Jung-Che Chang

Project #5

CUDA: Monte Carlo Simulation

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1. **Tell what machine you ran this on**

   DGX system

2. **What do you think this new probability is?**

   The probability is approximately 26.8%.

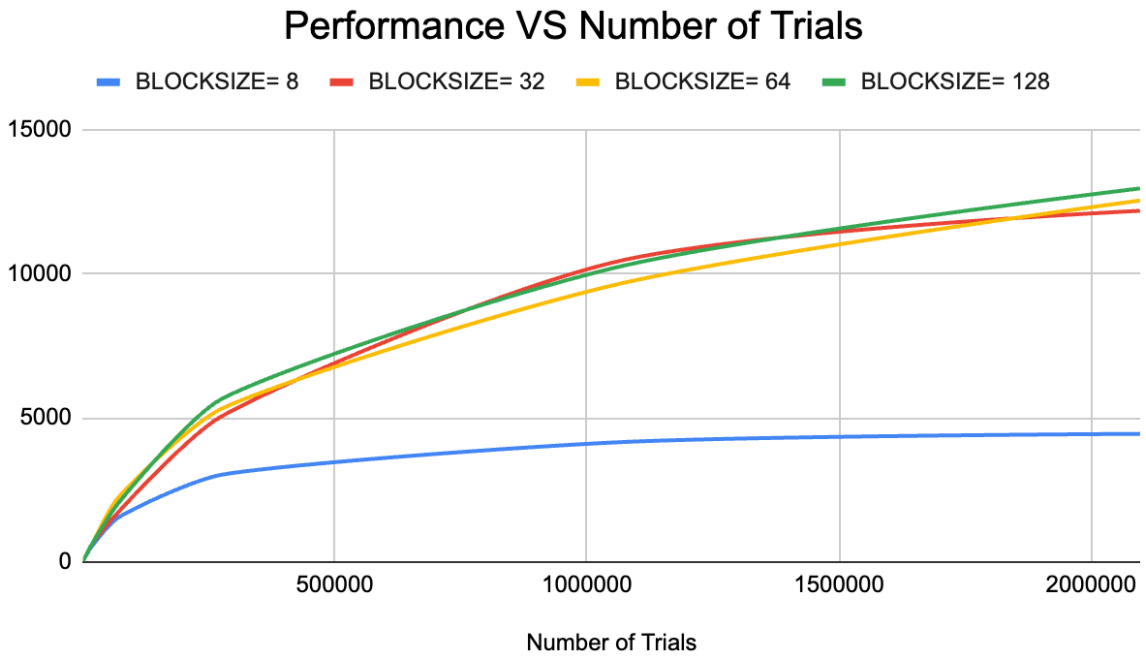
3. **Show the table and the two graphs**

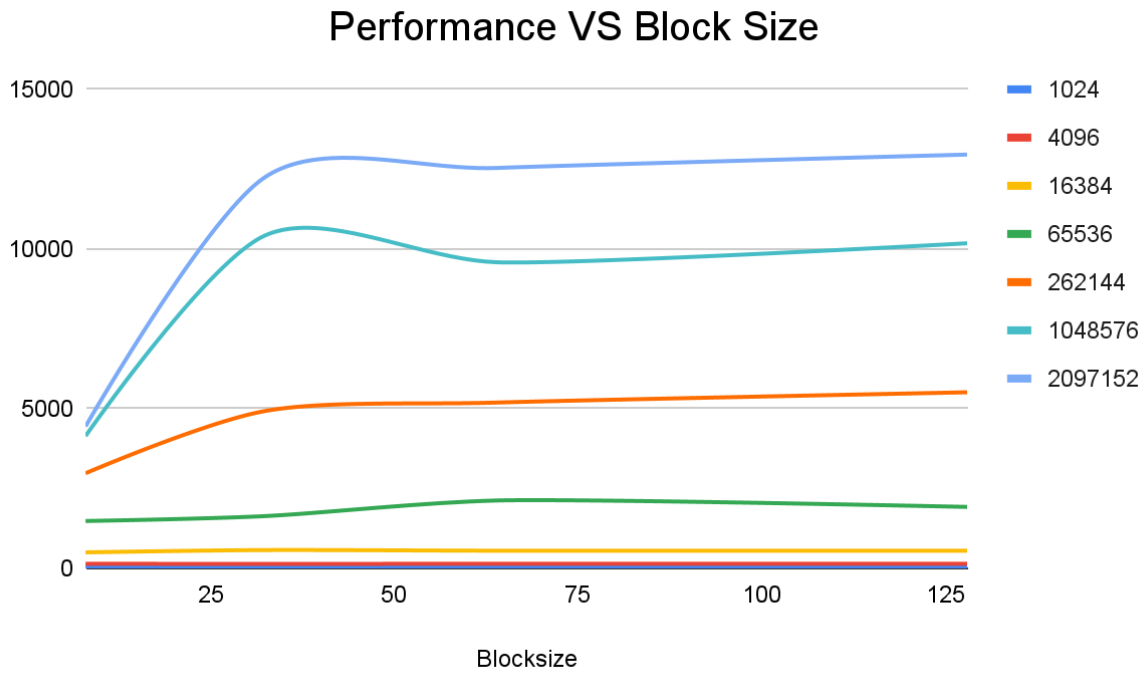
Number of Trials	BlockSize	MegaTrials/Second	Probability
1024	8	34.4828	29.69%
1024	32	35.7143	26.37%
1024	64	34.4828	28.52%
1024	128	35.7143	25.39%
4096	8	142.8571	26.56%
4096	32	137.931	26.54%
4096	64	142.8571	26.98%
4096	128	142.8571	26.64%
16384	8	500	27.48%
16384	32	571.4286	27.43%
16384	64	551.7241	26.68%
16384	128	551.7241	27.59%
65536	8	1481.9102	26.95%
65536	32	1630.5732	26.75%

