CS 575 -- Spring Quarter 2023

Project #5

CUDA: Monte Carlo Simulation

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1. The running machine is rabbit.

2. The table:

The new avg probability is 74.72%.

Number of Trials	Blocksize	MegaTrials/Second	Probability
1024	8	10.6101	74.9
1024	32	10.582	74.51
1024	64	7.5223	75.98
1024	128	9.434	75.49
4096	8	22.571	74.93
4096	32	29.568	74.58
4096	64	39.9127	74.27
4096	128	32.888	74.68
16384	8	125.4902	74.8
16384	32	118.546	74.74
16384	64	149.3582	74.4
16384	128	125.1528	74.28
65536	8	324.4613	74.41
65536	32	493.3751	74.51
65536	64	457.2449	74.65
65536	128	391.587	74.83
262144	8	629.7179	74.65
262144	32	1346.0401	74.75
262144	64	1408.7705	74.71
262144	128	1609.7466	74.61
1048576	8	748.8288	74.71
1048576	32	1858.861	74.64
1048576	64	2721.1427	74.72
1048576	128	2673.6292	74.72
2097152	8	791.6314	74.73
2097152	32	2495.4687	74.7
2097152	64	3516.6346	74.69
2097152	128	3659.5936	74.73

3. The graphs are below

   x-axis is NUMTRIALS

   y-axis is performance

Performance vs NUMTRIALS
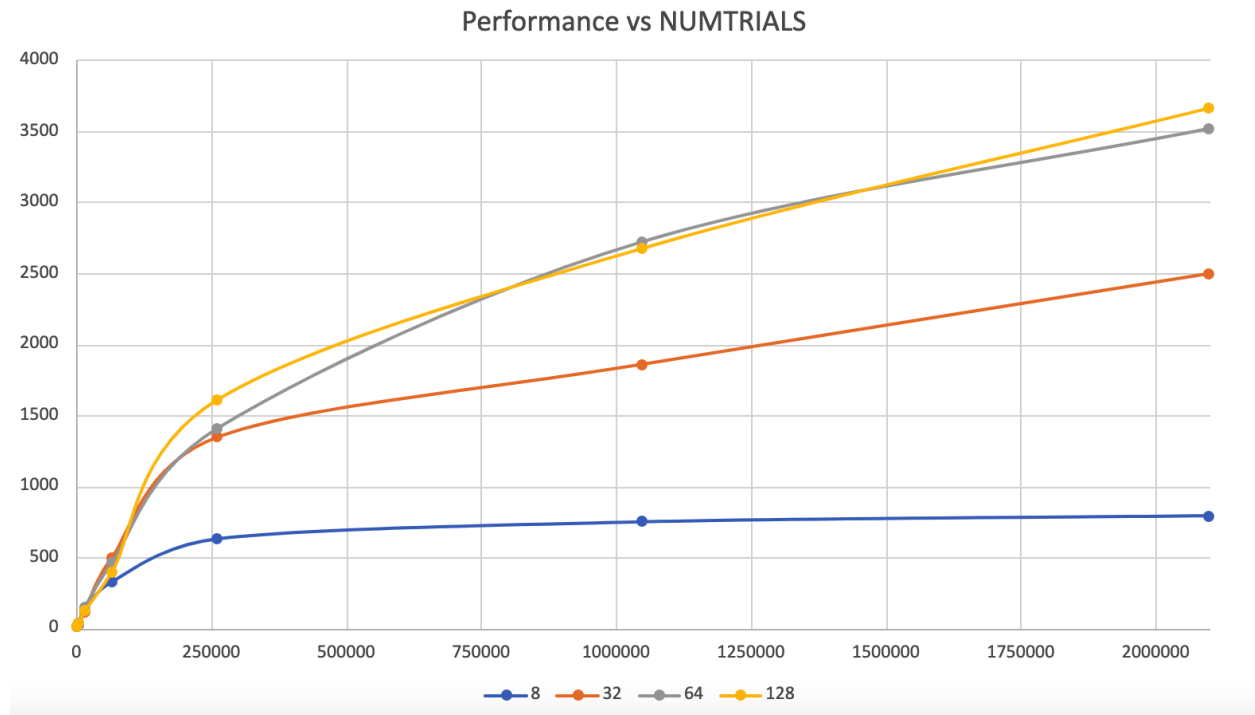
x-axis is BLOCKSIZE

