

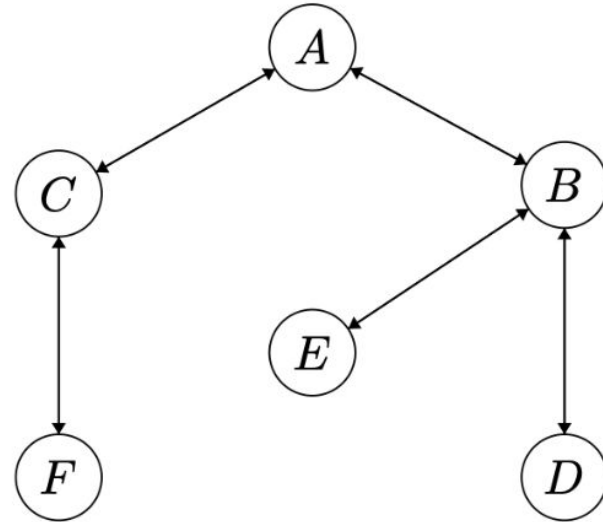


Minimum Vertex Cover

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MVC: BC

Why?





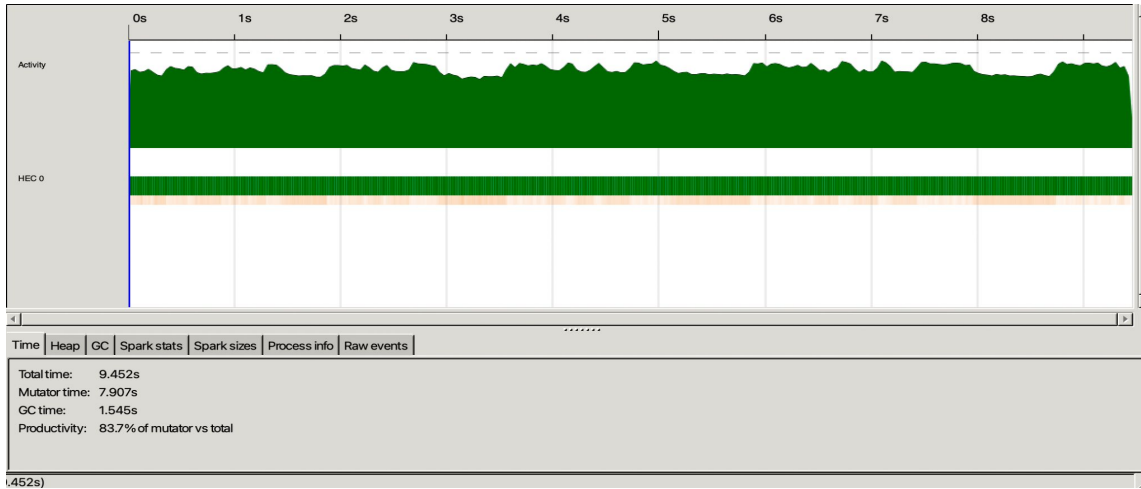
Package.yaml

ghc-options:

