.6992	0.997
g-SDDMM	3	tolokers-2	fwd	src_mul_edge/epw16	256	0.6973	0.6959	1.002
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw1	32	3.3079	4.8672	0.680
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw1	32	3.3079	4.9594	0.667
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw4	32	1.3799	2.2130	0.624
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw4	32	1.3799	1.9318	0.714
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw8	32	1.0457	1.7394	0.601
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw8	32	1.0457	1.3756	0.760
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw16	32	0.9170	1.5127	0.606
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw16	32	0.9170	1.1593	0.791
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw1	64	3.5561	5.4394	0.654
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw1	64	3.5561	5.4977	0.647
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw4	64	1.6564	2.3833	0.695
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw4	64	1.6564	2.1623	0.766
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw8	64	1.5630	1.9412	0.805
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw8	64	1.5630	1.6695	0.936
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw16	64	1.6277	1.7136	0.950
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw16	64	1.6277	1.5640	1.041
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw1	128	4.2764	5.8998	0.725
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw1	128	4.2764	5.9977	0.713
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw4	128	3.2498	3.2562	0.998
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw4	128	3.2498	3.2530	0.999
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw8	128	3.2646	3.2628	1.001
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw8	128	3.2646	3.2506	1.004
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw16	128	3.3142	3.3000	1.004
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw16	128	3.3142	3.2792	1.011
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw1	256	6.9433	7.4772	0.929
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw1	256	6.9433	7.4852	0.928
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw4	256	6.8489	6.7956	1.008
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw4	256	6.8489	6.7981	1.007
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw8	256	6.8759	6.8430	1.005
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw8	256	6.8759	6.8311	1.007
g-SDDMM	2	twitch-views	fwd	src_copy_edge/epw16	256	6.9460	6.9035	1.006
g-SDDMM	3	twitch-views	fwd	src_copy_edge/epw16	256	6.9460	6.8894	1.008
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw1	32	3.8795	4.6103	0.841
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw1	32	3.8795	4.7162	0.823
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw4	32	1.7935	2.7878	0.643
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw4	32	1.7935	2.8078	0.639
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw8	32	1.4340	2.3731	0.604

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw8	32	1.4340	2.3603	0.608
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw16	32	1.2677	2.1908	0.579
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw16	32	1.2677	2.1583	0.587
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw1	64	3.8474	4.8118	0.800
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw1	64	3.8474	4.8588	0.792
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw4	64	1.8649	2.9300	0.636
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw4	64	1.8649	2.9649	0.629
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw8	64	1.5330	2.5088	0.611
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw8	64	1.5330	2.5287	0.606
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw16	64	1.3743	2.2694	0.606
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw16	64	1.3743	2.2853	0.601
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw1	128	4.0812	6.5531	0.623
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw1	128	4.0812	6.6492	0.614
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw4	128	2.0915	4.0180	0.521
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw4	128	2.0915	4.0596	0.515
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw8	128	1.7809	3.2629	0.546
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw8	128	1.7809	3.2928	0.541
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw16	128	1.6361	2.7187	0.602
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw16	128	1.6361	2.7654	0.592
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw1	256	4.5582	8.3227	0.548
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw1	256	4.5582	9.3608	0.487
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw4	256	2.5370	5.4882	0.462
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw4	256	2.5370	6.0153	0.422
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw8	256	2.2328	4.5202	0.494
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw8	256	2.2328	4.9209	0.454
g-SDDMM	2	twitch-views	fwd	src_dot_dst/epw16	256	2.1100	3.9106	0.540
g-SDDMM	3	twitch-views	fwd	src_dot_dst/epw16	256	2.1100	4.1341	0.510
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw1	32	3.7953	4.8616	0.781
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw1	32	3.7953	4.9092	0.773
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw4	32	1.4385	2.6246	0.548
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw4	32	1.4385	2.6532	0.542
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw8	32	1.0699	2.1041	0.508
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw8	32	1.0699	2.0988	0.510
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw16	32	0.9318	1.8520	0.503
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw16	32	0.9318	1.8331	0.508
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw1	64	4.0060	6.5341	0.613
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw1	64	4.0060	5.9320	0.675
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw4	64	1.6799	3.2943	0.510
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw4	64	1.6799	3.1048	0.541
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw8	64	1.5543	2.5952	0.599
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw8	64	1.5543	2.4486	0.635
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw16	64	1.6187	2.1635	0.748
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw16	64	1.6187	2.0516	0.789
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw1	128	4.6402	7.8609	0.590
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw1	128	4.6402	7.9220	0.586
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw4	128	3.2470	4.7604	0.682
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw4	128	3.2470	4.7376	0.685
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw8	128	3.2554	3.9063	0.833
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw8	128	3.2554	3.9137	0.832
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw16	128	3.2972	3.5524	0.928
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw16	128	3.2972	3.5744	0.922
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw1	256	7.1351	9.4498	0.755
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw1	256	7.1351	10.5267	0.678
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw4	256	6.8599	7.3878	0.929
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw4	256	6.8599	7.5312	0.911
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw8	256	6.9246	7.1320	0.971
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw8	256	6.9246	7.2279	0.958
g-SDDMM	2	twitch-views	fwd	src_mul_dst/epw16	256	6.9816	7.0081	0.996
g-SDDMM	3	twitch-views	fwd	src_mul_dst/epw16	256	6.9816	7.0485	0.990
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw1	32	4.0895	5.4643	0.748
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw1	32	4.0895	5.5354	0.739
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw4	32	1.6586	2.6065	0.636
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw4	32	1.6586	2.5621	0.647
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw8	32	1.5532	2.1657	0.717
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw8	32	1.5532	2.1182	0.733
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw16	32	1.5262	1.9658	0.776
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw16	32	1.5262	1.9304	0.791
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw1	64	4.2196	5.7507	0.734
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw1	64	4.2196	5.8271	0.724
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw4	64	2.7867	3.1511	0.884
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw4	64	2.7867	3.0872	0.903
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw8	64	2.7132	2.8877	0.940
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw8	64	2.7132	2.8211	0.962
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw16	64	2.6982	2.8355	0.952
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw16	64	2.6982	2.7559	0.979
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw1	128	6.0079	7.1708	0.838
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw1	128	6.0079	6.6412	0.905
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw4	128	5.3744	5.5710	0.965

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw4	128	5.3744	5.5020	0.977
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw8	128	5.2779	5.4278	0.972
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw8	128	5.2779	5.2295	1.009
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw16	128	5.3039	5.3575	0.990
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw16	128	5.3039	5.1801	1.024
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw1	256	11.3835	11.4317	0.996
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw1	256	11.3835	11.6895	0.974
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw4	256	10.5387	10.5665	0.997
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw4	256	10.5387	10.6191	0.992
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw8	256	10.6075	10.6195	0.999
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw8	256	10.6075	10.5695	1.004
g-SDDMM	2	twitch-views	fwd	src_mul_edge/epw16	256	10.6879	10.7005	0.999
g-SDDMM	3	twitch-views	fwd	src_mul_edge/epw16	256	10.6879	10.6804	1.001
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw1	32	3.8236	6.1114	0.626
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw1	32	3.8236	6.1834	0.618
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw4	32	1.3338	3.7680	0.354
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw4	32	1.3338	3.5879	0.372
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw8	32	1.0220	3.2690	0.313
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw8	32	1.0220	3.0237	0.338
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw16	32	1.0152	2.9343	0.346
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw16	32	1.0152	2.7039	0.375
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw1	64	3.9512	8.2052	0.482
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw1	64	3.9512	8.2711	0.478
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw4	64	1.7659	5.6323	0.314
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw4	64	1.7659	5.4910	0.322
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw8	64	1.7748	5.0023	0.355
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw8	64	1.7748	4.8315	0.367
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw16	64	1.8008	4.5031	0.400
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw16	64	1.8008	4.3650	0.413
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw1	128	4.5464	12.8328	0.354
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw1	128	4.5464	12.8865	0.353
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw4	128	3.3199	9.9022	0.335
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw4	128	3.3199	9.8462	0.337
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw8	128	3.3469	9.0851	0.368
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw8	128	3.3469	9.1502	0.366
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw16	128	3.3554	8.3933	0.400
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw16	128	3.3554	8.4804	0.396
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw1	256	6.2058	13.7921	0.450
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw1	256	6.2058	13.8018	0.450
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw4	256	6.4628	12.1391	0.532
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw4	256	6.4628	12.1469	0.532
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw8	256	6.4718	11.5420	0.561
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw8	256	6.4718	11.6168	0.557
g-SDDMM	2	web-fraud	fwd	src_copy_edge/epw16	256	6.4331	10.9543	0.587
g-SDDMM	3	web-fraud	fwd	src_copy_edge/epw16	256	6.4331	10.9996	0.585
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw1	32	4.6244	5.7578	0.803
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw1	32	4.6244	5.8661	0.788
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw4	32	2.1161	3.4338	0.616
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw4	32	2.1161	3.4377	0.616
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw8	32	1.7462	3.0262	0.577
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw8	32	1.7462	3.0118	0.580
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw16	32	1.6049	2.8104	0.571
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw16	32	1.6049	2.7760	0.578
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw1	64	4.6047	5.7345	0.803
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw1	64	4.6047	5.8092	0.793
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw4	64	2.2025	3.9813	0.553
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw4	64	2.2025	3.9958	0.551
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw8	64	1.8433	3.6395	0.506
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw8	64	1.8433	3.6484	0.505
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw16	64	1.6883	3.3633	0.502
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw16	64	1.6883	3.3976	0.497
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw1	128	4.7601	7.9578	0.598
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw1	128	4.7601	8.0298	0.593
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw4	128	2.3894	5.9543	0.401
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw4	128	2.3894	5.9926	0.399
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw8	128	2.0325	5.4362	0.374
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw8	128	2.0325	5.4560	0.373
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw16	128	1.8810	4.8887	0.385
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw16	128	1.8810	4.9481	0.380
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw1	256	5.1779	9.6622	0.536
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw1	256	5.1779	10.6405	0.487
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw4	256	2.8735	7.4358	0.386
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw4	256	2.8735	7.7717	0.370
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw8	256	2.5849	6.9165	0.374
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw8	256	2.5849	7.1573	0.361
g-SDDMM	2	web-fraud	fwd	src_dot_dst/epw16	256	2.5042	6.4753	0.387
g-SDDMM	3	web-fraud	fwd	src_dot_dst/epw16	256	2.5042	6.6560	0.376
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw1	32	4.5071	6.1093	0.738

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family	depth	graph	pass	op	d	depth 0 (ms)	pipelined (ms)	ratio
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw1	32	4.5071	6.1672	0.731
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw4	32	1.7140	3.2699	0.524
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw4	32	1.7140	3.2945	0.520
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw8	32	1.3582	2.7723	0.490
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw8	32	1.3582	2.7465	0.495
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw16	32	1.2597	2.4940	0.505
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw16	32	1.2597	2.4742	0.509
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw1	64	4.6318	7.6740	0.604
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw1	64	4.6318	6.9794	0.664
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw4	64	2.1214	4.3552	0.487
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw4	64	2.1214	4.1587	0.510
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw8	64	2.0141	3.7790	0.533
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw8	64	2.0141	3.5830	0.562
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw16	64	2.0551	3.4012	0.604
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw16	64	2.0551	3.2284	0.637
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw1	128	5.2956	9.2176	0.575
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw1	128	5.2956	9.2752	0.571
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw4	128	3.8361	6.7093	0.572
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw4	128	3.8361	6.6899	0.573
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw8	128	3.8326	6.1588	0.622
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw8	128	3.8326	6.1917	0.619
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw16	128	3.8748	5.7802	0.670
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw16	128	3.8748	5.8293	0.665
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw1	256	7.7167	10.8317	0.712
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw1	256	7.7167	11.8152	0.653
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw4	256	7.6587	9.4523	0.810
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw4	256	7.6587	9.5494	0.802
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw8	256	7.7635	9.2304	0.841
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw8	256	7.7635	9.3117	0.834
g-SDDMM	2	web-fraud	fwd	src_mul_dst/epw16	256	7.8867	9.0003	0.876
g-SDDMM	3	web-fraud	fwd	src_mul_dst/epw16	256	7.8867	9.0724	0.869
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw1	32	4.6559	6.5220	0.714
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw1	32	4.6559	6.5874	0.707
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw4	32	1.6981	4.1731	0.407
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw4	32	1.6981	4.1544	0.409
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw8	32	1.6247	3.6844	0.441
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw8	32	1.6247	3.6550	0.445
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw16	32	1.6002	3.3836	0.473
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw16	32	1.6002	3.3572	0.477
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw1	64	4.7261	8.6223	0.548
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw1	64	4.7261	8.6727	0.545
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw4	64	2.8595	6.2093	0.461
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw4	64	2.8595	6.1860	0.462
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw8	64	2.8071	5.6723	0.495
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw8	64	2.8071	5.6704	0.495
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw16	64	2.8103	5.2814	0.532
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw16	64	2.8103	5.2559	0.535
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw1	128	6.0955	14.1995	0.429
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw1	128	6.0955	13.6853	0.445
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw4	128	5.3672	11.7373	0.457
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw4	128	5.3672	11.5024	0.467
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw8	128	5.3594	10.8922	0.492
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw8	128	5.3594	10.7214	0.500
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw16	128	5.4065	10.1761	0.531
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw16	128	5.4065	9.9939	0.541
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw1	256	11.0426	16.6568	0.663
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw1	256	11.0426	17.1224	0.645
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw4	256	10.3644	15.2390	0.680
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw4	256	10.3644	15.4476	0.671
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw8	256	10.4732	14.6707	0.714
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw8	256	10.4732	14.9158	0.702
g-SDDMM	2	web-fraud	fwd	src_mul_edge/epw16	256	10.5290	14.1415	0.745
g-SDDMM	3	web-fraud	fwd	src_mul_edge/epw16	256	10.5290	14.4511	0.729

K.6 SIMULATION SWEEP

Table 11: Numerical simulation sweep. Each group fixes the graph, operator, pass, feature dimension d and degree quantile q. Modes (a)–(e) are defined in Appendix J. Slice is the edge-slice size (zero means no edge slicing); T is makespan; T^* is the reported lower bound; U is mean SM-slot utilization; $R = T/T^*$; CP denotes the critical-path bound. T, T^* and drain-tail duration are in simulated cycles; t_{pred} is in ms. Entries are taken from the supplied sweep, with U converted to percent.