65536	64	2124.4813	26.88%
65536	128	1923.0048	26.79%
262144	8	2977.8263	26.92%
262144	32	4908.3283	26.83%
262144	64	5191.3814	26.67%
262144	128	5512.7859	26.85%
1048576	8	4143.1281	26.87%
1048576	32	10376.1872	26.85%
1048576	64	9584.089	26.85%
1048576	128	10179.5587	26.91%
2097152	8	4445.5298	26.84%
2097152	32	12181.4127	26.86%
2097152	64	12537.9759	26.87%
2097152	128	12956.9003	26.85%

Pivot Table

	Blocksize			
Number of Trials	8	32	64	128
1024	34.4828	35.7143	34.4828	35.7143
4096	142.8571	137.931	142.8571	142.8571
16384	500	571.4286	551.7241	551.7241
65536	1481.9102	1630.5732	2124.4813	1923.0048
262144	2977.8263	4908.3283	5191.3814	5512.7859
1048576	4143.1281	10376.1872	9584.089	10179.5587
2097152	4445.5298	12181.4127	12537.9759	12956.9003


Performance VS Number of Trials
BLOCKSIZE= 8
BLOCKSIZE= 32
BLOCKSIZE= 64
BLOCKSIZE= 128
15000
10000
5000
0
500000
1000000
1500000
2000000
Number of Trials


Performance VS Block Size
15000
10000
5000
0
25
50
75
100
125
Blocksize
1024
4096
16384
65536
262144
1048576
2097152

4. **What patterns are you seeing in the performance curves?**

   When the number of trials increases, the performance also increases. Based on the Performance vs. Block Size graph, it is evident that as the block size increases, there is a corresponding increase in performance. Nonetheless, it is important to note that when the number of trials is limited, the speed remains considerably low.

5. **Why do you think the patterns look this way?**

   When the data set is expanded, the scheduler must allocate a larger number of blocks per processor while maintaining the same BlockSize. Consequently, the workload on the scheduler increases, leading to longer calculation times and diminished performance enhancements.

6. **Why is a BLOCKSIZE of 8 so much worse than the others?**

   In comparison to the other three block sizes, it is evident that the 8-thread block size exhibits lower performance. This disparity can be attributed to its size being smaller than 32. With only 8 blocks, the remaining threads are not fully utilized. Conversely, the other three block sizes, which are multiples of 32, can fully leverage the available threads, resulting in optimal efficiency.

7. **How do these performance results compare with what you got in Project #1? Why?**

   In direct comparison to Project 1, Project 5 showcases significantly superior performance. This disparity arises from the relatively limited number of CPU threads when contrasted with the GPU.

8. **What does this mean for what you can do with GPU parallel computing?**

   GPU parallel computing offers an enhanced performance by leveraging the full potential of threads, especially with larger data sets. Optimal utilization is achieved as threads remain active without idling. Additionally, data selection using multiples of 32 ensures complete queue allocation for each block size simultaneously.