- -threaded
- -rtsopts
- -O2

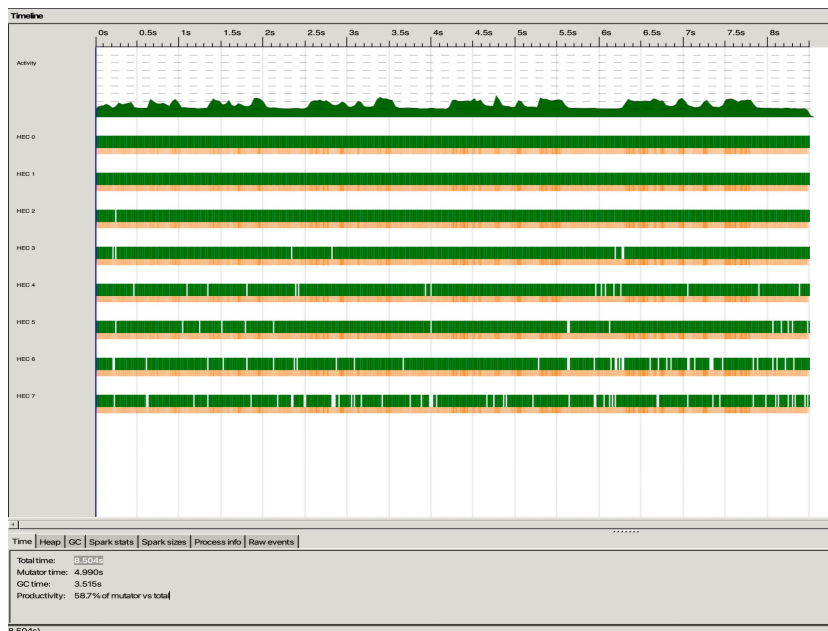


Sequential Brute Force



Maximum Heap Residency: 73.1 KiB

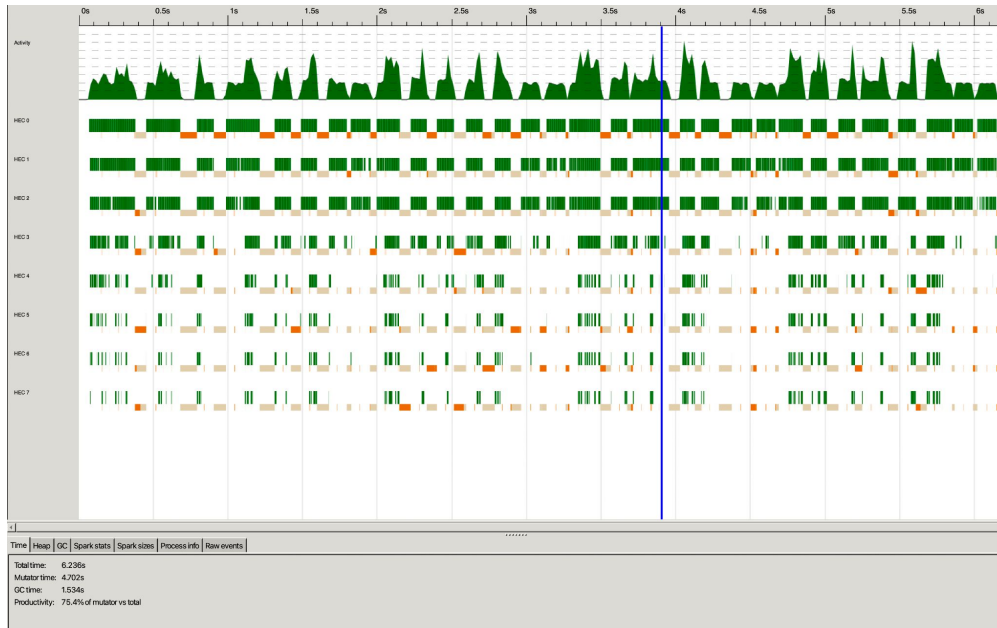
Parallel #1 — Initial Attempt



- Chunk Size 1000
- Parallel Subset Generation with par and pseq (depth = 3)
- Parallel Chunk Verification
- parList and rdeepseq