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
artnet-exp, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	900	823.97	91.55%	1.0923	slot	108	0.242765
(b)	0	1142	922.54	80.78%	1.2379	slot	109	0.298304
(c)	97	1064	926.1	87.04%	1.1489	slot	109	0.280403
(d)	0	999	922.54	92.35%	1.0829	slot	109	0.265485
(e)	97	1003	926.1	92.33%	1.083	slot	109	0.266403
artnet-exp, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	900	823.97	91.55%	1.0923	slot	108	0.220496
(b)	0	1280	1141.47	89.18%	1.1214	slot	73	0.298304
(c)	99	1245	1152.17	92.54%	1.0806	slot	74	0.291137
(d)	0	1177	1141.47	96.98%	1.0311	slot	73	0.277214
(e)	99	1188	1152.17	96.98%	1.0311	slot	74	0.279466
artnet-exp, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	846	765.63	90.50%	1.105	slot	108	0.32505
(b)	0	1087	863.61	79.45%	1.2587	slot	110	0.407774
(c)	97	1007	865.69	85.97%	1.1632	slot	110	0.380313
(d)	0	945	863.61	91.39%	1.0942	slot	110	0.359032
(e)	97	947	865.69	91.41%	1.0939	slot	110	0.359718
artnet-exp, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	846	765.63	90.50%	1.105	slot	108	0.293392
(b)	0	1220	1080.16	88.54%	1.1295	slot	71	0.407774
(c)	99	1180	1086.6	92.08%	1.086	slot	72	0.39554
(d)	0	1117	1080.16	96.70%	1.0341	slot	71	0.376273
(e)	99	1123	1086.6	96.76%	1.0335	slot	71	0.378108
artnet-exp, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	792	707.29	89.30%	1.1198	slot	109	1.522068
(b)	0	1031	804.69	78.05%	1.2812	slot	110	1.896109
(c)	97	949	805.28	84.86%	1.1785	slot	110	1.767777
(d)	0	889	804.69	90.52%	1.1048	slot	109	1.673875
(e)	97	890	805.28	90.48%	1.1052	slot	109	1.67544
artnet-exp, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	792	707.29	89.30%	1.1198	slot	109	1.385177
(b)	0	1159	1018.84	87.91%	1.1376	slot	69	1.896109
(c)	99	1113	1021.02	91.74%	1.0901	slot	69	1.832069
(d)	0	1056	1018.84	96.48%	1.0365	slot	69	1.752714
(e)	99	1058	1021.02	96.51%	1.0362	slot	69	1.755498
artnet-exp, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	792	707.29	89.30%	1.1198	slot	109	2.663715
(b)	0	1031	804.69	78.05%	1.2812	slot	110	3.384966
(c)	97	949	805.28	84.86%	1.1785	slot	110	3.137508
(d)	0	889	804.69	90.52%	1.1048	slot	109	2.956441
(e)	97	890	805.28	90.48%	1.1052	slot	109	2.959458
artnet-exp, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	792	707.29	89.30%	1.1198	slot	109	2.399754
(b)	0	1159	1018.84	87.91%	1.1376	slot	69	3.384966
(c)	99	1113	1021.02	91.74%	1.0901	slot	69	3.261479
(d)	0	1056	1018.84	96.48%	1.0365	slot	69	3.108463
(e)	99	1058	1021.02	96.51%	1.0362	slot	69	3.113832
artnet-exp, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	954	882.31	92.49%	1.0813	slot	108	0.314703
(b)	0	1197	981.47	81.99%	1.2196	slot	108	0.384763
(c)	97	1121	986.51	88.00%	1.1363	slot	108	0.362851
(d)	0	1053	981.47	93.21%	1.0729	slot	108	0.343246
(e)	97	1058	986.51	93.24%	1.0725	slot	108	0.344688
artnet-exp, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	954	882.31	92.49%	1.0813	slot	108	0.285351
(b)	0	1340	1202.78	89.76%	1.1141	slot	75	0.384763
(c)	99	1311	1217.75	92.89%	1.0766	slot	76	0.377294
(d)	0	1238	1202.78	97.16%	1.0293	slot	75	0.358494
(e)	99	1253	1217.75	97.19%	1.0289	slot	76	0.362357
artnet-exp, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	900	823.97	91.55%	1.0923	slot	108	0.420706
(b)	0	1142	922.54	80.78%	1.2379	slot	109	0.524884
(c)	97	1064	926.1	87.04%	1.1489	slot	109	0.491306
(d)	0	999	922.54	92.35%	1.0829	slot	109	0.463324
(e)	97	1003	926.1	92.33%	1.083	slot	109	0.465046

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
artnet-exp, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	900	823.97	91.55%	1.0923	slot	108	0.378935
(b)	0	1280	1141.47	89.18%	1.1214	slot	73	0.524884
(c)	99	1245	1152.17	92.54%	1.0806	slot	74	0.511441
(d)	0	1177	1141.47	96.98%	1.0311	slot	73	0.485324
(e)	99	1188	1152.17	96.98%	1.0311	slot	74	0.489549
artnet-exp, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	2010	1990.75	99.04%	1.0097	slot	106	0.418475
(b)	0	2279	2101.06	92.19%	1.0847	slot	105	0.442912
(c)	97	2243	2134.28	95.15%	1.0509	slot	106	0.439641
(d)	0	2120	2101.06	99.11%	1.009	slot	106	0.428468
(e)	97	2153	2134.28	99.13%	1.0088	slot	107	0.431465
artnet-exp, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	2010	1990.75	99.04%	1.0097	slot	106	0.402868
(b)	0	2492	2367.72	95.01%	1.0525	slot	106	0.442912
(c)	99	2563	2463.67	96.12%	1.0403	slot	111	0.44881
(d)	0	2387	2367.72	99.19%	1.0081	slot	106	0.434188
(e)	99	2483	2463.67	99.22%	1.0078	slot	110	0.442164
artnet-exp, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	2186	2165.77	99.07%	1.0093	slot	114	0.63342
(b)	0	2460	2277.84	92.59%	1.08	slot	114	0.683151
(c)	97	2430	2315.51	95.29%	1.0494	slot	116	0.677706
(d)	0	2298	2277.84	99.12%	1.0089	slot	114	0.653748
(e)	97	2335	2315.51	99.17%	1.0084	slot	115	0.660463
artnet-exp, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	2186	2165.77	99.07%	1.0093	slot	114	0.601259
(b)	0	2677	2551.66	95.32%	1.0491	slot	114	0.683151
(c)	99	2764	2660.39	96.25%	1.0389	slot	120	0.697661
(d)	0	2572	2551.66	99.21%	1.008	slot	114	0.665638
(e)	99	2681	2660.39	99.23%	1.0077	slot	120	0.683818
artnet-exp, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	1113	1057.33	95.00%	1.0527	slot	100	0.149799
(b)	0	1361	1158.24	85.10%	1.1751	slot	101	0.171018
(c)	97	1292	1167.73	90.38%	1.1064	slot	102	0.165114
(d)	0	1214	1158.24	95.41%	1.0481	slot	101	0.15844
(e)	97	1224	1167.73	95.40%	1.0482	slot	101	0.159296
artnet-exp, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	1113	1057.33	95.00%	1.0527	slot	100	0.139725
(b)	0	1522	1386.72	91.11%	1.0976	slot	80	0.171018
(c)	99	1509	1414.47	93.74%	1.0668	slot	81	0.170023
(d)	0	1419	1386.72	97.73%	1.0233	slot	80	0.163137
(e)	99	1447	1414.47	97.75%	1.023	slot	82	0.165279
artnet-exp, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	1166	1115.67	95.68%	1.0451	slot	97	0.248375
(b)	0	1415	1217.17	86.02%	1.1625	slot	98	0.289814
(c)	97	1348	1228.14	91.11%	1.0976	slot	98	0.278664
(d)	0	1268	1217.17	95.99%	1.0418	slot	98	0.26535
(e)	97	1279	1228.14	96.02%	1.0414	slot	98	0.267181
artnet-exp, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	1166	1115.67	95.68%	1.0451	slot	97	0.227891
(b)	0	1582	1448.03	91.53%	1.0925	slot	81	0.289814
(c)	99	1574	1480.05	94.03%	1.0635	slot	82	0.288623
(d)	0	1479	1448.03	97.91%	1.0214	slot	81	0.274482
(e)	99	1511	1480.05	97.95%	1.0209	slot	83	0.279245
avazu-ctr, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	42034	42034	61.12%	1.0	CP	16704	5.663761
(b)	0	61839	42034	51.77%	1.4712	CP	1555	8.315271
(c)	6323	35098	32019.59	91.23%	1.0961	slot	1556	4.735164
(d)	0	42034	42034	76.17%	1.0	CP	11115	5.663761
(e)	6323	32459	32019.59	98.65%	1.0137	slot	1556	4.381852
avazu-ctr, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	42034	42034	61.12%	1.0	CP	16704	6.340139
(b)	0	55204	42034	70.02%	1.3133	CP	1571	8.315271
(c)	12951	40159	38658.0	96.26%	1.0388	slot	1572	6.058942
(d)	0	42034	42034	91.95%	1.0	CP	4476	6.340139
(e)	12951	39097	38658.0	98.88%	1.0114	slot	1572	5.899671
avazu-ctr, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	42033	42033	60.91%	1.0	CP	16779	8.246827
(b)	0	61753	42033	51.70%	1.4692	CP	1553	12.099609
(c)	6323	35009	31928.98	91.20%	1.0965	slot	1553	6.874517
(d)	0	42033	42033	75.96%	1.0	CP	11198	8.246827
(e)	6323	32370	31928.98	98.64%	1.0138	slot	1553	6.358924
avazu-ctr, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	42033	42033	60.91%	1.0	CP	16779	9.234891
(b)	0	55121	42033	69.95%	1.3114	CP	1569	12.099609
(c)	12951	40065	38562.98	96.25%	1.0389	slot	1570	8.804133
(d)	0	42033	42033	91.73%	1.0	CP	4565	9.234891
(e)	12951	39004	38562.98	98.87%	1.0114	slot	1570	8.5719

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
avazu-ctr, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	42032	42032	60.70%	1.0	CP	16854	39.338322
(b)	0	61666	42032	51.63%	1.4671	CP	1549	57.582058
(c)	6323	34919	31838.38	91.18%	1.0968	slot	1549	32.728987
(d)	0	42032	42032	75.75%	1.0	CP	11286	39.338322
(e)	6323	32282	31838.38	98.63%	1.0139	slot	1550	30.27871
avazu-ctr, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	42032	42032	60.70%	1.0	CP	16854	44.040851
(b)	0	55039	42032	69.89%	1.3095	CP	1566	57.582058
(c)	12951	39971	38467.96	96.24%	1.0391	slot	1566	41.895204
(d)	0	42032	42032	91.52%	1.0	CP	4652	44.040851
(e)	12951	38912	38467.96	98.86%	1.0115	slot	1566	40.79271
avazu-ctr, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	42032	42032	60.70%	1.0	CP	16854	74.094917
(b)	0	61666	42032	51.63%	1.4671	CP	1549	108.578339
(c)	6323	34919	31838.38	91.18%	1.0968	slot	1549	61.602273
(d)	0	42032	42032	75.75%	1.0	CP	11286	74.094917
(e)	6323	32282	31838.38	98.63%	1.0139	slot	1550	56.970879
avazu-ctr, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	42032	42032	60.70%	1.0	CP	16854	82.983409
(b)	0	55039	42032	69.89%	1.3095	CP	1566	108.578339
(c)	12951	39971	38467.96	96.24%	1.0391	slot	1566	78.927812
(d)	0	42032	42032	91.52%	1.0	CP	4652	82.983409
(e)	12951	38912	38467.96	98.86%	1.0115	slot	1566	76.843931
avazu-ctr, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	42035	42035	61.33%	1.0	CP	16624	6.73997
(b)	0	61926	42035	51.84%	1.4732	CP	1562	9.910565
(c)	6323	35188	32110.2	91.25%	1.0959	slot	1563	5.648568
(d)	0	42035	42035	76.38%	1.0	CP	11034	6.73997
(e)	6323	32548	32110.2	98.65%	1.0136	slot	1562	5.227756
avazu-ctr, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	42035	42035	61.33%	1.0	CP	16624	7.54456
(b)	0	55287	42035	70.08%	1.3153	CP	1573	9.910565
(c)	12951	40254	38753.02	96.27%	1.0387	slot	1574	7.226582
(d)	0	42035	42035	92.17%	1.0	CP	4388	7.54456
(e)	12951	39190	38753.02	98.88%	1.0113	slot	1574	7.036616
avazu-ctr, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	42034	42034	61.12%	1.0	CP	16704	10.239048
(b)	0	61839	42034	51.77%	1.4712	CP	1555	15.047667
(c)	6323	35098	32019.59	91.23%	1.0961	slot	1556	8.555
(d)	0	42034	42034	76.17%	1.0	CP	11115	10.239048
(e)	6323	32459	32019.59	98.65%	1.0137	slot	1556	7.914255
avazu-ctr, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	42034	42034	61.12%	1.0	CP	16704	11.465687
(b)	0	55204	42034	70.02%	1.3133	CP	1571	15.047667
(c)	12951	40159	38658.0	96.26%	1.0388	slot	1572	10.955724
(d)	0	42034	42034	91.95%	1.0	CP	4476	11.465687
(e)	12951	39097	38658.0	98.88%	1.0114	slot	1572	10.666881
avazu-ctr, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	42054	42054	65.29%	1.0	CP	15025	2.148331
(b)	0	63560	42054	53.18%	1.5114	CP	1608	3.126341
(c)	6323	36879	33831.72	91.74%	1.0901	slot	1610	1.912992
(d)	0	42054	42054	80.38%	1.0	CP	9438	2.148331
(e)	6323	34226	33831.72	98.85%	1.0117	slot	1610	1.792344
avazu-ctr, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	42054	42054	65.29%	1.0	CP	15025	2.373832
(b)	0	56856	42054	71.24%	1.352	CP	1608	3.126341
(c)	12951	42036	40558.37	96.48%	1.0364	slot	1612	2.372917
(d)	0	42054	42054	96.32%	1.0	CP	2720	2.373832
(e)	12951	40953	40558.37	99.04%	1.0097	slot	1613	2.317859
avazu-ctr, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	42057	42057	65.91%	1.0	CP	14772	3.987885
(b)	0	63818	42057	53.38%	1.5174	CP	1616	5.92883
(c)	6323	37146	34103.54	91.81%	1.0892	slot	1618	3.549854
(d)	0	42057	42057	81.01%	1.0	CP	9184	3.987885
(e)	6323	34491	34103.54	98.88%	1.0114	slot	1618	3.313045
avazu-ctr, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	42057	42057	65.91%	1.0	CP	14772	4.428935
(b)	0	57104	42057	71.42%	1.3578	CP	1616	5.92883
(c)	12951	42319	40843.42	96.51%	1.0361	slot	1621	4.455051
(d)	0	42057	42057	96.97%	1.0	CP	2454	4.428935
(e)	12951	41230	40843.42	99.06%	1.0095	slot	1620	4.346499
avazu-ctr, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	42038	42038	61.95%	1.0	CP	16372	1.997363
(b)	0	62184	42038	52.06%	1.4792	CP	1571	2.928414
(c)	6323	35455	32382.02	91.33%	1.0949	slot	1572	1.693128
(d)	0	42038	42038	77.01%	1.0	CP	10780	1.997363
(e)	6323	32813	32382.02	98.69%	1.0133	slot	1571	1.571028

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
avazu-ctr, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	42038	42038	61.95%	1.0	CP	16372	2.229967
(b)	0	55535	42038	70.27%	1.3211	CP	1580	2.928414
(c)	12951	40536	39038.07	96.30%	1.0384	slot	1582	2.152241
(d)	0	42038	42038	92.83%	1.0	CP	4121	2.229967
(e)	12951	39469	39038.07	98.91%	1.011	slot	1582	2.097025
avazu-ctr, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	42039	42039	62.16%	1.0	CP	16288	3.865196
(b)	0	62269	42039	52.13%	1.4812	CP	1574	5.699061
(c)	6323	35543	32472.62	91.36%	1.0946	slot	1574	3.276329
(d)	0	42039	42039	77.22%	1.0	CP	10698	3.865196
(e)	6323	32901	32472.62	98.70%	1.0132	slot	1575	3.03683
avazu-ctr, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	42039	42039	62.16%	1.0	CP	16288	4.32099
(b)	0	55617	42039	70.33%	1.323	CP	1581	5.699061
(c)	12951	40629	39133.09	96.32%	1.0382	slot	1581	4.177885
(d)	0	42039	42039	93.04%	1.0	CP	4034	4.32099
(e)	12951	39561	39133.09	98.92%	1.0109	slot	1581	4.069491
citeseer, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	107	102	20.64%	1.049	CP	80	0.041711
(b)	0	134	102	17.32%	1.3137	CP	9	0.043099
(c)	10	56	23.61	42.16%	2.3717	slot	9	0.039091
(d)	0	102	102	22.75%	1.0	CP	71	0.041455
(e)	10	38	23.61	62.14%	1.6094	slot	8	0.038166
citeseer, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	107	102	20.64%	1.049	CP	80	0.042014
(b)	0	127	102	19.80%	1.2451	CP	4	0.043099
(c)	10	49	26.16	53.38%	1.8732	slot	5	0.03887
(d)	0	102	102	24.66%	1.0	CP	72	0.041743
(e)	10	34	26.16	76.94%	1.2998	slot	5	0.038057
citeseer, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	105	101	17.37%	1.0396	CP	80	0.042395
(b)	0	128	101	15.09%	1.2673	CP	7	0.04409
(c)	10	49	19.54	39.89%	2.5071	slot	7	0.038268
(d)	0	101	101	19.12%	1.0	CP	73	0.0421
(e)	10	34	19.54	57.48%	1.7396	slot	8	0.037163
citeseer, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	105	101	17.37%	1.0396	CP	80	0.042775
(b)	0	122	101	17.30%	1.2079	CP	4	0.04409
(c)	10	43	21.7	50.46%	1.9819	slot	4	0.037982
(d)	0	101	101	20.89%	1.0	CP	75	0.042466
(e)	10	29	21.7	74.82%	1.3366	slot	4	0.036899
citeseer, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	103	100	13.97%	1.03	CP	80	0.311055
(b)	0	123	100	12.53%	1.23	CP	6	0.316587
(c)	10	43	15.48	35.99%	2.7782	slot	6	0.29446
(d)	0	100	100	15.42%	1.0	CP	75	0.310225
(e)	10	29	15.48	53.37%	1.8737	slot	6	0.290588
citeseer, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	103	100	13.97%	1.03	CP	80	0.312516
(b)	0	117	100	14.58%	1.17	CP	4	0.316587
(c)	10	37	17.23	46.58%	2.1468	slot	4	0.293325
(d)	0	100	100	17.06%	1.0	CP	77	0.311644
(e)	10	24	17.23	71.81%	1.3925	slot	3	0.289545
citeseer, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	103	100	13.97%	1.03	CP	80	0.330978
(b)	0	123	100	12.53%	1.23	CP	6	0.342114
(c)	10	43	15.48	35.99%	2.7782	slot	6	0.29757
(d)	0	100	100	15.42%	1.0	CP	75	0.329307
(e)	10	29	15.48	53.37%	1.8737	slot	6	0.289775
citeseer, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	103	100	13.97%	1.03	CP	80	0.333919
(b)	0	117	100	14.58%	1.17	CP	4	0.342114
(c)	10	37	17.23	46.58%	2.1468	slot	4	0.295286
(d)	0	100	100	17.06%	1.0	CP	77	0.332163
(e)	10	24	17.23	71.81%	1.3925	slot	3	0.287677
citeseer, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	109	103	23.80%	1.0583	CP	79	0.047831
(b)	0	139	103	19.50%	1.3495	CP	9	0.050081
(c)	10	62	27.68	44.64%	2.24	slot	9	0.044305
(d)	0	103	103	26.31%	1.0	CP	68	0.047381
(e)	10	43	27.68	64.37%	1.5535	slot	9	0.04288
citeseer, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	109	103	23.80%	1.0583	CP	79	0.048264
(b)	0	132	103	22.12%	1.2816	CP	5	0.050081
(c)	10	55	30.62	55.67%	1.7962	slot	5	0.043999
(d)	0	103	103	28.34%	1.0	CP	69	0.04779
(e)	10	39	30.62	78.51%	1.2737	slot	5	0.042735