y-axis is performance

Performance vs BLOCKSIZE
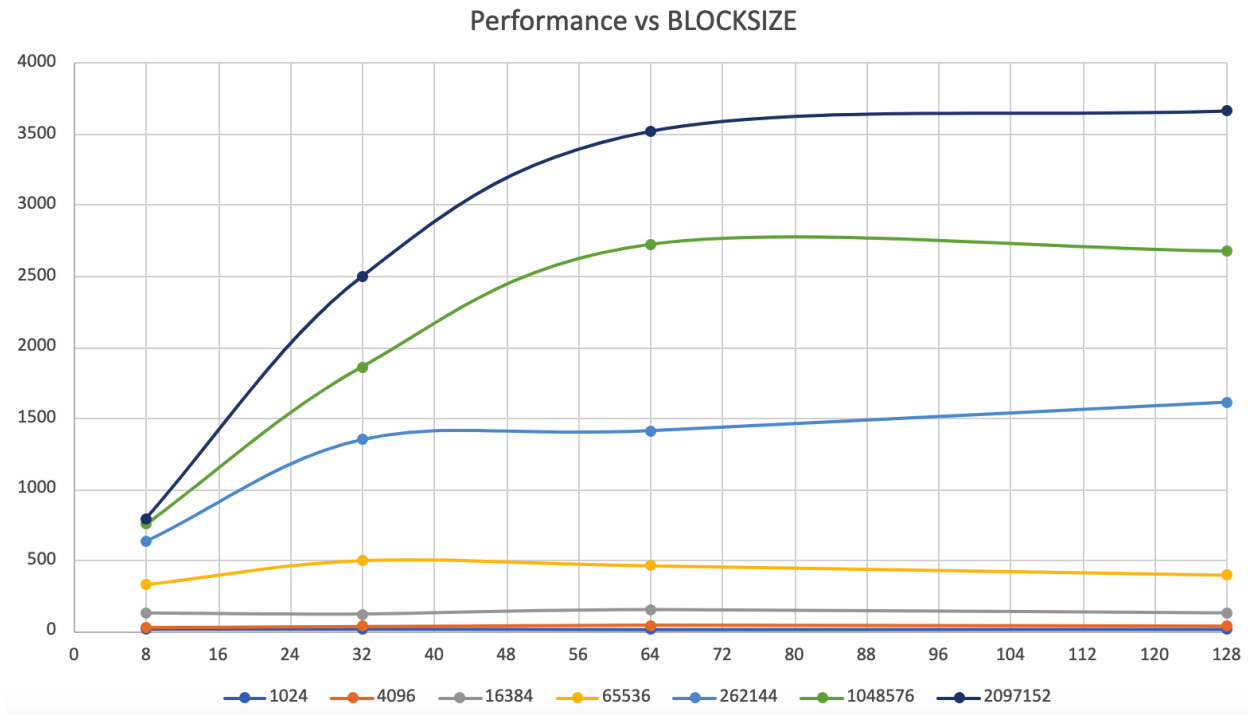
4. In Performance vs. NUMTRIALS, the performance of blocksize 32, 64 and 128 are much better than block size 8, and when NUMTRIALS increases, the performance increases.

In Performance vs. BLOCKSIZE, the performance of blocksize 32, 64 and 128 are much better than block size 8. In blocksize 8, we can find even NUMTRIALS increases to 2097152, and the performance is still not increasing too much. The larger NUMTRIALS is the performance gets more stable.

5. If the data is big enough, the performance can be stable.

6. Since the warps are a set of 32 parallel threads. If the block size is lower than 32, the empty threads are not kept busy and can not fill all warps. This will result in the GPUs creating stalls and lower the performance.

7. The performance is much better than project 1 when the NUMTRIALS and BLOCKSIZE are larger, especially blocksize above 32. Since GPUs have better parallel computing performance compared with CPUs. GPUs have much more cores than CPU for calculating the matrix multiplication.

8. When we are doing large data and matrix computing, GPUs will be a good choice. It can save a lot of time.