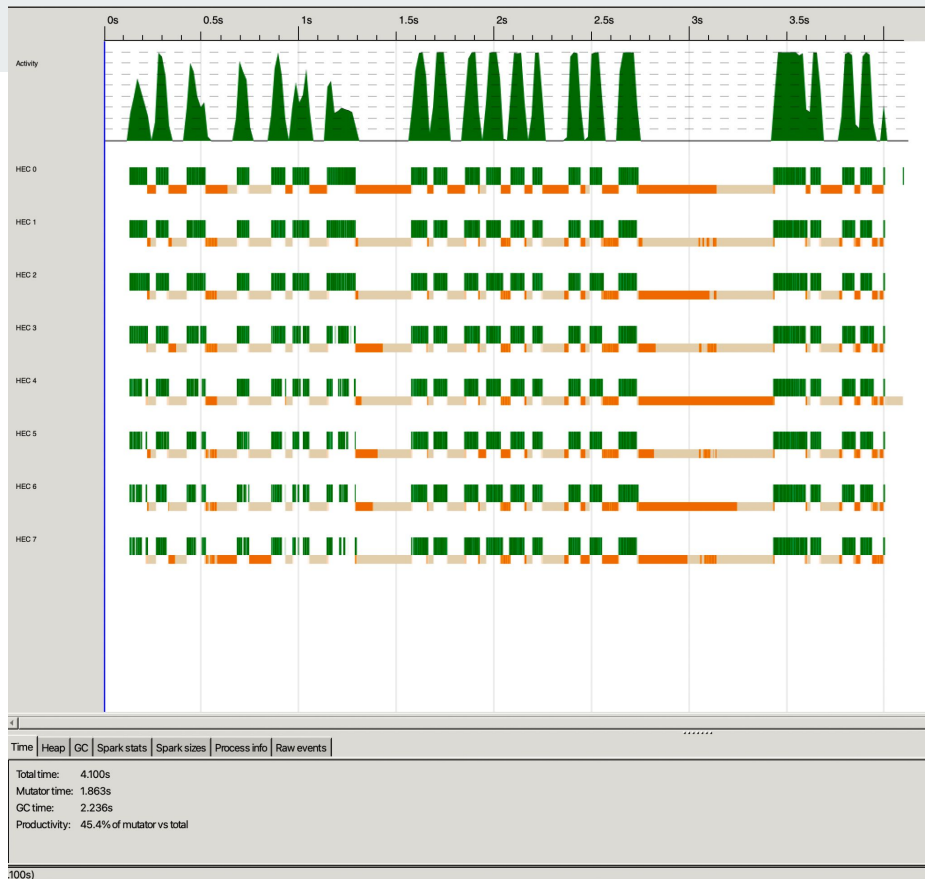
Time	Heap	GC	Spark stats	Spark sizes	Process info	Raw events
HEC	Total	Converted	Overflowed	Dud	GCed	Fizzled
Total	48512	48414	0	0	91	7
HEC 0	48512	0	0	0	91	0
HEC 1	0	11555	0	0	0	0
HEC 2	0	11302	0	0	0	0