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
citeseer, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	107	102	20.64%	1.049	CP	80	0.044123
(b)	0	134	102	17.32%	1.3137	CP	9	0.046862
(c)	10	56	23.61	42.16%	2.3717	slot	9	0.038949
(d)	0	102	102	22.75%	1.0	CP	71	0.043616
(e)	10	38	23.61	62.14%	1.6094	slot	8	0.037123
citeseer, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	107	102	20.64%	1.049	CP	80	0.044721
(b)	0	127	102	19.80%	1.2451	CP	4	0.046862
(c)	10	49	26.16	53.38%	1.8732	slot	5	0.038513
(d)	0	102	102	24.66%	1.0	CP	72	0.044186
(e)	10	34	26.16	76.94%	1.2998	slot	5	0.036907
citeseer, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	147	122	67.42%	1.2049	CP	43	0.242297
(b)	0	235	122	43.02%	1.9262	CP	11	0.246139
(c)	10	177	104.95	59.30%	1.6864	slot	11	0.243606
(d)	0	122	122	82.87%	1.0	CP	12	0.241205
(e)	10	135	104.95	77.74%	1.2863	slot	23	0.241773
citeseer, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	147	122	67.42%	1.2049	CP	43	0.242523
(b)	0	227	122	46.72%	1.8607	CP	5	0.246139
(c)	10	169	115.39	68.28%	1.4645	slot	5	0.243517
(d)	0	131	122	80.95%	1.0738	CP	20	0.2418
(e)	10	134	115.39	86.12%	1.1612	slot	6	0.241935
citeseer, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	153	125	72.32%	1.224	CP	37	0.250643
(b)	0	250	125	45.11%	2.0	CP	11	0.259505
(c)	10	195	117.16	60.08%	1.6645	slot	11	0.25448
(d)	0	134	125	84.17%	1.072	CP	12	0.248907
(e)	10	150	117.16	78.10%	1.2803	slot	26	0.250369
citeseer, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	153	125	72.32%	1.224	CP	37	0.251105
(b)	0	242	125	48.84%	1.936	CP	5	0.259505
(c)	10	187	128.78	68.87%	1.4521	slot	5	0.254314
(d)	0	145	125	81.51%	1.16	CP	22	0.25035
(e)	10	149	128.78	86.43%	1.157	slot	6	0.250727
citeseer, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	115	106	32.60%	1.0849	CP	74	0.057627
(b)	0	155	106	25.02%	1.4623	CP	10	0.058691
(c)	10	81	39.88	49.23%	2.0311	slot	10	0.056723
(d)	0	106	106	36.59%	1.0	CP	59	0.057388
(e)	10	57	39.88	69.97%	1.4293	slot	10	0.056085
citeseer, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	115	106	32.60%	1.0849	CP	74	0.057794
(b)	0	147	106	28.11%	1.3868	CP	5	0.058691
(c)	10	73	44.01	60.28%	1.6589	slot	5	0.056616
(d)	0	106	106	38.99%	1.0	CP	59	0.057541
(e)	10	54	44.01	81.49%	1.2271	slot	6	0.056083
citeseer, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	117	107	35.34%	1.0935	CP	72	0.060585
(b)	0	160	107	26.68%	1.4953	CP	10	0.062884
(c)	10	87	43.95	50.51%	1.9796	slot	10	0.058981
(d)	0	107	107	39.89%	1.0	CP	56	0.06005
(e)	10	62	43.95	70.88%	1.4108	slot	11	0.057644
citeseer, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	117	107	35.34%	1.0935	CP	72	0.060914
(b)	0	152	107	29.85%	1.4206	CP	5	0.062884
(c)	10	79	48.47	61.35%	1.63	slot	5	0.058775
(d)	0	107	107	42.41%	1.0	CP	56	0.060351
(e)	10	59	48.47	82.15%	1.2173	slot	6	0.057649
city-reviews, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	7684	7440	41.83%	1.0328	CP	4569	0.806091
(b)	0	10239	7440	37.01%	1.3762	CP	295	1.062082
(c)	572	4365	3792.97	86.90%	1.1508	slot	296	0.473553
(d)	0	7440	7440	50.94%	1.0	CP	3786	0.781644
(e)	572	3953	3792.97	95.95%	1.0422	slot	296	0.432274
city-reviews, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	7684	7440	41.83%	1.0328	CP	4569	0.864845
(b)	0	9513	7440	47.86%	1.2786	CP	199	1.062082
(c)	1321	5577	4566.09	81.87%	1.2214	slot	200	0.637629
(d)	0	7604	7440	59.88%	1.022	CP	3199	0.856218
(e)	1321	4616	4566.09	98.92%	1.0109	slot	200	0.533997
city-reviews, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	7666	7439	39.68%	1.0305	CP	4711	1.153686
(b)	0	10066	7439	35.92%	1.3531	CP	285	1.504021
(c)	572	4187	3617.85	86.41%	1.1573	slot	285	0.645846
(d)	0	7439	7439	48.61%	1.0	CP	3950	1.12055
(e)	572	3777	3617.85	95.79%	1.044	slot	286	0.585997

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
city-reviews, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	7666	7439	39.68%	1.0305	CP	4711	1.239894
(b)	0	9346	7439	46.78%	1.2564	CP	190	1.504021
(c)	1321	5390	4380.88	81.28%	1.2303	slot	190	0.882065
(d)	0	7602	7439	57.51%	1.0219	CP	3369	1.229832
(e)	1321	4430	4380.88	98.89%	1.0112	slot	190	0.731135
city-reviews, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	7648	7438	37.53%	1.0282	CP	4856	5.321088
(b)	0	9894	7438	34.79%	1.3302	CP	275	6.800758
(c)	572	4011	3442.73	85.83%	1.1651	slot	275	2.925023
(d)	0	7438	7438	46.27%	1.0	CP	4114	5.182739
(e)	572	3600	3442.73	95.63%	1.0457	slot	275	2.654255
city-reviews, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	7648	7438	37.53%	1.0282	CP	4856	5.713564
(b)	0	9179	7438	45.66%	1.2341	CP	179	6.800758
(c)	1321	5203	4195.67	80.64%	1.2401	slot	180	3.977321
(d)	0	7599	7438	55.16%	1.0216	CP	3538	5.678769
(e)	1321	4244	4195.67	98.86%	1.0115	slot	180	3.296316
city-reviews, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	7648	7438	37.53%	1.0282	CP	4856	9.935232
(b)	0	9894	7438	34.79%	1.3302	CP	275	12.772571
(c)	572	4011	3442.73	85.83%	1.1651	slot	275	5.340665
(d)	0	7438	7438	46.27%	1.0	CP	4114	9.669942
(e)	572	3600	3442.73	95.63%	1.0457	slot	275	4.821454
city-reviews, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	7648	7438	37.53%	1.0282	CP	4856	10.687825
(b)	0	9179	7438	45.66%	1.2341	CP	179	12.772571
(c)	1321	5203	4195.67	80.64%	1.2401	slot	180	7.358496
(d)	0	7599	7438	55.16%	1.0216	CP	3538	10.621102
(e)	1321	4244	4195.67	98.86%	1.0115	slot	180	6.052636
city-reviews, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	7702	7441	43.97%	1.0351	CP	4427	1.014501
(b)	0	10412	7441	38.07%	1.3993	CP	306	1.357507
(c)	572	4542	3968.09	87.36%	1.1446	slot	306	0.614538
(d)	0	7441	7441	53.27%	1.0	CP	3622	0.981466
(e)	572	4129	3968.09	96.10%	1.0406	slot	306	0.562264
city-reviews, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	7702	7441	43.97%	1.0351	CP	4427	1.08811
(b)	0	9681	7441	48.90%	1.301	CP	209	1.357507
(c)	1321	5765	4751.3	82.42%	1.2134	slot	211	0.824431
(d)	0	7610	7441	62.21%	1.0227	CP	3032	1.075586
(e)	1321	4803	4751.3	98.92%	1.0109	slot	211	0.693476
city-reviews, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	7684	7440	41.83%	1.0328	CP	4569	1.465003
(b)	0	10239	7440	37.01%	1.3762	CP	295	1.941067
(c)	572	4365	3792.97	86.90%	1.1508	slot	296	0.846584
(d)	0	7440	7440	50.94%	1.0	CP	3786	1.419539
(e)	572	3953	3792.97	95.95%	1.0422	slot	296	0.769818
city-reviews, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	7684	7440	41.83%	1.0328	CP	4569	1.574268
(b)	0	9513	7440	47.86%	1.2786	CP	199	1.941067
(c)	1321	5577	4566.09	81.87%	1.2214	slot	200	1.151716
(d)	0	7604	7440	59.88%	1.022	CP	3199	1.558224
(e)	1321	4616	4566.09	98.92%	1.0109	slot	200	0.958991
city-reviews, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	8024	7460	82.99%	1.0756	CP	1651	0.642635
(b)	0	13683	7460	53.12%	1.8342	CP	480	0.929504
(c)	572	7898	7295.4	92.37%	1.0826	slot	482	0.636248
(d)	0	7460	7460	97.44%	1.0	CP	490	0.614045
(e)	572	7470	7295.4	97.66%	1.0239	slot	482	0.614552
city-reviews, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	8024	7460	82.99%	1.0756	CP	1651	0.669341
(b)	0	12840	8170.37	63.63%	1.5715	slot	377	0.929504
(c)	1321	9314	8270.26	88.79%	1.1262	slot	388	0.739027
(d)	0	8233	8170.37	99.24%	1.0077	slot	377	0.680631
(e)	1321	8333	8270.26	99.25%	1.0076	slot	388	0.686033
city-reviews, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	8171	7463	87.82%	1.0949	CP	1307	1.087516
(b)	0	14199	7790.77	54.87%	1.8225	slot	506	1.715217
(c)	572	8428	7820.76	92.80%	1.0776	slot	509	1.114278
(d)	0	7967	7790.77	97.79%	1.0226	slot	504	1.066273
(e)	572	7997	7820.76	97.80%	1.0225	slot	509	1.069397
city-reviews, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	8171	7463	87.82%	1.0949	CP	1307	1.142373
(b)	0	13339	8712.96	65.32%	1.5309	slot	406	1.715217
(c)	1321	9876	8825.88	89.37%	1.119	slot	416	1.331362
(d)	0	8778	8712.96	99.26%	1.0075	slot	406	1.209655
(e)	1321	8891	8825.88	99.27%	1.0074	slot	416	1.222181

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
city-reviews, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	7755	7444	50.33%	1.0418	CP	3995	0.359761
(b)	0	10928	7444	41.05%	1.468	CP	335	0.484633
(c)	572	5073	4493.45	88.58%	1.129	slot	336	0.254213
(d)	0	7444	7444	60.26%	1.0	CP	3129	0.347522
(e)	572	4657	4493.45	96.49%	1.0364	slot	336	0.237842
city-reviews, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	7755	7444	50.33%	1.0418	CP	3995	0.382154
(b)	0	10181	7444	51.83%	1.3677	CP	236	0.484633
(c)	1321	6326	5306.92	83.89%	1.192	slot	240	0.321791
(d)	0	7623	7444	69.22%	1.024	CP	2526	0.376578
(e)	1321	5361	5306.92	98.99%	1.0102	slot	240	0.281027
city-reviews, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	7772	7445	52.44%	1.0439	CP	3850	0.659528
(b)	0	11100	7445	41.98%	1.4909	CP	344	0.918677
(c)	572	5250	4668.58	88.93%	1.1245	slot	345	0.463142
(d)	0	7445	7445	62.59%	1.0	CP	2964	0.634065
(e)	572	4832	4668.58	96.62%	1.035	slot	345	0.430593
city-reviews, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	7772	7445	52.44%	1.0439	CP	3850	0.703571
(b)	0	10347	7445	52.74%	1.3898	CP	245	0.918677
(c)	1321	6512	5492.13	84.34%	1.1857	slot	249	0.598316
(d)	0	7626	7445	71.56%	1.0243	CP	2357	0.691375
(e)	1321	5547	5492.13	99.01%	1.01	slot	249	0.517704
city-roads-L, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	826	816.94	98.90%	1.0111	slot	47	0.276916
(b)	0	869	856.69	98.58%	1.0144	slot	41	0.289446
(c)	5	874	865.47	99.02%	1.0099	slot	42	0.290903
(d)	0	860	856.69	99.62%	1.0039	slot	41	0.286824
(e)	5	869	865.47	99.59%	1.0041	slot	43	0.289446
city-roads-L, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	826	816.94	98.90%	1.0111	slot	47	0.241887
(b)	0	1017	1005.9	98.91%	1.011	slot	41	0.289446
(c)	5	1061	1051.97	99.15%	1.0086	slot	45	0.300402
(d)	0	1008	1005.9	99.79%	1.0021	slot	41	0.287205
(e)	5	1054	1051.97	99.81%	1.0019	slot	45	0.298659
city-roads-L, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	661	652.29	98.68%	1.0134	slot	39	0.359766
(b)	0	698	686.38	98.33%	1.0169	slot	33	0.377965
(c)	5	700	692.19	98.88%	1.0113	slot	34	0.378948
(d)	0	689	686.38	99.62%	1.0038	slot	33	0.373538
(e)	5	695	692.19	99.60%	1.0041	slot	34	0.376489
city-roads-L, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	661	652.29	98.68%	1.0134	slot	39	0.311059
(b)	0	821	810.71	98.75%	1.0127	slot	33	0.377965
(c)	5	849	841.39	99.10%	1.009	slot	36	0.389673
(d)	0	813	810.71	99.72%	1.0028	slot	33	0.374619
(e)	5	843	841.39	99.81%	1.0019	slot	36	0.387164
city-roads-L, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	490	487.64	99.52%	1.0048	slot	25	1.379315
(b)	0	522	516.08	98.87%	1.0115	slot	25	1.45094
(c)	5	525	518.95	98.85%	1.0117	slot	25	1.457654
(d)	0	518	516.08	99.63%	1.0037	slot	25	1.441986
(e)	5	521	518.95	99.61%	1.0039	slot	25	1.448701
city-roads-L, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	490	487.64	99.52%	1.0048	slot	25	1.20745
(b)	0	619	615.52	99.44%	1.0057	slot	24	1.45094
(c)	5	635	630.82	99.34%	1.0066	slot	26	1.48114
(d)	0	617	615.52	99.76%	1.0024	slot	24	1.447164
(e)	5	632	630.82	99.81%	1.0019	slot	26	1.475477
city-roads-L, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	490	487.64	99.52%	1.0048	slot	25	2.514966
(b)	0	522	516.08	98.87%	1.0115	slot	25	2.661339
(c)	5	525	518.95	98.85%	1.0117	slot	25	2.675061
(d)	0	518	516.08	99.63%	1.0037	slot	25	2.643042
(e)	5	521	518.95	99.61%	1.0039	slot	25	2.656765
city-roads-L, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	490	487.64	99.52%	1.0048	slot	25	2.163738
(b)	0	619	615.52	99.44%	1.0057	slot	24	2.661339
(c)	5	635	630.82	99.34%	1.0066	slot	26	2.723057
(d)	0	617	615.52	99.76%	1.0024	slot	24	2.653624
(e)	5	632	630.82	99.81%	1.0019	slot	26	2.711484
city-roads-L, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	992	981.58	98.95%	1.0106	slot	56	0.418014
(b)	0	1041	1027.01	98.66%	1.0136	slot	50	0.436703
(c)	0	1041	1027.01	98.66%	1.0136	slot	50	0.436703
(d)	0	1031	1027.01	99.61%	1.0039	slot	50	0.432889
(e)	0	1031	1027.01	99.61%	1.0039	slot	50	0.432889