Increased Nursery Size



- Increased Nursery Size using -A128M

Time: 6.236s, 75.4% Productivity
212.5 MiB Maximum Heap Residency



- Added Cached Subset Generation
- This now generates subsets sequentially

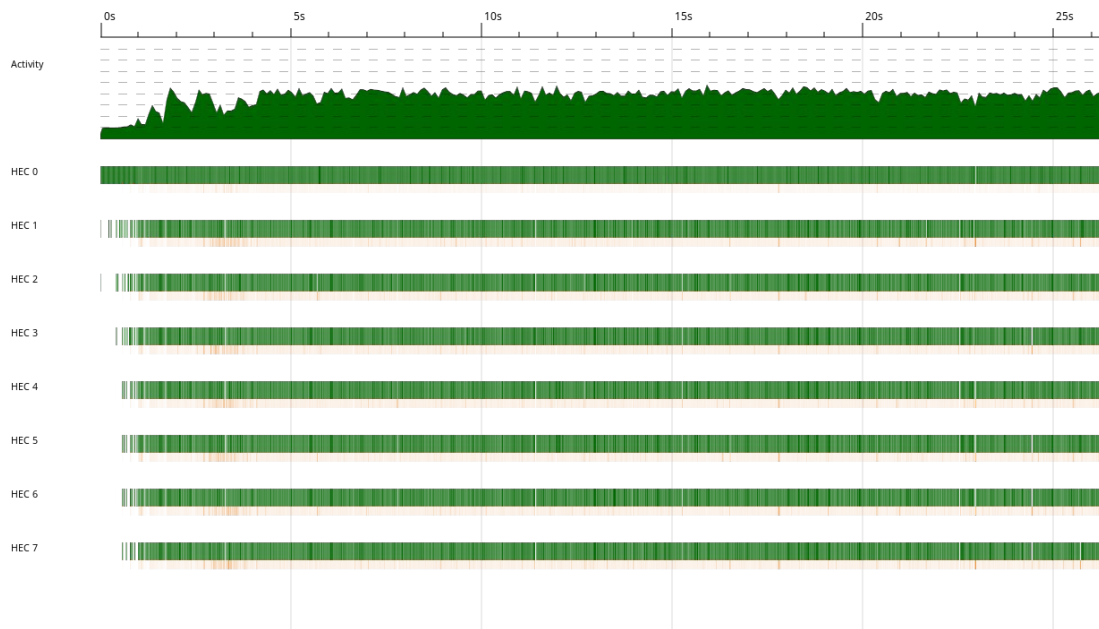
Time: 4.100s, 45.4% Productivity



Moving Towards Memory-Efficient Solutions



Bitmasked Subset Generation



- Bitmasked Subset Generation

Time: 26.347s, 95.9% Productivity
242.1 KiB Maximum Heap Residency

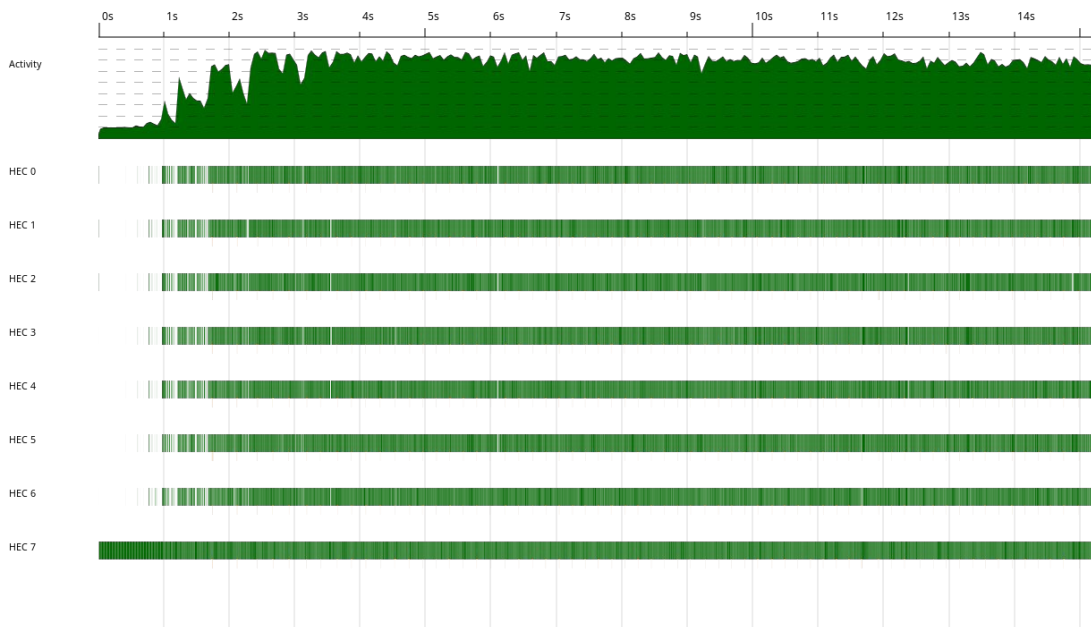


Spark Fizzling...

HEC	Total	Converted	Overflowed	Dud	GCed	Fizzled
Total	48412431	39393101	0	0	8280294	739036
HEC 0	48412431	107281	0	0	8280294	2745
HEC 1	0	5593184	0	0	0	293214
HEC 2	0	5665006	0	0	0	110508
HEC 3	0	5656693	0	0	0	82618
HEC 4	0	5648286	0	0	0	64266
HEC 5	0	5650167	0	0	0	43047
HEC 6	0	5619230	0	0	0	117387
HEC 7	0	5453254	0	0	0	25251



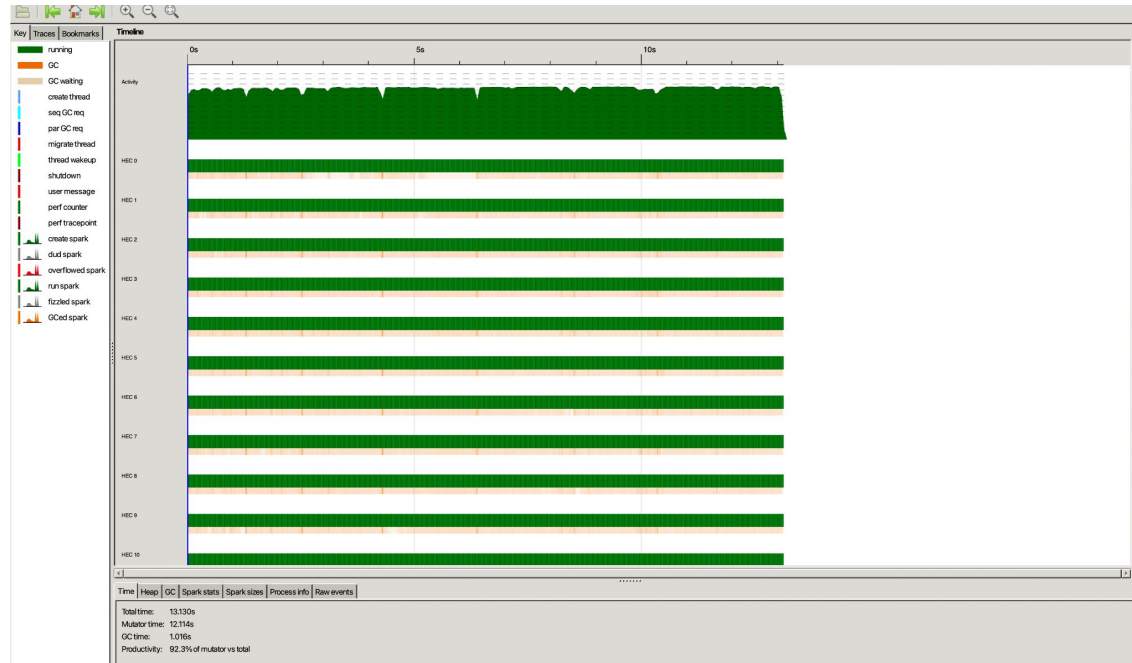
Bitmasked Subset Generation (cont.)