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
city-roads-L, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	992	981.58	98.95%	1.0106	slot	56	0.364364
(b)	0	1213	1201.08	99.02%	1.0099	slot	50	0.436703
(c)	0	1213	1201.08	99.02%	1.0099	slot	50	0.436703
(d)	0	1204	1201.08	99.76%	1.0024	slot	50	0.433757
(e)	0	1204	1201.08	99.76%	1.0024	slot	50	0.433757
city-roads-L, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	826	816.94	98.90%	1.0111	slot	47	0.51498
(b)	0	869	856.69	98.58%	1.0144	slot	41	0.540057
(c)	5	874	865.47	99.02%	1.0099	slot	42	0.542973
(d)	0	860	856.69	99.62%	1.0039	slot	41	0.534808
(e)	5	869	865.47	99.59%	1.0041	slot	43	0.540057
city-roads-L, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	826	816.94	98.90%	1.0111	slot	47	0.444878
(b)	0	1017	1005.9	98.91%	1.011	slot	41	0.540057
(c)	5	1061	1051.97	99.15%	1.0086	slot	45	0.561983
(d)	0	1008	1005.9	99.79%	1.0021	slot	41	0.535572
(e)	5	1054	1051.97	99.81%	1.0019	slot	45	0.558495
city-roads-L, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	4120	4109.92	99.76%	1.0025	slot	203	0.643999
(b)	0	4293	4263.21	99.31%	1.007	slot	205	0.661136
(c)	0	4293	4263.21	99.31%	1.007	slot	205	0.661136
(d)	0	4275	4263.21	99.72%	1.0028	slot	205	0.659353
(e)	0	4275	4263.21	99.72%	1.0028	slot	205	0.659353
city-roads-L, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	4120	4109.92	99.76%	1.0025	slot	203	0.590188
(b)	0	4945	4909.54	99.28%	1.0072	slot	212	0.661136
(c)	0	4945	4909.54	99.28%	1.0072	slot	212	0.661136
(d)	0	4921	4909.54	99.77%	1.0023	slot	204	0.659072
(e)	0	4921	4909.54	99.77%	1.0023	slot	204	0.659072
city-roads-L, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	4615	4603.87	99.76%	1.0024	slot	227	1.149408
(b)	0	4806	4774.19	99.34%	1.0067	slot	229	1.187184
(c)	0	4806	4774.19	99.34%	1.0067	slot	229	1.187184
(d)	0	4787	4774.19	99.73%	1.0027	slot	229	1.183426
(e)	0	4787	4774.19	99.73%	1.0027	slot	229	1.183426
city-roads-L, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	4615	4603.87	99.76%	1.0024	slot	227	1.02905
(b)	0	5536	5495.09	99.26%	1.0074	slot	238	1.187184
(c)	0	5536	5495.09	99.26%	1.0074	slot	238	1.187184
(d)	0	5508	5495.09	99.77%	1.0023	slot	228	1.182376
(e)	0	5508	5495.09	99.77%	1.0023	slot	228	1.182376
city-roads-L, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	1487	1475.53	99.23%	1.0078	slot	80	0.209647
(b)	0	1555	1537.97	98.90%	1.0111	slot	74	0.216738
(c)	0	1555	1537.97	98.90%	1.0111	slot	74	0.216738
(d)	0	1543	1537.97	99.67%	1.0033	slot	74	0.215487
(e)	0	1543	1537.97	99.67%	1.0033	slot	74	0.215487
city-roads-L, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	1487	1475.53	99.23%	1.0078	slot	80	0.18839
(b)	0	1802	1786.64	99.15%	1.0086	slot	74	0.216738
(c)	0	1802	1786.64	99.15%	1.0086	slot	74	0.216738
(d)	0	1791	1786.64	99.76%	1.0024	slot	74	0.215748
(e)	0	1791	1786.64	99.76%	1.0024	slot	74	0.215748
city-roads-L, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	1652	1640.18	99.28%	1.0072	slot	89	0.378065
(b)	0	1726	1708.29	98.97%	1.0104	slot	82	0.392566
(c)	0	1726	1708.29	98.97%	1.0104	slot	82	0.392566
(d)	0	1714	1708.29	99.67%	1.0033	slot	83	0.390215
(e)	0	1714	1708.29	99.67%	1.0033	slot	83	0.390215
city-roads-L, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	1652	1640.18	99.28%	1.0072	slot	89	0.333993
(b)	0	1998	1981.83	99.19%	1.0082	slot	82	0.392566
(c)	0	1998	1981.83	99.19%	1.0082	slot	82	0.392566
(d)	0	1986	1981.83	99.79%	1.0021	slot	81	0.390535
(e)	0	1986	1981.83	99.79%	1.0021	slot	81	0.390535
city-roads-M, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	355	351.61	99.04%	1.0096	slot	18	0.134436
(b)	0	395	389.8	98.68%	1.0133	slot	19	0.145503
(c)	0	395	389.8	98.68%	1.0133	slot	19	0.145503
(d)	0	393	389.8	99.19%	1.0082	slot	18	0.144949
(e)	0	393	389.8	99.19%	1.0082	slot	18	0.144949
city-roads-M, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	355	351.61	99.04%	1.0096	slot	18	0.134436
(b)	0	395	389.8	98.68%	1.0133	slot	19	0.145503
(c)	0	395	389.8	98.68%	1.0133	slot	19	0.145503
(d)	0	393	389.8	99.19%	1.0082	slot	18	0.144949
(e)	0	393	389.8	99.19%	1.0082	slot	18	0.144949

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
city-roads-M, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	289	285.55	98.81%	1.0121	slot	16	0.167935
(b)	0	323	318.3	98.54%	1.0148	slot	15	0.183615
(c)	0	323	318.3	98.54%	1.0148	slot	15	0.183615
(d)	0	321	318.3	99.16%	1.0085	slot	15	0.182692
(e)	0	321	318.3	99.16%	1.0085	slot	15	0.182692
city-roads-M, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	289	285.55	98.81%	1.0121	slot	16	0.167935
(b)	0	323	318.3	98.54%	1.0148	slot	15	0.183615
(c)	0	323	318.3	98.54%	1.0148	slot	15	0.183615
(d)	0	321	318.3	99.16%	1.0085	slot	15	0.182692
(e)	0	321	318.3	99.16%	1.0085	slot	15	0.182692
city-roads-M, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	222	219.49	98.87%	1.0114	slot	12	0.746356
(b)	0	250	246.9	98.76%	1.0126	slot	11	0.804852
(c)	3	256	252.37	98.58%	1.0144	slot	12	0.817387
(d)	0	249	246.9	99.16%	1.0085	slot	11	0.802763
(e)	3	255	252.37	98.97%	1.0104	slot	12	0.815298
city-roads-M, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	222	219.49	98.87%	1.0114	slot	12	0.746356
(b)	0	250	246.9	98.76%	1.0126	slot	11	0.804852
(c)	3	256	252.37	98.58%	1.0144	slot	12	0.817387
(d)	0	249	246.9	99.16%	1.0085	slot	11	0.802763
(e)	3	255	252.37	98.97%	1.0104	slot	12	0.815298
city-roads-M, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	222	219.49	98.87%	1.0114	slot	12	1.214061
(b)	0	250	246.9	98.76%	1.0126	slot	11	1.332674
(c)	3	256	252.37	98.58%	1.0144	slot	12	1.358091
(d)	0	249	246.9	99.16%	1.0085	slot	11	1.328438
(e)	3	255	252.37	98.97%	1.0104	slot	12	1.353855
city-roads-M, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	222	219.49	98.87%	1.0114	slot	12	1.214061
(b)	0	250	246.9	98.76%	1.0126	slot	11	1.332674
(c)	3	256	252.37	98.58%	1.0144	slot	12	1.358091
(d)	0	249	246.9	99.16%	1.0085	slot	11	1.328438
(e)	3	255	252.37	98.97%	1.0104	slot	12	1.353855
city-roads-M, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	422	417.66	98.97%	1.0104	slot	22	0.191844
(b)	0	467	461.3	98.78%	1.0124	slot	22	0.208073
(c)	0	467	461.3	98.78%	1.0124	slot	22	0.208073
(d)	0	465	461.3	99.20%	1.008	slot	21	0.207351
(e)	0	465	461.3	99.20%	1.008	slot	21	0.207351
city-roads-M, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	422	417.66	98.97%	1.0104	slot	22	0.191844
(b)	0	467	461.3	98.78%	1.0124	slot	22	0.208073
(c)	0	467	461.3	98.78%	1.0124	slot	22	0.208073
(d)	0	465	461.3	99.20%	1.008	slot	21	0.207351
(e)	0	465	461.3	99.20%	1.008	slot	21	0.207351
city-roads-M, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	355	351.61	99.04%	1.0096	slot	18	0.228517
(b)	0	395	389.8	98.68%	1.0133	slot	19	0.250517
(c)	0	395	389.8	98.68%	1.0133	slot	19	0.250517
(d)	0	393	389.8	99.19%	1.0082	slot	18	0.249417
(e)	0	393	389.8	99.19%	1.0082	slot	18	0.249417
city-roads-M, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	355	351.61	99.04%	1.0096	slot	18	0.228517
(b)	0	395	389.8	98.68%	1.0133	slot	19	0.250517
(c)	0	395	389.8	98.68%	1.0133	slot	19	0.250517
(d)	0	393	389.8	99.19%	1.0082	slot	18	0.249417
(e)	0	393	389.8	99.19%	1.0082	slot	18	0.249417
city-roads-M, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	1689	1672.74	99.04%	1.0097	slot	90	0.395231
(b)	0	1835	1820.41	99.20%	1.008	slot	80	0.409005
(c)	0	1835	1820.41	99.20%	1.008	slot	80	0.409005
(d)	0	1834	1820.41	99.26%	1.0075	slot	84	0.408911
(e)	0	1834	1820.41	99.26%	1.0075	slot	84	0.408911
city-roads-M, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	1689	1672.74	99.04%	1.0097	slot	90	0.395231
(b)	0	1835	1820.41	99.20%	1.008	slot	80	0.409005
(c)	0	1835	1820.41	99.20%	1.008	slot	80	0.409005
(d)	0	1834	1820.41	99.26%	1.0075	slot	84	0.408911
(e)	0	1834	1820.41	99.26%	1.0075	slot	84	0.408911
city-roads-M, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	1890	1870.91	98.99%	1.0102	slot	102	0.592585
(b)	0	2051	2034.98	99.22%	1.0079	slot	89	0.622905
(c)	0	2051	2034.98	99.22%	1.0079	slot	89	0.622905
(d)	0	2050	2034.98	99.27%	1.0074	slot	94	0.622716
(e)	0	2050	2034.98	99.27%	1.0074	slot	94	0.622716

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
city-roads-M, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	1890	1870.91	98.99%	1.0102	slot	102	0.592585
(b)	0	2051	2034.98	99.22%	1.0079	slot	89	0.622905
(c)	0	2051	2034.98	99.22%	1.0079	slot	89	0.622905
(d)	0	2050	2034.98	99.27%	1.0074	slot	94	0.622716
(e)	0	2050	2034.98	99.27%	1.0074	slot	94	0.622716
city-roads-M, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	622	615.83	99.01%	1.01	slot	32	0.116218
(b)	0	683	675.81	98.95%	1.0106	slot	31	0.122263
(c)	0	683	675.81	98.95%	1.0106	slot	31	0.122263
(d)	0	681	675.81	99.24%	1.0077	slot	31	0.122065
(e)	0	681	675.81	99.24%	1.0077	slot	31	0.122065
city-roads-M, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	622	615.83	99.01%	1.01	slot	32	0.116218
(b)	0	683	675.81	98.95%	1.0106	slot	31	0.122263
(c)	0	683	675.81	98.95%	1.0106	slot	31	0.122263
(d)	0	681	675.81	99.24%	1.0077	slot	31	0.122065
(e)	0	681	675.81	99.24%	1.0077	slot	31	0.122065
city-roads-M, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	688	681.89	99.11%	1.009	slot	35	0.182689
(b)	0	755	747.31	98.98%	1.0103	slot	34	0.19519
(c)	0	755	747.31	98.98%	1.0103	slot	34	0.19519
(d)	0	753	747.31	99.24%	1.0076	slot	35	0.194816
(e)	0	753	747.31	99.24%	1.0076	slot	35	0.194816
city-roads-M, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	688	681.89	99.11%	1.009	slot	35	0.182689
(b)	0	755	747.31	98.98%	1.0103	slot	34	0.19519
(c)	0	755	747.31	98.98%	1.0103	slot	34	0.19519
(d)	0	753	747.31	99.24%	1.0076	slot	35	0.194816
(e)	0	753	747.31	99.24%	1.0076	slot	35	0.194816
cora, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	178	171	12.15%	1.0409	CP	145	0.042099
(b)	0	205	171	11.20%	1.1988	CP	10	0.042992
(c)	13	64	23.37	36.52%	2.7382	slot	10	0.03833
(d)	0	171	171	13.43%	1.0	CP	136	0.041868
(e)	13	41	23.37	57.01%	1.7542	slot	10	0.03757
cora, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	178	171	12.15%	1.0409	CP	145	0.042401
(b)	0	195	171	12.81%	1.1404	CP	4	0.042992
(c)	13	54	25.79	47.75%	2.0942	slot	4	0.038091
(d)	0	171	171	14.61%	1.0	CP	139	0.042158
(e)	13	34	25.79	75.84%	1.3186	slot	4	0.037396
cora, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	176	170	10.50%	1.0353	CP	142	0.042921
(b)	0	200	170	9.90%	1.1765	CP	9	0.044048
(c)	13	58	20.03	34.53%	2.8959	slot	9	0.03738
(d)	0	170	170	11.64%	1.0	CP	137	0.042639
(e)	13	37	20.03	54.13%	1.8474	slot	9	0.036394
cora, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	176	170	10.50%	1.0353	CP	142	0.04331
(b)	0	191	170	11.35%	1.1235	CP	4	0.044048
(c)	13	49	22.16	45.21%	2.2117	slot	4	0.037066
(d)	0	170	170	12.76%	1.0	CP	138	0.043015
(e)	13	30	22.16	73.85%	1.3541	slot	3	0.036132
cora, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	173	169	8.87%	1.0237	CP	137	0.31422
(b)	0	196	169	8.48%	1.1598	CP	9	0.318428
(c)	13	53	19	31.48%	2.7895	CP	9	0.292264
(d)	0	169	169	9.84%	1.0	CP	136	0.313488
(e)	13	33	19	50.56%	1.7368	CP	9	0.288604
cora, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	173	169	8.87%	1.0237	CP	137	0.315743
(b)	0	187	169	9.83%	1.1065	CP	4	0.318428
(c)	13	44	18.52	42.10%	2.3752	slot	4	0.291005
(d)	0	169	169	10.88%	1.0	CP	136	0.314976
(e)	13	26	18.52	71.25%	1.4035	slot	3	0.287553
cora, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	173	169	8.87%	1.0237	CP	137	0.336451
(b)	0	196	169	8.48%	1.1598	CP	9	0.344803
(c)	13	53	19	31.48%	2.7895	CP	9	0.292874
(d)	0	169	169	9.84%	1.0	CP	136	0.334998
(e)	13	33	19	50.56%	1.7368	CP	9	0.285612
cora, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	173	169	8.87%	1.0237	CP	137	0.339474
(b)	0	187	169	9.83%	1.1065	CP	4	0.344803
(c)	13	44	18.52	42.10%	2.3752	slot	4	0.290375
(d)	0	169	169	10.88%	1.0	CP	136	0.337952
(e)	13	26	18.52	71.25%	1.4035	slot	3	0.283524