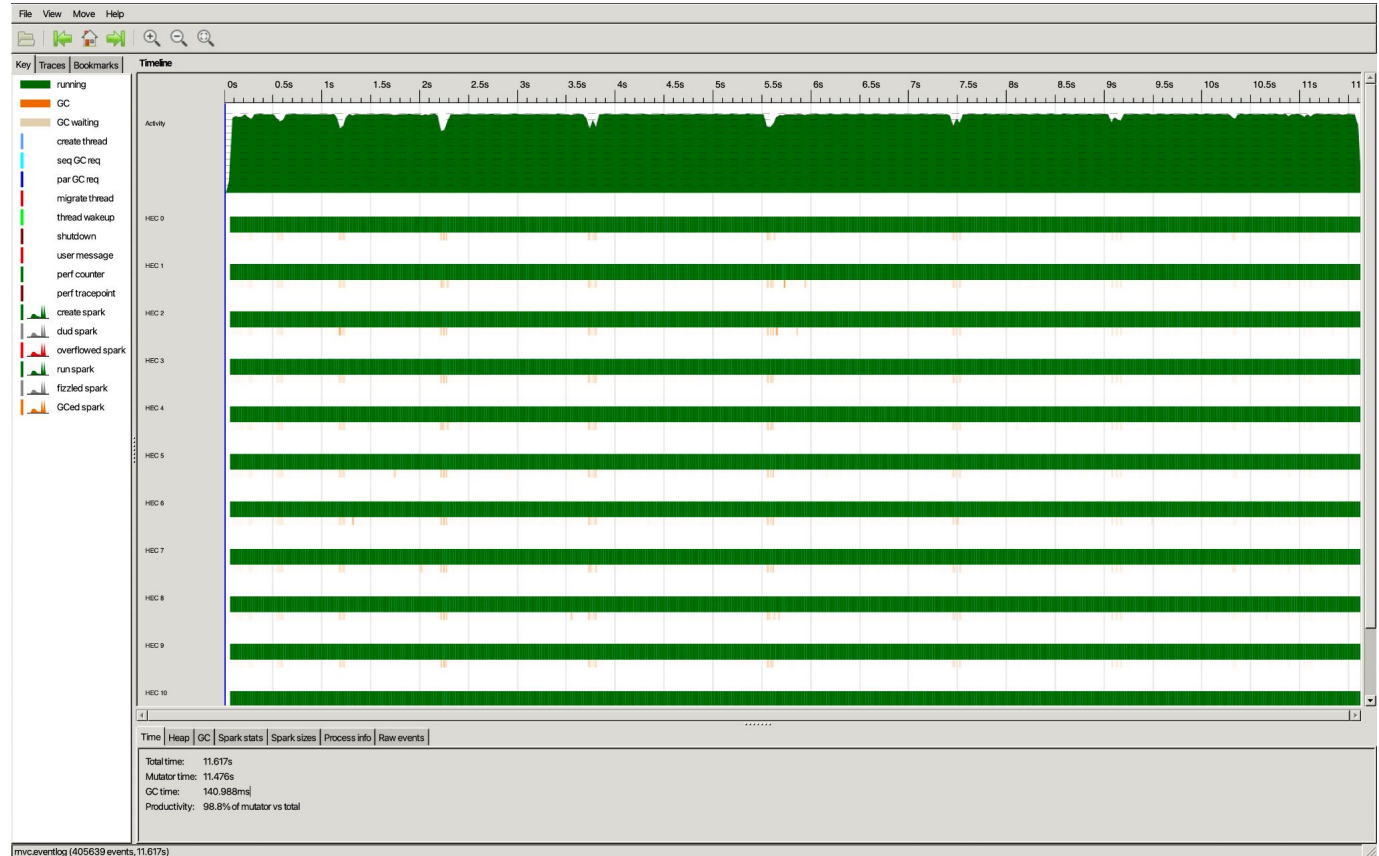
- ParBuffer increased to 10000 from 1000

Time: 15.242s, 99.7% Productivity
1.1MiB Maximum Heap Residency

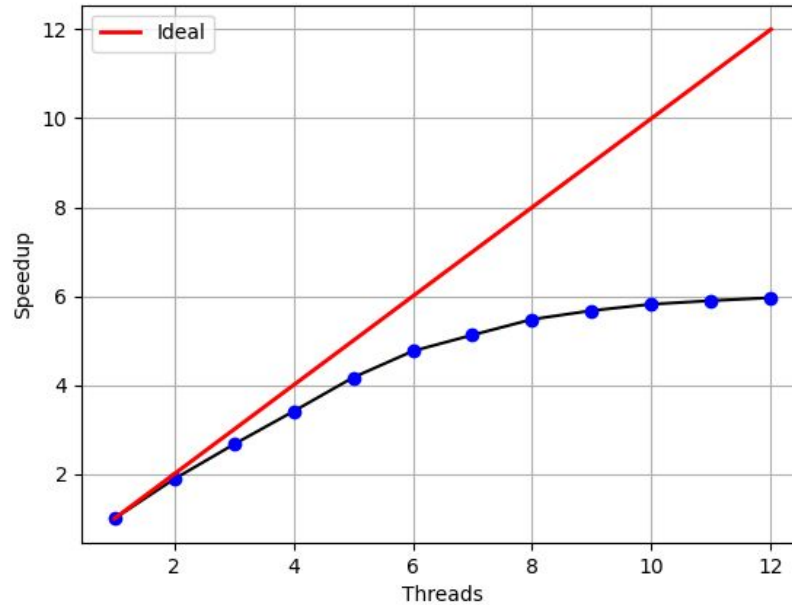
Optimized BFS Stateless Queue (default nursery)

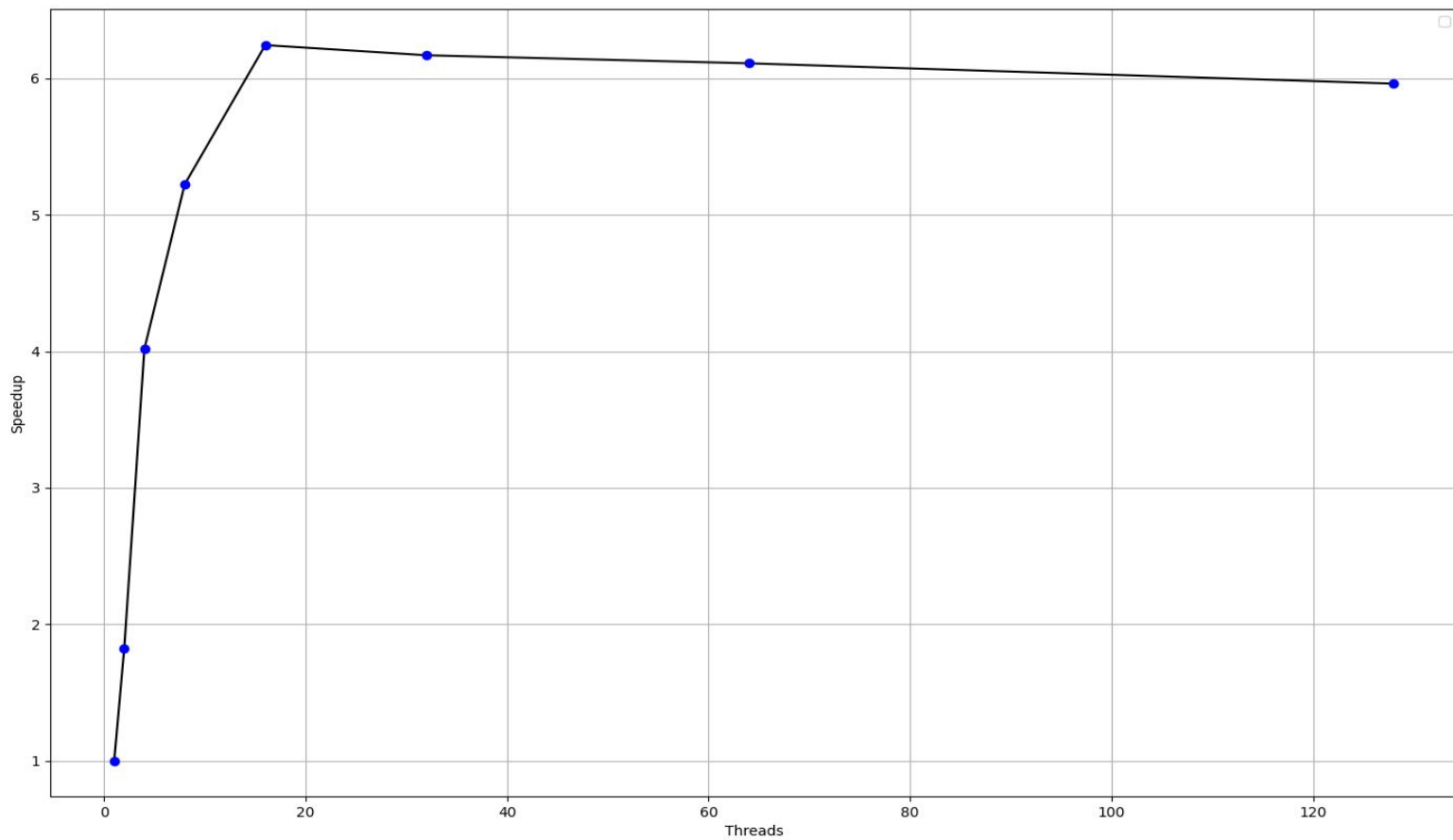


-A128M



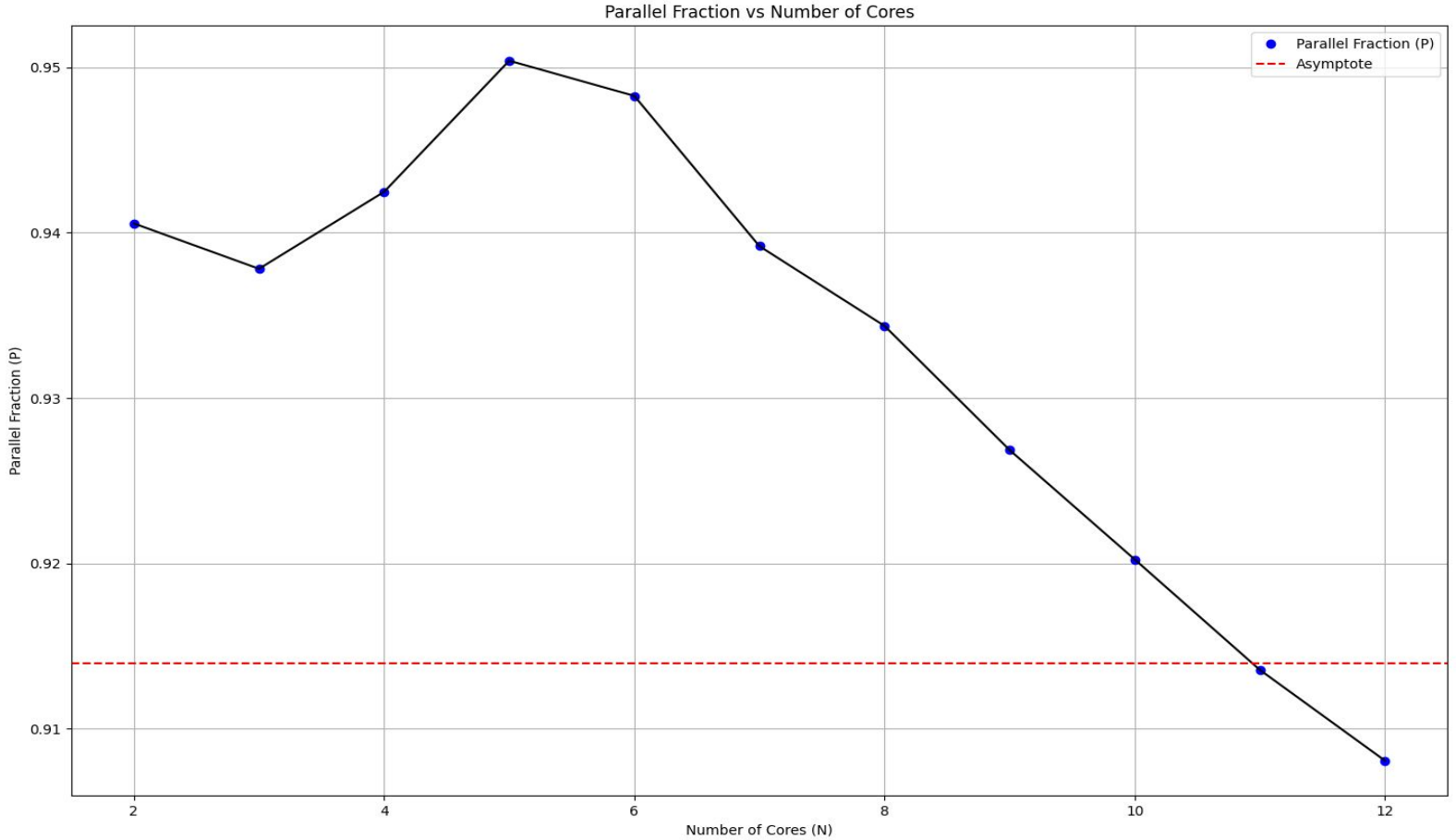
Speedup Graph with Cores





Chunk Size

$$p = (1 - 1.0/s) / (1 - 1.0/n)$$





Tasks

Sparks are not used by the Par monad. Everytime you throw another core into the mix, a thread for execution and a GC thread are created.

<https://simonmar.github.io/publications/multicore-ghc.pdf>

-N 26 tasks

-N1 4 tasks

-N2 6 tasks

-N3 8 tasks

N4 10

N5 12

N6 14

N7 16

N8 18

N9 20

N10 22

N11 24