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
cora, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	180	172	13.75%	1.0465	CP	146	0.048163
(b)	0	209	172	12.50%	1.2151	CP	10	0.049534
(c)	13	69	26.72	38.72%	2.5826	slot	10	0.042916
(d)	0	172	172	15.19%	1.0	CP	136	0.047785
(e)	13	45	26.72	59.37%	1.6843	slot	11	0.041781
cora, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	180	172	13.75%	1.0465	CP	146	0.04859
(b)	0	199	172	14.22%	1.157	CP	3	0.049534
(c)	13	59	29.42	49.86%	2.0057	slot	3	0.042583
(d)	0	172	172	16.45%	1.0	CP	137	0.048193
(e)	13	38	29.42	77.41%	1.2918	slot	4	0.041541
cora, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	178	171	12.15%	1.0409	CP	145	0.044721
(b)	0	205	171	11.20%	1.1988	CP	10	0.046459
(c)	13	64	23.37	36.52%	2.7382	slot	10	0.037386
(d)	0	171	171	13.43%	1.0	CP	136	0.044271
(e)	13	41	23.37	57.01%	1.7542	slot	10	0.035906
cora, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	178	171	12.15%	1.0409	CP	145	0.045309
(b)	0	195	171	12.81%	1.1404	CP	4	0.046459
(c)	13	54	25.79	47.75%	2.0942	slot	4	0.036921
(d)	0	171	171	14.61%	1.0	CP	139	0.044835
(e)	13	34	25.79	75.84%	1.3186	slot	4	0.035568
cora, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	218	191	38.67%	1.1414	CP	120	0.242163
(b)	0	303	191	28.49%	1.5864	CP	25	0.244614
(c)	13	182	90.26	49.59%	2.0164	slot	25	0.241125
(d)	0	191	191	45.19%	1.0	CP	86	0.241385
(e)	13	120	90.26	75.22%	1.3295	slot	13	0.239338
cora, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	218	191	38.67%	1.1414	CP	120	0.242778
(b)	0	276	191	33.00%	1.445	CP	4	0.244614
(c)	13	155	98.39	63.48%	1.5754	slot	4	0.240784
(d)	0	191	191	47.68%	1.0	CP	84	0.241923
(e)	13	114	98.39	86.31%	1.1587	slot	4	0.239486
cora, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	224	194	41.83%	1.1546	CP	114	0.250286
(b)	0	318	194	30.13%	1.6392	CP	28	0.256003
(c)	13	200	100.29	50.15%	1.9942	slot	28	0.248826
(d)	0	194	194	49.39%	1.0	CP	78	0.248462
(e)	13	132	100.29	75.98%	1.3162	slot	13	0.244691
cora, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	224	194	41.83%	1.1546	CP	114	0.251705
(b)	0	288	194	35.07%	1.4845	CP	4	0.256003
(c)	13	170	109.28	64.28%	1.5556	slot	4	0.248079
(d)	0	194	194	52.06%	1.0	CP	75	0.249691
(e)	13	126	109.28	86.73%	1.153	slot	4	0.245124
cora, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	186	175	18.36%	1.0629	CP	146	0.057689
(b)	0	224	175	15.91%	1.28	CP	13	0.058326
(c)	13	87	36.75	42.24%	2.3673	slot	13	0.056028
(d)	0	175	175	20.36%	1.0	CP	131	0.057504
(e)	13	56	36.75	65.62%	1.5238	slot	12	0.055508
cora, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	186	175	18.36%	1.0629	CP	146	0.057865
(b)	0	212	175	18.02%	1.2114	CP	4	0.058326
(c)	13	75	40.31	53.74%	1.8608	slot	4	0.055898
(d)	0	175	175	21.83%	1.0	CP	130	0.05767
(e)	13	50	40.31	80.61%	1.2405	slot	4	0.055455
cora, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	188	176	19.84%	1.0682	CP	146	0.060692
(b)	0	229	176	16.94%	1.3011	CP	13	0.06208
(c)	13	93	40.09	43.11%	2.3195	slot	13	0.057477
(d)	0	176	176	22.05%	1.0	CP	128	0.060286
(e)	13	60	40.09	66.82%	1.4965	slot	12	0.056359
cora, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	188	176	19.84%	1.0682	CP	146	0.061075
(b)	0	216	176	19.22%	1.2273	CP	4	0.06208
(c)	13	80	43.94	54.92%	1.8208	slot	4	0.057199
(d)	0	176	176	23.59%	1.0	CP	127	0.060645
(e)	13	54	43.94	81.36%	1.2291	slot	4	0.056266
hm-categories, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	31461	31461	79.47%	1.0	CP	7328	4.981688
(b)	0	51268	31461	59.48%	1.6296	CP	1341	8.095226
(c)	5494	33801	30500.84	90.24%	1.1082	slot	1341	5.349522
(d)	0	31461	31461	96.93%	1.0	CP	1984	4.981688
(e)	5494	30801	30500.84	99.03%	1.0098	slot	1342	4.87794

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
hm-categories, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	31461	31461	79.47%	1.0	CP	7328	5.880679
(b)	0	43382	38382.3	88.48%	1.1303	slot	1341	8.095226
(c)	13375	41173	38386.74	93.23%	1.0726	slot	1341	7.684863
(d)	0	40264	38382.3	95.33%	1.049	slot	2877	7.516
(e)	13375	40528	38386.74	94.72%	1.0558	slot	3119	7.565043
hm-categories, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	31460	31460	79.30%	1.0	CP	7376	7.248741
(b)	0	51238	31460	59.41%	1.6287	CP	1353	11.784028
(c)	5494	33768	30444.63	90.16%	1.1092	slot	1353	7.777988
(d)	0	31460	31460	96.76%	1.0	CP	2029	7.248741
(e)	5494	30768	30444.63	98.95%	1.0106	slot	1352	7.090059
hm-categories, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	31460	31460	79.30%	1.0	CP	7376	8.560634
(b)	0	43354	38325.71	88.40%	1.1312	slot	1352	11.784028
(c)	13375	41140	38328.63	93.17%	1.0733	slot	1352	11.184012
(d)	0	40088	38325.71	95.60%	1.046	slot	2701	10.89891
(e)	13375	40383	38328.63	94.91%	1.0536	slot	3039	10.978858
hm-categories, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	31459	31459	79.13%	1.0	CP	7419	34.619873
(b)	0	51207	31459	59.34%	1.6277	CP	1362	56.174695
(c)	5494	33734	30388.43	90.08%	1.1101	slot	1362	37.103022
(d)	0	31459	31459	96.59%	1.0	CP	2067	34.619873
(e)	5494	30736	30388.43	98.87%	1.0114	slot	1362	33.830723
hm-categories, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	31459	31459	79.13%	1.0	CP	7419	40.86583
(b)	0	43326	38269.12	88.33%	1.1321	slot	1362	56.174695
(c)	13375	41108	38270.52	93.10%	1.0741	slot	1362	53.313393
(d)	0	40110	38269.12	95.41%	1.0481	slot	2766	52.025937
(e)	13375	40190	38270.52	95.22%	1.0502	slot	2875	52.12914
hm-categories, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	31459	31459	79.13%	1.0	CP	7419	65.154544
(b)	0	51207	31459	59.34%	1.6277	CP	1362	105.88274
(c)	5494	33734	30388.43	90.08%	1.1101	slot	1362	69.846495
(d)	0	31459	31459	96.59%	1.0	CP	2067	65.154544
(e)	5494	30736	30388.43	98.87%	1.0114	slot	1362	63.663432
hm-categories, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	31459	31459	79.13%	1.0	CP	7419	76.956384
(b)	0	43326	38269.12	88.33%	1.1321	slot	1362	105.88274
(c)	13375	41108	38270.52	93.10%	1.0741	slot	1362	100.476264
(d)	0	40110	38269.12	95.41%	1.0481	slot	2766	98.043593
(e)	13375	40190	38270.52	95.22%	1.0502	slot	2875	98.238596
hm-categories, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	31462	31462	79.64%	1.0	CP	7285	5.921102
(b)	0	51299	31462	59.55%	1.6305	CP	1327	9.629394
(c)	5494	33835	30557.05	90.31%	1.1073	slot	1327	6.364706
(d)	0	31462	31462	97.10%	1.0	CP	1942	5.921102
(e)	5494	30833	30557.05	99.11%	1.009	slot	1327	5.803518
hm-categories, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	31462	31462	79.64%	1.0	CP	7285	6.989791
(b)	0	43411	38438.89	88.55%	1.1294	slot	1326	9.629394
(c)	13375	41207	38444.86	93.30%	1.0718	slot	1327	9.142518
(d)	0	40288	38438.89	95.41%	1.0481	slot	2800	8.939505
(e)	13375	40613	38444.86	94.66%	1.0564	slot	3143	9.0113
hm-categories, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	31461	31461	79.47%	1.0	CP	7328	8.996311
(b)	0	51268	31461	59.48%	1.6296	CP	1341	14.639202
(c)	5494	33801	30500.84	90.24%	1.1082	slot	1341	9.662962
(d)	0	31461	31461	96.93%	1.0	CP	1984	8.996311
(e)	5494	30801	30500.84	99.03%	1.0098	slot	1342	8.808281
hm-categories, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	31461	31461	79.47%	1.0	CP	7328	10.625617
(b)	0	43382	38382.3	88.48%	1.1303	slot	1341	14.639202
(c)	13375	41173	38386.74	93.23%	1.0726	slot	1341	13.895472
(d)	0	40264	38382.3	95.33%	1.049	slot	2877	13.589428
(e)	13375	40528	38386.74	94.72%	1.0558	slot	3119	13.678312
hm-categories, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	31481	31481	82.84%	1.0	CP	6459	1.896053
(b)	0	52090	31585.28	60.64%	1.6492	slot	1221	2.982884
(c)	5494	34683	31624.96	91.18%	1.0967	slot	1223	2.064913
(d)	0	31620	31585.28	99.89%	1.0011	slot	1196	1.903383
(e)	5494	31660	31624.96	99.89%	1.0011	slot	1223	1.905492
hm-categories, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	31481	31481	82.84%	1.0	CP	6459	2.194089
(b)	0	44162	39514.06	89.48%	1.1176	slot	1222	2.982884
(c)	13375	42075	39549.02	94.00%	1.0639	slot	1225	2.853066
(d)	0	40816	39514.06	96.81%	1.0329	slot	2258	2.774753
(e)	13375	41359	39549.02	95.62%	1.0458	slot	2793	2.808529

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
hm-categories, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	31484	31484	83.35%	1.0	CP	6308	3.482793
(b)	0	52251	31748.57	60.76%	1.6458	slot	1237	5.623956
(c)	5494	34857	31793.58	91.21%	1.0964	slot	1239	3.830563
(d)	0	31781	31748.57	99.90%	1.001	slot	1210	3.513415
(e)	5494	31826	31793.58	99.90%	1.001	slot	1239	3.518054
hm-categories, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	31484	31484	83.35%	1.0	CP	6308	4.064028
(b)	0	44316	39683.82	89.55%	1.1167	slot	1238	5.623956
(c)	13375	42246	39723.37	94.03%	1.0635	slot	1240	5.372315
(d)	0	40791	39683.82	97.29%	1.0279	slot	2054	5.195437
(e)	13375	41467	39723.37	95.80%	1.0439	slot	2712	5.277616
hm-categories, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	31465	31465	80.14%	1.0	CP	7150	1.758368
(b)	0	51391	31465	59.77%	1.6333	CP	1284	2.837341
(c)	5494	33936	30725.66	90.54%	1.1045	slot	1285	1.89217
(d)	0	31465	31465	97.61%	1.0	CP	1800	1.758368
(e)	5494	30931	30725.66	99.34%	1.0067	slot	1285	1.729452
hm-categories, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	31465	31465	80.14%	1.0	CP	7150	2.067626
(b)	0	43496	38608.65	88.76%	1.1266	slot	1284	2.837341
(c)	13375	41307	38619.2	93.49%	1.0696	slot	1285	2.697294
(d)	0	40549	38608.65	95.21%	1.0503	slot	2939	2.648799
(e)	13375	40479	38619.2	95.41%	1.0482	slot	2861	2.64432
hm-categories, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	31466	31466	80.31%	1.0	CP	7105	3.396654
(b)	0	51421	31466	59.84%	1.6342	CP	1263	5.516278
(c)	5494	33969	30781.87	90.62%	1.1035	slot	1265	3.662523
(d)	0	31466	31466	97.78%	1.0	CP	1758	3.396654
(e)	5494	30963	30781.87	99.42%	1.0059	slot	1265	3.343225
hm-categories, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	31466	31466	80.31%	1.0	CP	7105	4.002995
(b)	0	43525	38665.24	88.83%	1.1257	slot	1264	5.516278
(c)	13375	41341	38677.31	93.56%	1.0689	slot	1266	5.242208
(d)	0	40603	38665.24	95.23%	1.0501	slot	2961	5.149597
(e)	13375	40566	38677.31	95.34%	1.0488	slot	2803	5.144954
ogbn-arxiv, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	13203	13158	14.68%	1.0034	CP	9816	0.589754
(b)	0	14615	13158	17.00%	1.1107	CP	154	0.648952
(c)	543	2942	2489.04	84.60%	1.182	slot	154	0.159558
(d)	0	13158	13158	18.88%	1.0	CP	10421	0.587867
(e)	543	2555	2489.04	97.42%	1.0265	slot	154	0.143333
ogbn-arxiv, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	13203	13158	14.68%	1.0034	CP	9816	0.60521
(b)	0	14218	13158	19.93%	1.0806	CP	110	0.648952
(c)	875	3590	2849.39	79.37%	1.2599	slot	112	0.190929
(d)	0	13158	13158	21.53%	1.0	CP	9919	0.603271
(e)	875	2867	2849.39	99.39%	1.0062	slot	111	0.15977
ogbn-arxiv, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	13161	13157	13.23%	1.0003	CP	9681	0.822218
(b)	0	14419	13157	15.86%	1.0959	CP	142	0.897497
(c)	543	2741	2289.36	83.52%	1.1973	slot	142	0.19868
(d)	0	13157	13157	17.38%	1.0	CP	10279	0.821978
(e)	543	2355	2289.36	97.21%	1.0287	slot	143	0.175581
ogbn-arxiv, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	13161	13157	13.23%	1.0003	CP	9681	0.843996
(b)	0	14031	13157	18.72%	1.0664	CP	100	0.897497
(c)	875	3378	2637.75	78.09%	1.2806	slot	102	0.242388
(d)	0	13157	13157	19.97%	1.0	CP	9698	0.84375
(e)	875	2654	2637.75	99.39%	1.0062	slot	84	0.197865
ogbn-arxiv, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	1637	1545.82	94.43%	1.059	slot	160	3.256633
(b)	0	1958	1659.35	84.75%	1.18	slot	99	3.839818
(c)	114	1772	1660.49	93.71%	1.0672	slot	99	3.501898
(d)	0	1688	1659.35	98.30%	1.0173	slot	99	3.349288
(e)	114	1689	1660.49	98.31%	1.0172	slot	99	3.351105
ogbn-arxiv, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	1637	1545.82	94.43%	1.059	slot	160	3.098438
(b)	0	2068	1899.08	91.83%	1.0889	slot	89	3.839818
(c)	218	2004	1904.26	95.02%	1.0524	slot	90	3.729729
(d)	0	1917	1899.08	99.07%	1.0094	slot	90	3.580077
(e)	218	1922	1904.26	99.08%	1.0093	slot	90	3.588678
ogbn-arxiv, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	1637	1545.82	94.43%	1.059	slot	160	6.070447
(b)	0	1958	1659.35	84.75%	1.18	slot	99	7.207147
(c)	114	1772	1660.49	93.71%	1.0672	slot	99	6.548498
(d)	0	1688	1659.35	98.30%	1.0173	slot	99	6.251044
(e)	114	1689	1660.49	98.31%	1.0172	slot	99	6.254585

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
ogbn-arxiv, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	1637	1545.82	94.43%	1.059	slot	160	5.762105
(b)	0	2068	1899.08	91.83%	1.0889	slot	89	7.207147
(c)	218	2004	1904.26	95.02%	1.0524	slot	90	6.99257
(d)	0	1917	1899.08	99.07%	1.0094	slot	90	6.70088
(e)	218	1922	1904.26	99.08%	1.0093	slot	90	6.717644
ogbn-arxiv, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	13285	13159	16.06%	1.0096	CP	10352	0.79476
(b)	0	14811	13159	18.11%	1.1255	CP	165	0.881496
(c)	543	3142	2688.72	85.57%	1.1686	slot	165	0.218242
(d)	0	13159	13159	20.38%	1.0	CP	10574	0.787598
(e)	543	2755	2688.72	97.59%	1.0247	slot	164	0.196245
ogbn-arxiv, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	13285	13159	16.06%	1.0096	CP	10352	0.815988
(b)	0	14406	13159	21.10%	1.0948	CP	121	0.881496
(c)	875	3801	3061.03	80.53%	1.2417	slot	124	0.261773
(d)	0	13159	13159	23.10%	1.0	CP	10229	0.808625
(e)	875	3080	3061.03	99.38%	1.0062	slot	124	0.21964
ogbn-arxiv, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	13203	13158	14.68%	1.0034	CP	9816	1.087381
(b)	0	14615	13158	17.00%	1.1107	CP	154	1.200113
(c)	543	2942	2489.04	84.60%	1.182	slot	154	0.268154
(d)	0	13158	13158	18.88%	1.0	CP	10421	1.083788
(e)	543	2555	2489.04	97.42%	1.0265	slot	154	0.237256
ogbn-arxiv, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	13203	13158	14.68%	1.0034	CP	9816	1.116814
(b)	0	14218	13158	19.93%	1.0806	CP	110	1.200113
(c)	875	3590	2849.39	79.37%	1.2599	slot	112	0.327893
(d)	0	13158	13158	21.53%	1.0	CP	9919	1.113121
(e)	875	2867	2849.39	99.39%	1.0062	slot	111	0.268558
ogbn-arxiv, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	5951	5857.79	98.43%	1.0159	slot	370	0.808746
(b)	0	6316	6019.99	95.31%	1.0492	slot	315	0.843883
(c)	114	6193	6048.05	97.66%	1.024	slot	319	0.832042
(d)	0	6058	6019.99	99.37%	1.0063	slot	315	0.819046
(e)	114	6087	6048.05	99.36%	1.0064	slot	319	0.821838
ogbn-arxiv, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	5951	5857.79	98.43%	1.0159	slot	370	0.787438
(b)	0	6560	6438.82	98.15%	1.0188	slot	305	0.843883
(c)	218	6698	6558.29	97.91%	1.0213	slot	318	0.856673
(d)	0	6467	6438.82	99.56%	1.0044	slot	305	0.835263
(e)	218	6587	6558.29	99.56%	1.0044	slot	318	0.846385
ogbn-arxiv, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	6539	6445.79	98.57%	1.0145	slot	398	1.494707
(b)	0	6911	6614.62	95.71%	1.0448	slot	345	1.566276
(c)	114	6796	6646.35	97.80%	1.0225	slot	349	1.544151
(d)	0	6654	6614.62	99.41%	1.006	slot	344	1.516832
(e)	114	6686	6646.35	99.41%	1.006	slot	348	1.522988
ogbn-arxiv, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	6539	6445.79	98.57%	1.0145	slot	398	1.447237
(b)	0	7182	7057.88	98.27%	1.0176	slot	336	1.566276
(c)	218	7338	7192.93	98.02%	1.0202	slot	350	1.595157
(d)	0	7088	7057.88	99.57%	1.0043	slot	336	1.548874
(e)	218	7223	7192.93	99.58%	1.0042	slot	349	1.573867
ogbn-arxiv, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	13532	13162	20.11%	1.0281	CP	10680	0.317879
(b)	0	15396	13162	21.28%	1.1697	CP	194	0.354149
(c)	543	3742	3287.76	87.86%	1.1382	slot	195	0.127382
(d)	0	13162	13162	24.89%	1.0	CP	10014	0.310679
(e)	543	3355	3287.76	98.00%	1.0205	slot	195	0.119852
ogbn-arxiv, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	13532	13162	20.11%	1.0281	CP	10680	0.325444
(b)	0	14966	13162	24.44%	1.1371	CP	149	0.354149
(c)	875	4442	3695.94	83.20%	1.2019	slot	153	0.143486
(d)	0	13179	13162	27.76%	1.0013	CP	9642	0.318378
(e)	875	3715	3695.94	99.49%	1.0052	slot	153	0.128934
ogbn-arxiv, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	13613	13163	21.43%	1.0342	CP	10674	0.588202
(b)	0	15592	13163	22.28%	1.1845	CP	205	0.665814
(c)	543	3944	3487.44	88.42%	1.1309	slot	206	0.209004
(d)	0	13163	13163	26.40%	1.0	CP	9822	0.570554
(e)	543	3555	3487.44	98.10%	1.0194	slot	205	0.193748
ogbn-arxiv, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	13613	13163	21.43%	1.0342	CP	10674	0.603669
(b)	0	15153	13163	25.50%	1.1512	CP	159	0.665814
(c)	875	4655	3907.57	83.94%	1.1913	slot	163	0.242177
(d)	0	13207	13163	29.26%	1.0033	CP	9476	0.587285
(e)	875	3927	3907.57	99.51%	1.005	slot	163	0.212799

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
pokec-regions, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	41133	41112.24	99.95%	1.0005	slot	2072	10.571456
(b)	0	51304	44677.43	87.08%	1.1483	slot	2072	13.176516
(c)	3527	44988	44706.41	99.37%	1.0063	slot	2075	11.558822
(d)	0	44698	44677.43	99.95%	1.0005	slot	2071	11.484546
(e)	3527	44727	44706.41	99.95%	1.0005	slot	2074	11.491973
pokec-regions, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	41133	41112.24	99.95%	1.0005	slot	2072	10.376556
(b)	0	52271	52135.19	99.74%	1.0026	slot	2072	13.176516
(c)	6867	52418	52279.35	99.74%	1.0027	slot	2086	13.21347
(d)	0	52156	52135.19	99.96%	1.0004	slot	2072	13.147606
(e)	6867	52300	52279.35	99.96%	1.0004	slot	2086	13.183806
pokec-regions, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	39245	39222.42	99.94%	1.0006	slot	1978	15.015989
(b)	0	49435	42768.31	86.51%	1.1559	slot	1979	18.905906
(c)	3527	43071	42787.63	99.34%	1.0066	slot	1981	16.476521
(d)	0	42791	42768.31	99.95%	1.0005	slot	1979	16.369635
(e)	3527	42811	42787.63	99.95%	1.0005	slot	1981	16.377269
pokec-regions, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	39245	39222.42	99.94%	1.0006	slot	1978	14.762164
(b)	0	50287	50149.27	99.73%	1.0027	slot	1979	18.905906
(c)	6867	50385	50245.38	99.72%	1.0028	slot	1988	18.942682
(d)	0	50172	50149.27	99.95%	1.0005	slot	1978	18.86275
(e)	6867	50268	50245.38	99.96%	1.0005	slot	1988	18.898776
pokec-regions, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	37359	37332.6	99.93%	1.0007	slot	1887	74.778705
(b)	0	42442	41013.98	96.64%	1.0348	slot	1887	84.914519
(c)	3681	41664	41023.51	98.46%	1.0156	slot	1888	83.363139
(d)	0	41040	41013.98	99.94%	1.0006	slot	1886	82.118845
(e)	3681	41050	41023.51	99.94%	1.0006	slot	1888	82.138785
pokec-regions, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	37359	37332.6	99.93%	1.0007	slot	1887	65.654214
(b)	0	48366	48138.98	99.53%	1.0047	slot	1887	84.914519
(c)	4382	48415	48187.5	99.53%	1.0047	slot	1892	85.00026
(d)	0	48165	48138.98	99.95%	1.0005	slot	1886	84.562804
(e)	4382	48214	48187.5	99.95%	1.0005	slot	1892	84.648545
pokec-regions, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	37359	37332.6	99.93%	1.0007	slot	1887	142.787854
(b)	0	42442	41013.98	96.64%	1.0348	slot	1887	162.17809
(c)	3681	41664	41023.51	98.46%	1.0156	slot	1888	159.210236
(d)	0	41040	41013.98	99.94%	1.0006	slot	1886	156.829849
(e)	3681	41050	41023.51	99.94%	1.0006	slot	1888	156.867996
pokec-regions, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	37359	37332.6	99.93%	1.0007	slot	1887	125.332322
(b)	0	48366	48138.98	99.53%	1.0047	slot	1887	162.17809
(c)	4382	48415	48187.5	99.53%	1.0047	slot	1892	162.342117
(d)	0	48165	48138.98	99.95%	1.0005	slot	1886	161.505245
(e)	4382	48214	48187.5	99.95%	1.0005	slot	1892	161.669272
pokec-regions, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	43021	43002.06	99.96%	1.0004	slot	2164	13.546607
(b)	0	53174	46586.54	87.61%	1.1414	slot	2165	16.734262
(c)	3527	46906	46625.19	99.40%	1.006	slot	2169	14.766349
(d)	0	46605	46586.54	99.96%	1.0004	slot	2164	14.671846
(e)	3527	46644	46625.19	99.96%	1.0004	slot	2168	14.684091
pokec-regions, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	43021	43002.06	99.96%	1.0004	slot	2164	13.277489
(b)	0	54255	54121.11	99.75%	1.0025	slot	2164	16.734262
(c)	6867	54451	54313.33	99.75%	1.0025	slot	2183	16.794572
(d)	0	54140	54121.11	99.97%	1.0003	slot	2164	16.698875
(e)	6867	54332	54313.33	99.97%	1.0003	slot	2183	16.757955
pokec-regions, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	41133	41112.24	99.95%	1.0005	slot	2072	19.551166
(b)	0	51304	44677.43	87.08%	1.1483	slot	2072	24.377378
(c)	3527	44988	44706.41	99.37%	1.0063	slot	2075	21.380391
(d)	0	44698	44677.43	99.95%	1.0005	slot	2071	21.242784
(e)	3527	44727	44706.41	99.95%	1.0005	slot	2074	21.256545
pokec-regions, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	41133	41112.24	99.95%	1.0005	slot	2072	19.19009
(b)	0	52271	52135.19	99.74%	1.0026	slot	2072	24.377378
(c)	6867	52418	52279.35	99.74%	1.0027	slot	2086	24.44584
(d)	0	52156	52135.19	99.96%	1.0004	slot	2072	24.323819
(e)	6867	52300	52279.35	99.96%	1.0004	slot	2086	24.390884
pokec-regions, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	78924	78908.6	99.98%	1.0002	slot	3948	8.000655
(b)	0	83622	83009.16	99.27%	1.0074	slot	3947	8.462858
(c)	3681	83853	83228.68	99.26%	1.0075	slot	3969	8.485584
(d)	0	83024	83009.16	99.98%	1.0002	slot	3947	8.404025
(e)	3681	83244	83228.68	99.98%	1.0002	slot	3970	8.425669

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
pokec-regions, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	78924	78908.6	99.98%	1.0002	slot	3948	7.288035
(b)	0	92072	91849.85	99.76%	1.0024	slot	3947	8.462858
(c)	4382	93199	92966.06	99.75%	1.0025	slot	4059	8.56356
(d)	0	91865	91849.85	99.98%	1.0002	slot	3948	8.444362
(e)	4382	92981	92966.06	99.98%	1.0002	slot	4059	8.544081
pokec-regions, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	84594	84578.06	99.98%	1.0002	slot	4231	16.732522
(b)	0	89348	88735.77	99.31%	1.0069	slot	4232	17.659554
(c)	3681	89610	88983.93	99.30%	1.007	slot	4257	17.710644
(d)	0	88752	88735.77	99.98%	1.0002	slot	4231	17.543334
(e)	3681	89000	88983.93	99.98%	1.0002	slot	4256	17.591694
pokec-regions, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	84594	84578.06	99.98%	1.0002	slot	4231	15.270804
(b)	0	98035	97810.42	99.77%	1.0023	slot	4231	17.659554
(c)	4382	99309	99072.22	99.76%	1.0024	slot	4357	17.88597
(d)	0	97827	97810.42	99.98%	1.0002	slot	4231	17.622588
(e)	4382	99089	99072.22	99.98%	1.0002	slot	4358	17.846872
pokec-regions, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	48688	48671.51	99.97%	1.0003	slot	2444	4.49697
(b)	0	58785	52313.88	88.99%	1.1237	slot	2443	5.418243
(c)	3527	52660	52381.52	99.47%	1.0053	slot	2450	4.859384
(d)	0	52330	52313.88	99.97%	1.0003	slot	2444	4.829274
(e)	3527	52398	52381.52	99.97%	1.0003	slot	2451	4.835479
pokec-regions, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	48688	48671.51	99.97%	1.0003	slot	2444	4.391759
(b)	0	60211	60078.86	99.78%	1.0022	slot	2443	5.418243
(c)	6867	60554	60415.25	99.77%	1.0023	slot	2477	5.448798
(d)	0	60095	60078.86	99.97%	1.0003	slot	2444	5.407909
(e)	6867	60431	60415.25	99.97%	1.0003	slot	2477	5.437841
pokec-regions, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	50578	50561.33	99.97%	1.0003	slot	2539	9.01651
(b)	0	60657	54222.99	89.39%	1.1187	slot	2538	10.802461
(c)	3527	54580	54300.3	99.49%	1.0052	slot	2546	9.725645
(d)	0	54239	54222.99	99.97%	1.0003	slot	2538	9.665222
(e)	3527	54317	54300.3	99.97%	1.0003	slot	2546	9.679043
pokec-regions, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	50578	50561.33	99.97%	1.0003	slot	2539	8.794465
(b)	0	62198	62064.77	99.79%	1.0021	slot	2538	10.802461
(c)	6867	62590	62449.22	99.78%	1.0023	slot	2576	10.8702
(d)	0	62081	62064.77	99.97%	1.0003	slot	2538	10.782243
(e)	6867	62466	62449.22	99.97%	1.0003	slot	2577	10.848772
pubmed, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	266	174	64.31%	1.5287	CP	95	0.076374
(b)	0	356	183.98	51.68%	1.935	slot	27	0.089963
(c)	13	233	188.0	80.69%	1.2394	slot	27	0.071392
(d)	0	211	183.98	87.19%	1.1469	slot	27	0.068071
(e)	13	212	188.0	88.68%	1.1277	slot	27	0.068222
pubmed, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	266	174	64.31%	1.5287	CP	95	0.077775
(b)	0	344	209.49	60.90%	1.6421	slot	15	0.089963
(c)	36	251	212.48	84.65%	1.1813	slot	15	0.075432
(d)	0	221	209.49	94.79%	1.0549	slot	15	0.070744
(e)	36	224	212.48	94.86%	1.0542	slot	16	0.071213
pubmed, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	252	173	58.83%	1.4566	CP	101	0.091257
(b)	0	333	173	48.32%	1.9249	CP	26	0.10945
(c)	13	207	163.19	78.83%	1.2685	slot	27	0.08115
(d)	0	187	173	86.05%	1.0809	CP	25	0.076658
(e)	13	187	163.19	87.26%	1.1459	slot	26	0.076658
pubmed, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	252	173	58.83%	1.4566	CP	101	0.093557
(b)	0	320	185.45	57.95%	1.7255	slot	14	0.10945
(c)	36	225	187.31	83.25%	1.2012	slot	14	0.087246
(d)	0	202	185.45	91.81%	1.0892	slot	19	0.08187
(e)	36	199	187.31	94.13%	1.0624	slot	15	0.081169
pubmed, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	238	172	52.70%	1.3837	CP	106	0.507267
(b)	0	309	172	44.61%	1.7965	CP	24	0.5743
(c)	13	180	138.37	76.87%	1.3008	slot	24	0.452508
(d)	0	172	172	80.14%	1.0	CP	31	0.444955
(e)	13	163	138.37	84.89%	1.178	slot	24	0.436458
pubmed, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	238	172	52.70%	1.3837	CP	106	0.516346
(b)	0	297	172	54.35%	1.7267	CP	14	0.5743
(c)	36	199	162.15	81.48%	1.2273	slot	14	0.478038
(d)	0	199	172	81.11%	1.157	CP	40	0.478038
(e)	36	173	162.15	93.73%	1.0669	slot	13	0.452499

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
pubmed, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	238	172	52.70%	1.3837	CP	106	0.717319
(b)	0	309	172	44.61%	1.7965	CP	24	0.84968
(c)	13	180	138.37	76.87%	1.3008	slot	24	0.609193
(d)	0	172	172	80.14%	1.0	CP	31	0.594279
(e)	13	163	138.37	84.89%	1.178	slot	24	0.577501
pubmed, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	238	172	52.70%	1.3837	CP	106	0.735246
(b)	0	297	172	54.35%	1.7267	CP	14	0.84968
(c)	36	199	162.15	81.48%	1.2273	slot	14	0.659603
(d)	0	199	172	81.11%	1.157	CP	40	0.659603
(e)	36	173	162.15	93.73%	1.0669	slot	13	0.609174
pubmed, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	281	193.88	69.00%	1.4493	slot	89	0.096705
(b)	0	380	207.05	54.49%	1.8353	slot	28	0.116805
(c)	13	260	212.81	81.85%	1.2217	slot	28	0.092442
(d)	0	233	207.05	88.86%	1.1253	slot	27	0.08696
(e)	13	237	212.81	89.79%	1.1137	slot	28	0.087772
pubmed, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	281	193.88	69.00%	1.4493	slot	89	0.098726
(b)	0	367	233.53	63.63%	1.5715	slot	15	0.116805
(c)	36	277	237.64	85.79%	1.1656	slot	16	0.097885
(d)	0	245	233.53	95.32%	1.0491	slot	16	0.091158
(e)	36	249	237.64	95.44%	1.0478	slot	16	0.091999
pubmed, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	266	174	64.31%	1.5287	CP	95	0.11098
(b)	0	356	183.98	51.68%	1.935	slot	27	0.137274
(c)	13	233	188.0	80.69%	1.2394	slot	27	0.101339
(d)	0	211	183.98	87.19%	1.1469	slot	27	0.094912
(e)	13	212	188.0	88.68%	1.1277	slot	27	0.095204
pubmed, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	266	174	64.31%	1.5287	CP	95	0.113691
(b)	0	344	209.49	60.90%	1.6421	slot	15	0.137274
(c)	36	251	212.48	84.65%	1.1813	slot	15	0.109156
(d)	0	221	209.49	94.79%	1.0549	slot	15	0.100086
(e)	36	224	212.48	94.86%	1.0542	slot	16	0.100993
pubmed, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	678	627.48	92.55%	1.0805	slot	65	0.289589
(b)	0	821	645.35	78.60%	1.2722	slot	32	0.300917
(c)	13	758	684.25	90.27%	1.1078	slot	35	0.295927
(d)	0	665	645.35	97.04%	1.0305	slot	32	0.288559
(e)	13	702	684.25	97.47%	1.0259	slot	35	0.29149
pubmed, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	678	627.48	92.55%	1.0805	slot	65	0.289852
(b)	0	817	690.25	84.49%	1.1836	slot	30	0.300917
(c)	36	770	715.74	92.95%	1.0758	slot	32	0.297176
(d)	0	703	690.25	98.19%	1.0185	slot	31	0.291842
(e)	36	729	715.74	98.18%	1.0185	slot	33	0.293912
pubmed, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	744	695.94	93.54%	1.0691	slot	64	0.356582
(b)	0	891	714.55	80.20%	1.2469	slot	34	0.380276
(c)	13	837	758.69	90.64%	1.1032	slot	36	0.371572
(d)	0	734	714.55	97.35%	1.0272	slot	34	0.35497
(e)	13	775	758.69	97.89%	1.0215	slot	35	0.361579
pubmed, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	744	695.94	93.54%	1.0691	slot	64	0.356717
(b)	0	890	762.37	85.66%	1.1674	slot	34	0.380276
(c)	36	849	791.23	93.20%	1.073	slot	36	0.37366
(d)	0	777	762.37	98.12%	1.0192	slot	34	0.362042
(e)	36	806	791.23	98.17%	1.0187	slot	36	0.366721
pubmed, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	323	262.35	81.22%	1.2312	slot	65	0.075284
(b)	0	450	276.25	61.39%	1.6289	slot	29	0.083429
(c)	13	339	287.25	84.73%	1.1802	slot	29	0.07631
(d)	0	302	276.25	91.47%	1.0932	slot	29	0.073937
(e)	13	311	287.25	92.36%	1.0827	slot	29	0.074514
pubmed, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	323	262.35	81.22%	1.2312	slot	65	0.075851
(b)	0	438	305.64	69.78%	1.433	slot	18	0.083429
(c)	36	354	313.13	88.45%	1.1305	slot	19	0.077894
(d)	0	316	305.64	96.72%	1.0339	slot	17	0.07539
(e)	36	324	313.13	96.65%	1.0347	slot	19	0.075917
pubmed, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	344	285.17	82.90%	1.2063	slot	64	0.097523
(b)	0	473	299.32	63.28%	1.5802	slot	29	0.113721
(c)	13	365	312.06	85.50%	1.1696	slot	29	0.10016
(d)	0	325	299.32	92.10%	1.0858	slot	29	0.095137
(e)	13	335	312.06	93.15%	1.0735	slot	29	0.096393

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
pubmed, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	344	285.17	82.90%	1.2063	slot	64	0.098648
(b)	0	461	329.68	71.51%	1.3983	slot	18	0.113721
(c)	36	379	338.29	89.26%	1.1203	slot	19	0.103157
(d)	0	340	329.68	96.96%	1.0313	slot	18	0.098132
(e)	36	349	338.29	96.93%	1.0316	slot	19	0.099292
tolokers-2, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	3002	2141	41.38%	1.4021	CP	1242	0.343433
(b)	0	3906	2141	35.73%	1.8244	CP	457	0.435947
(c)	153	2179	1399.78	64.24%	1.5567	slot	457	0.259209
(d)	0	2141	2141	65.18%	1.0	CP	499	0.25532
(e)	153	2076	1399.78	67.43%	1.4831	slot	458	0.248668
tolokers-2, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	3002	2141	41.38%	1.4021	CP	1242	0.366883
(b)	0	3629	2141	46.44%	1.695	CP	256	0.435947
(c)	442	2230	1689.43	75.76%	1.32	slot	256	0.281848
(d)	0	2549	2141	66.12%	1.1906	CP	787	0.316985
(e)	442	1989	1689.43	84.94%	1.1773	slot	257	0.255301
tolokers-2, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	2988	2140	41.12%	1.3963	CP	1242	0.480967
(b)	0	3890	2140	35.52%	1.8178	CP	455	0.615697
(c)	153	2160	1384.13	64.08%	1.5606	slot	455	0.357291
(d)	0	2140	2140	64.56%	1.0	CP	501	0.354304
(e)	153	2058	1384.13	67.26%	1.4869	slot	455	0.342056
tolokers-2, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	2988	2140	41.12%	1.3963	CP	1242	0.515185
(b)	0	3613	2140	46.25%	1.6883	CP	254	0.615697
(c)	442	2211	1673.48	75.69%	1.3212	slot	254	0.390228
(d)	0	2548	2140	65.59%	1.1907	CP	800	0.444424
(e)	442	1972	1673.48	84.86%	1.1784	slot	254	0.351793
tolokers-2, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	2975	2139	40.84%	1.3908	CP	1225	2.381221
(b)	0	3874	2139	35.31%	1.8111	CP	451	3.015403
(c)	153	2141	1368.47	63.92%	1.5645	slot	451	1.792892
(d)	0	2139	2139	63.95%	1.0	CP	508	1.791481
(e)	153	2041	1368.47	67.05%	1.4914	slot	451	1.722349
tolokers-2, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	2975	2139	40.84%	1.3908	CP	1225	2.542207
(b)	0	3598	2139	46.05%	1.6821	CP	251	3.015403
(c)	442	2194	1657.52	75.55%	1.3237	slot	253	1.949004
(d)	0	2545	2139	65.10%	1.1898	CP	810	2.215604
(e)	442	1955	1657.52	84.78%	1.1795	slot	253	1.767473
tolokers-2, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	2975	2139	40.84%	1.3908	CP	1225	4.24835
(b)	0	3874	2139	35.31%	1.8111	CP	451	5.449451
(c)	153	2141	1368.47	63.92%	1.5645	slot	451	3.134092
(d)	0	2139	2139	63.95%	1.0	CP	508	3.13142
(e)	153	2041	1368.47	67.05%	1.4914	slot	451	3.000488
tolokers-2, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	2975	2139	40.84%	1.3908	CP	1225	4.553248
(b)	0	3598	2139	46.05%	1.6821	CP	251	5.449451
(c)	442	2194	1657.52	75.55%	1.3237	slot	253	3.429758
(d)	0	2545	2139	65.10%	1.1898	CP	810	3.934681
(e)	442	1955	1657.52	84.78%	1.1795	slot	253	3.08595
tolokers-2, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	3016	2142	41.64%	1.408	CP	1247	0.410372
(b)	0	3922	2142	35.93%	1.831	CP	462	0.521735
(c)	153	2198	1415.44	64.40%	1.5529	slot	462	0.309826
(d)	0	2142	2142	65.79%	1.0	CP	487	0.302943
(e)	153	2093	1415.44	67.63%	1.4787	slot	462	0.29692
tolokers-2, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	3016	2142	41.64%	1.408	CP	1247	0.438545
(b)	0	3645	2142	46.63%	1.7017	CP	257	0.521735
(c)	442	2249	1705.39	75.83%	1.3188	slot	258	0.337103
(d)	0	2551	2142	66.63%	1.1909	CP	775	0.377045
(e)	442	2006	1705.39	85.01%	1.1763	slot	259	0.304964
tolokers-2, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	3002	2141	41.38%	1.4021	CP	1242	0.592531
(b)	0	3906	2141	35.73%	1.8244	CP	457	0.760943
(c)	153	2179	1399.78	64.24%	1.5567	slot	457	0.439208
(d)	0	2141	2141	65.18%	1.0	CP	499	0.432129
(e)	153	2076	1399.78	67.43%	1.4831	slot	458	0.42002
tolokers-2, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	3002	2141	41.38%	1.4021	CP	1242	0.635219
(b)	0	3629	2141	46.44%	1.695	CP	256	0.760943
(c)	442	2230	1689.43	75.76%	1.32	slot	256	0.48042
(d)	0	2549	2141	66.12%	1.1906	CP	787	0.544385
(e)	442	1989	1689.43	84.94%	1.1773	slot	257	0.432096

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
tolokers-2, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	3271	2161	46.30%	1.5137	CP	1338	0.359092
(b)	0	4221	2161	39.57%	1.9533	CP	541	0.394878
(c)	153	2554	1712.91	67.07%	1.491	slot	543	0.332084
(d)	0	2371	2161	70.45%	1.0972	CP	522	0.325191
(e)	153	2414	1712.91	70.96%	1.4093	slot	542	0.32681
tolokers-2, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	3271	2161	46.30%	1.5137	CP	1338	0.367646
(b)	0	3947	2161	49.94%	1.8265	CP	300	0.394878
(c)	442	2605	2008.55	77.10%	1.297	slot	305	0.340817
(d)	0	2591	2161	76.08%	1.199	CP	585	0.340253
(e)	442	2327	2008.55	86.32%	1.1585	slot	305	0.329618
tolokers-2, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	3311	2164	46.97%	1.53	CP	1347	0.484632
(b)	0	4268	2164	40.10%	1.9723	CP	547	0.556304
(c)	153	2610	1759.88	67.43%	1.4831	slot	550	0.432133
(d)	0	2416	2164	70.84%	1.1165	CP	534	0.417603
(e)	153	2465	1759.88	71.39%	1.4007	slot	549	0.421273
tolokers-2, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	3311	2164	46.97%	1.53	CP	1347	0.501644
(b)	0	3994	2164	50.43%	1.8457	CP	307	0.556304
(c)	442	2659	2056.42	77.34%	1.293	slot	311	0.449464
(d)	0	2599	2164	77.49%	1.201	CP	555	0.444662
(e)	442	2377	2056.42	86.51%	1.1559	slot	311	0.426895
tolokers-2, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	3057	2145	42.42%	1.4252	CP	1264	0.164715
(b)	0	3970	2145	36.53%	1.8508	CP	473	0.197611
(c)	153	2255	1462.41	64.85%	1.542	slot	476	0.135818
(d)	0	2145	2145	67.62%	1.0	CP	454	0.131855
(e)	153	2145	1462.41	68.18%	1.4668	slot	477	0.131855
tolokers-2, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	3057	2145	42.42%	1.4252	CP	1264	0.172977
(b)	0	3693	2145	47.19%	1.7217	CP	263	0.197611
(c)	442	2307	1753.26	76.00%	1.3158	slot	263	0.143927
(d)	0	2559	2145	68.10%	1.193	CP	748	0.153688
(e)	442	2056	1753.26	85.28%	1.1727	slot	263	0.134205
tolokers-2, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	3071	2146	42.67%	1.431	CP	1274	0.271669
(b)	0	3986	2146	36.73%	1.8574	CP	479	0.336426
(c)	153	2274	1478.06	65.00%	1.5385	slot	479	0.215264
(d)	0	2146	2146	68.23%	1.0	CP	442	0.206205
(e)	153	2162	1478.06	68.37%	1.4627	slot	479	0.207338
tolokers-2, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	3071	2146	42.67%	1.431	CP	1274	0.287901
(b)	0	3709	2146	47.37%	1.7283	CP	266	0.336426
(c)	442	2325	1769.21	76.10%	1.3141	slot	266	0.231162
(d)	0	2561	2146	68.60%	1.1934	CP	737	0.249112
(e)	442	2073	1769.21	85.35%	1.1717	slot	265	0.211996
twitch-views, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	42714	35282	38.20%	1.2106	CP	26458	4.56186
(b)	0	49553	35282	40.41%	1.4045	CP	1258	5.286467
(c)	3701	23108	20027.91	86.67%	1.1538	slot	1259	2.484559
(d)	0	36569	35282	54.76%	1.0365	CP	17196	3.910783
(e)	3701	20567	20027.91	97.38%	1.0269	slot	1259	2.215335
twitch-views, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	42714	35282	38.20%	1.2106	CP	26458	4.542128
(b)	0	49770	35282	46.59%	1.4106	CP	962	5.286467
(c)	6848	29299	23201.09	79.19%	1.2628	slot	964	3.126975
(d)	0	42293	35282	54.82%	1.1987	CP	19753	4.497716
(e)	6848	23399	23201.09	99.15%	1.0085	slot	952	2.504582
twitch-views, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	42563	35281	37.88%	1.2064	CP	26449	6.61348
(b)	0	49358	35281	40.17%	1.399	CP	1247	7.663761
(c)	3701	22909	19829.83	86.56%	1.1553	slot	1248	3.575626
(d)	0	36567	35281	54.22%	1.0365	CP	17382	5.686698
(e)	3701	20369	19829.83	97.35%	1.0272	slot	1248	3.183027
twitch-views, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	42563	35281	37.88%	1.2064	CP	26449	6.585476
(b)	0	49569	35281	46.36%	1.405	CP	951	7.663761
(c)	6848	29087	22991.75	79.04%	1.2651	slot	952	4.511402
(d)	0	42207	35281	54.45%	1.1963	CP	19865	6.530685
(e)	6848	23188	22991.75	99.15%	1.0085	slot	934	3.603494
twitch-views, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	42412	35280	37.56%	1.2022	CP	26432	31.198551
(b)	0	49163	35280	39.93%	1.3935	CP	1235	36.119654
(c)	3701	22710	19631.75	86.45%	1.1568	slot	1235	16.836891
(d)	0	36578	35280	53.67%	1.0368	CP	17583	26.94589
(e)	3701	20170	19631.75	97.33%	1.0274	slot	1235	14.985373

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
twitch-views, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	42412	35280	37.56%	1.2022	CP	26432	31.072044
(b)	0	49365	35280	46.14%	1.3992	CP	940	36.119654
(c)	6848	28876	22782.42	78.90%	1.2675	slot	941	21.24543
(d)	0	42103	35280	54.10%	1.1934	CP	19960	30.847722
(e)	6848	22978	22782.42	99.15%	1.0086	slot	930	16.963709
twitch-views, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	42412	35280	37.56%	1.2022	CP	26432	58.841899
(b)	0	49163	35280	39.93%	1.3935	CP	1235	68.1646
(c)	3701	22710	19631.75	86.45%	1.1568	slot	1235	31.634692
(d)	0	36578	35280	53.67%	1.0368	CP	17583	50.785516
(e)	3701	20170	19631.75	97.33%	1.0274	slot	1235	28.127114
twitch-views, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	42412	35280	37.56%	1.2022	CP	26432	58.602239
(b)	0	49365	35280	46.14%	1.3992	CP	940	68.1646
(c)	6848	28876	22782.42	78.90%	1.2675	slot	941	39.986374
(d)	0	42103	35280	54.10%	1.1934	CP	19960	58.177276
(e)	6848	22978	22782.42	99.15%	1.0086	slot	930	31.87494
twitch-views, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	42864	35283	38.53%	1.2149	CP	26438	5.503226
(b)	0	49749	35283	40.64%	1.41	CP	1271	6.380808
(c)	3701	23308	20225.99	86.78%	1.1524	slot	1271	3.010561
(d)	0	36578	35283	55.28%	1.0367	CP	17015	4.701994
(e)	3701	20766	20225.99	97.40%	1.0267	slot	1271	2.68655
twitch-views, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	42864	35283	38.53%	1.2149	CP	26438	5.478736
(b)	0	49973	35283	46.81%	1.4163	CP	973	6.380808
(c)	6848	29512	23410.43	79.33%	1.2606	slot	976	3.784479
(d)	0	42300	35283	55.30%	1.1989	CP	19557	5.407169
(e)	6848	23609	23410.43	99.16%	1.0085	slot	962	3.035438
twitch-views, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	42714	35282	38.20%	1.2106	CP	26458	8.275778
(b)	0	49553	35282	40.41%	1.4045	CP	1258	9.595498
(c)	3701	23108	20027.91	86.67%	1.1538	slot	1259	4.492413
(d)	0	36569	35282	54.76%	1.0365	CP	17196	7.089979
(e)	3701	20567	20027.91	97.38%	1.0269	slot	1259	4.002077
twitch-views, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	42714	35282	38.20%	1.2106	CP	26458	8.23984
(b)	0	49770	35282	46.59%	1.4106	CP	962	9.595498
(c)	6848	29299	23201.09	79.19%	1.2628	slot	964	5.662438
(d)	0	42293	35282	54.82%	1.1987	CP	19753	8.158954
(e)	6848	23399	23201.09	99.15%	1.0085	slot	952	4.52888
twitch-views, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	45716	35302	44.21%	1.295	CP	26048	2.050092
(b)	0	53454	35302	44.81%	1.5142	CP	1465	2.35717
(c)	3701	27094	23989.52	88.54%	1.1294	slot	1468	1.311088
(d)	0	36665	35302	65.33%	1.0386	CP	13550	1.690908
(e)	3701	24537	23989.52	97.77%	1.0228	slot	1468	1.209615
twitch-views, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	45716	35302	44.21%	1.295	CP	26048	2.038022
(b)	0	53812	35302	50.68%	1.5243	CP	1169	2.35717
(c)	6848	33526	27387.8	81.69%	1.2241	slot	1179	1.557487
(d)	0	43604	35302	62.55%	1.2352	CP	17191	1.954766
(e)	6848	27600	27387.8	99.23%	1.0077	slot	1180	1.323882
twitch-views, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	46163	35305	45.04%	1.3075	CP	25947	3.887985
(b)	0	54038	35305	45.42%	1.5306	CP	1496	4.510868
(c)	3701	27695	24583.76	88.77%	1.1266	slot	1499	2.427235
(d)	0	36706	35305	66.87%	1.0397	CP	13022	3.139971
(e)	3701	25132	24583.76	97.82%	1.0223	slot	1500	2.224511
twitch-views, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	46163	35305	45.04%	1.3075	CP	25947	3.862554
(b)	0	54417	35305	51.24%	1.5413	CP	1197	4.510868
(c)	6848	34161	28015.81	82.01%	1.2193	slot	1212	2.919852
(d)	0	43764	35305	63.72%	1.2396	CP	16798	3.674124
(e)	6848	28230	28015.81	99.24%	1.0076	slot	1212	2.454
twitch-views, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	43316	35286	39.47%	1.2276	CP	26412	1.677607
(b)	0	50335	35286	41.34%	1.4265	CP	1302	1.940606
(c)	3701	23907	20820.23	87.09%	1.1483	slot	1302	0.950357
(d)	0	36585	35286	56.88%	1.0368	CP	16473	1.425398
(e)	3701	21363	20820.23	97.46%	1.0261	slot	1303	0.855034
twitch-views, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	43316	35286	39.47%	1.2276	CP	26412	1.669745
(b)	0	50580	35286	47.46%	1.4334	CP	1004	1.940606
(c)	6848	30146	24038.43	79.74%	1.2541	slot	1009	1.178659
(d)	0	42490	35286	56.49%	1.2042	CP	19182	1.638945
(e)	6848	24239	24038.43	99.17%	1.0083	slot	1010	0.958398

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
twitch-views, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	43467	35287	39.78%	1.2318	CP	26405	3.255535
(b)	0	50530	35287	41.57%	1.432	CP	1312	3.775702
(c)	3701	24107	21018.31	87.19%	1.147	slot	1313	1.829732
(d)	0	36587	35287	57.41%	1.0368	CP	16286	2.748844
(e)	3701	21561	21018.31	97.48%	1.0258	slot	1313	1.642227
twitch-views, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	43467	35287	39.78%	1.2318	CP	26405	3.239712
(b)	0	50781	35287	47.67%	1.4391	CP	1014	3.775702
(c)	6848	30356	24247.77	79.88%	1.2519	slot	1018	2.278901
(d)	0	42551	35287	56.89%	1.2059	CP	19064	3.172585
(e)	6848	24449	24247.77	99.18%	1.0083	slot	1021	1.846019
web-fraud, GATv2 forward, $d = 128$, $q = 0.99$								
(a)	0	228993	228993	10.90%	1.0	CP	204887	7.288282
(b)	0	247616	228993	12.64%	1.0813	CP	1248	7.878061
(c)	6272	31596	31354.0	99.23%	1.0077	slot	1254	1.03684
(d)	0	228993	228993	13.67%	1.0	CP	199286	7.288282
(e)	6272	31357	31354.0	99.99%	1.0001	slot	1254	1.029271
web-fraud, GATv2 forward, $d = 128$, $q = 0.95$								
(a)	0	228993	228993	10.90%	1.0	CP	204887	7.380976
(b)	0	244491	228993	14.08%	1.0677	CP	1248	7.878061
(c)	9131	34817	34678.48	99.60%	1.004	slot	1274	1.152941
(d)	0	228993	228993	15.03%	1.0	CP	196162	7.380976
(e)	9131	34681	34678.48	99.99%	1.0001	slot	1274	1.148579
web-fraud, GATv2 forward, $d = 256$, $q = 0.99$								
(a)	0	228992	228992	9.44%	1.0	CP	198429	10.260605
(b)	0	244304	228992	11.43%	1.0669	CP	1082	10.944383
(c)	6272	28201	27956.9	99.13%	1.0087	slot	1085	1.294011
(d)	0	228992	228992	12.19%	1.0	CP	198429	10.260605
(e)	6272	27959	27956.9	99.99%	1.0001	slot	1085	1.283204
web-fraud, GATv2 forward, $d = 256$, $q = 0.95$								
(a)	0	228992	228992	9.44%	1.0	CP	198429	10.387395
(b)	0	241312	228992	12.81%	1.0538	CP	1081	10.944383
(c)	9131	31222	31081.68	99.55%	1.0045	slot	1098	1.446205
(d)	0	228992	228992	13.50%	1.0	CP	198429	10.387395
(e)	9131	31084	31081.68	99.99%	1.0001	slot	1098	1.439966
web-fraud, Graph Transformer backward, $d = 128$, $q = 0.99$								
(a)	0	909647	898796	2.01%	1.0121	CP	0	42.387825
(b)	0	918319	898796	3.19%	1.0217	CP	929	42.78923
(c)	11041	37706	29328.61	77.78%	1.2856	slot	931	2.027882
(d)	0	911477	898796	3.22%	1.0141	CP	0	42.472531
(e)	11041	30828	29328.61	95.14%	1.0511	slot	382	1.709517
web-fraud, Graph Transformer backward, $d = 128$, $q = 0.95$								
(a)	0	909647	898796	2.01%	1.0121	CP	0	42.294132
(b)	0	920367	898796	3.39%	1.024	CP	918	42.78923
(c)	12953	41548	31318.52	75.38%	1.3266	slot	927	2.201439
(d)	0	915707	898796	3.41%	1.0188	CP	0	42.57401
(e)	12953	36883	31318.52	84.91%	1.1777	slot	732	1.985988
web-fraud, Graph Transformer backward, $d = 256$, $q = 0.99$								
(a)	0	909647	898796	2.01%	1.0121	CP	0	83.436134
(b)	0	918319	898796	3.19%	1.0217	CP	929	84.228953
(c)	11041	37706	29328.61	77.78%	1.2856	slot	931	3.720818
(d)	0	911477	898796	3.22%	1.0141	CP	0	83.603438
(e)	11041	30828	29328.61	95.14%	1.0511	slot	382	3.092011
web-fraud, Graph Transformer backward, $d = 256$, $q = 0.95$								
(a)	0	909647	898796	2.01%	1.0121	CP	0	83.251081
(b)	0	920367	898796	3.39%	1.024	CP	918	84.228953
(c)	12953	41548	31318.52	75.38%	1.3266	slot	927	4.063612
(d)	0	915707	898796	3.41%	1.0188	CP	0	83.80387
(e)	12953	36883	31318.52	84.91%	1.1777	slot	732	3.638073
web-fraud, Graph Transformer forward, $d = 128$, $q = 0.99$								
(a)	0	228994	228994	12.36%	1.0	CP	201754	10.32038
(b)	0	250929	228994	13.82%	1.0958	CP	1416	11.305156
(c)	6272	34995	34751.1	99.30%	1.007	slot	1423	1.610761
(d)	0	228994	228994	15.14%	1.0	CP	196073	10.32038
(e)	6272	34754	34751.1	99.99%	1.0001	slot	1423	1.599941
web-fraud, Graph Transformer forward, $d = 128$, $q = 0.95$								
(a)	0	228994	228994	12.36%	1.0	CP	201754	10.455661
(b)	0	247670	228994	15.32%	1.0816	CP	1416	11.305156
(c)	9131	38412	38275.29	99.64%	1.0036	slot	1449	1.78686
(d)	0	228994	228994	16.57%	1.0	CP	192746	10.455661
(e)	9131	38278	38275.29	99.99%	1.0001	slot	1449	1.780765
web-fraud, Graph Transformer forward, $d = 256$, $q = 0.99$								
(a)	0	228993	228993	10.90%	1.0	CP	204887	14.070677
(b)	0	247616	228993	12.64%	1.0813	CP	1248	15.212278
(c)	6272	31596	31354.0	99.23%	1.0077	slot	1254	1.970122
(d)	0	228993	228993	13.67%	1.0	CP	199286	14.070677
(e)	6272	31357	31354.0	99.99%	1.0001	slot	1254	1.955471

Numerical simulation sweep, continued

mode	slice	T	T^*	U	R	bound	drain	t_{pred}
web-fraud, Graph Transformer forward, $d = 256$, $q = 0.95$								
(a)	0	228993	228993	10.90%	1.0	CP	204887	14.250098
(b)	0	244491	228993	14.08%	1.0677	CP	1248	15.212278
(c)	9131	34817	34678.48	99.60%	1.004	slot	1274	2.194851
(d)	0	228993	228993	15.03%	1.0	CP	196162	14.250098
(e)	9131	34681	34678.48	99.99%	1.0001	slot	1274	2.186408
web-fraud, min aggregation backward, $d = 128$, $q = 0.99$								
(a)	0	949116	898818	9.68%	1.056	CP	860827	9.338523
(b)	0	992836	898818	10.44%	1.1046	CP	4595	9.757827
(c)	11041	112488	104075.76	92.52%	1.0808	slot	4635	1.314712
(d)	0	916446	898818	11.31%	1.0196	CP	818976	9.025197
(e)	11041	104089	104075.76	99.99%	1.0001	slot	4635	1.23416
web-fraud, min aggregation backward, $d = 128$, $q = 0.95$								
(a)	0	949116	898818	9.68%	1.056	CP	860827	9.292494
(b)	0	997882	898818	10.92%	1.1102	CP	4597	9.757827
(c)	12953	121072	111203.91	91.85%	1.0887	slot	4814	1.391167
(d)	0	936308	898818	11.64%	1.0417	CP	833557	9.170278
(e)	12953	111219	111203.91	99.99%	1.0001	slot	4814	1.297148
web-fraud, min aggregation backward, $d = 256$, $q = 0.99$								
(a)	0	954388	898821	10.68%	1.0618	CP	856728	20.246197
(b)	0	1002996	898821	11.35%	1.1159	CP	5097	21.265304
(c)	11041	122683	114268.55	93.14%	1.0736	slot	5140	2.808814
(d)	0	917262	898821	12.41%	1.0205	CP	810085	19.467819
(e)	11041	114283	114268.55	99.99%	1.0001	slot	5141	2.632701
web-fraud, min aggregation backward, $d = 256$, $q = 0.95$								
(a)	0	954388	898821	10.68%	1.0618	CP	856728	20.138512
(b)	0	1008423	898821	11.86%	1.1219	CP	5098	21.265304
(c)	12953	131917	122097.37	92.56%	1.0804	slot	5347	2.987528
(d)	0	939292	898821	12.73%	1.045	CP	826252	19.823715
(e)	12953	122114	122097.37	99.99%	1.0001	slot	5347	2.783106
web-fraud, min aggregation forward, $d = 128$, $q = 0.99$								
(a)	0	228997	228997	16.74%	1.0	CP	192185	3.757114
(b)	0	260866	228997	17.18%	1.1392	CP	1917	4.272388
(c)	6272	45189	44942.4	99.45%	1.0055	slot	1930	0.785209
(d)	0	228997	228997	19.57%	1.0	CP	186395	3.757114
(e)	6272	44947	44942.4	99.99%	1.0001	slot	1930	0.781296
web-fraud, min aggregation forward, $d = 128$, $q = 0.95$								
(a)	0	228997	228997	16.74%	1.0	CP	192185	3.809771
(b)	0	257208	228997	18.85%	1.1232	CP	1917	4.272388
(c)	9131	49199	49065.7	99.73%	1.0027	slot	1976	0.861358
(d)	0	228997	228997	21.17%	1.0	CP	182742	3.809771
(e)	9131	49070	49065.7	99.99%	1.0001	slot	1976	0.859242
web-fraud, min aggregation forward, $d = 256$, $q = 0.99$								
(a)	0	228998	228998	18.20%	1.0	CP	189066	7.579688
(b)	0	264179	228998	18.24%	1.1536	CP	2085	8.735811
(c)	6272	48588	48339.51	99.49%	1.0051	slot	2099	1.651033
(d)	0	228998	228998	21.05%	1.0	CP	183193	7.579688
(e)	6272	48344	48339.51	99.99%	1.0001	slot	2098	1.643015
web-fraud, min aggregation forward, $d = 256$, $q = 0.95$								
(a)	0	228998	228998	18.20%	1.0	CP	189066	7.68928
(b)	0	260387	228998	19.97%	1.1371	CP	2084	8.735811
(c)	9131	52794	52662.5	99.75%	1.0025	slot	2151	1.814517
(d)	0	228998	228998	22.70%	1.0	CP	179358	7.68928
(e)	9131	52667	52662.5	99.99%	1.0001	slot	2151	1.810283