Project #5
CUDA: Monte Carlo Simulation

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Machine this ran on:

- I ran this on my MacBook Pro running on OS Monterey version 12.0.1 while on the DGX and Rabbit OSU server:
  CPU: 2 GHz Dual-Core Intel Core i5
  Memory: 8 GB 1867 MHz LPDDR3

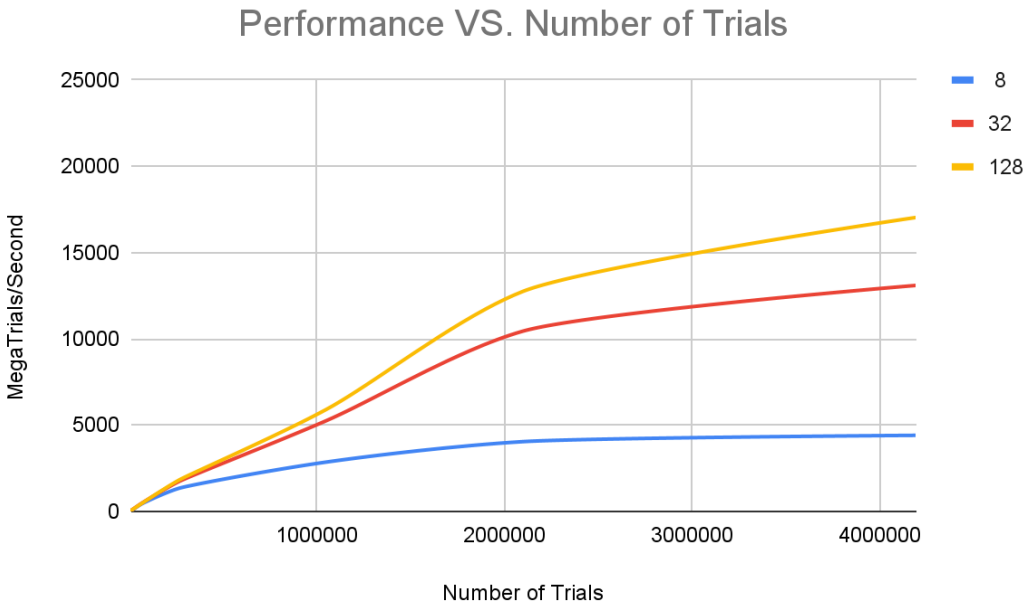
Table of Data:

- This table of data shows the relationship between the Number of trials, Block size, Performance, and the Probability calculated. It seems that the average probability calculated was ~22-23%.

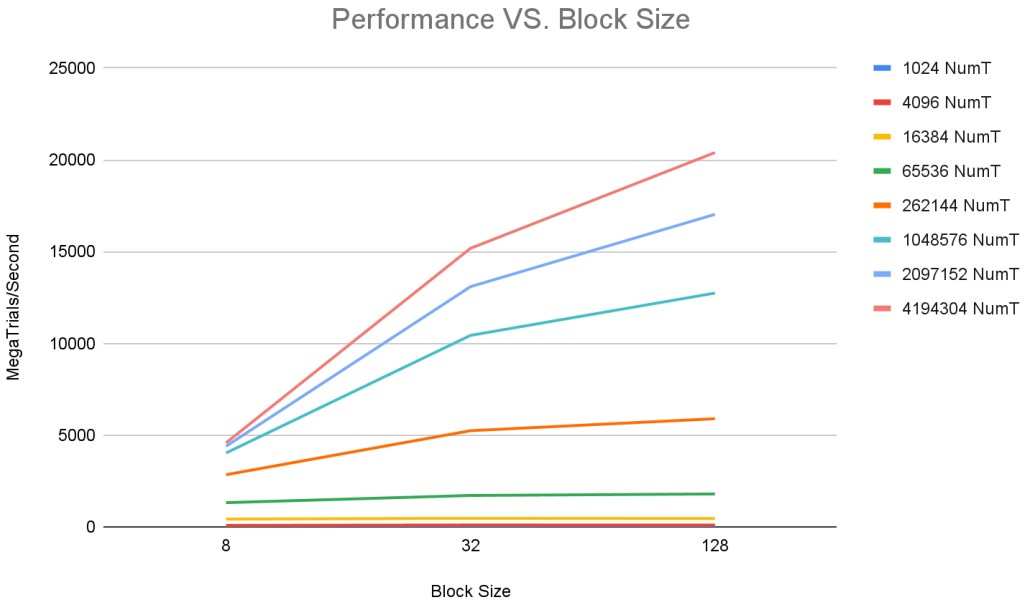
Number Of Trials	Block Size	Performance	Probability
1024	8	29.4118	23.24%
4096	8	100	22.39%
16384	8	444.4444	22.19%
65536	8	1337.6878	22.41%
262144	8	2858.3392	22.47%
1048576	8	4041.939	22.50%
2097152	8	4407.8559	22.49%
4194304	8	4594.1816	22.50%
1024	32	30.303	24.32%
4096	32	121.2121	22.39%
16384	32	484.8485	22.89%
65536	32	1728.2701	22.54%
262144	32	5254.6504	22.43%
1048576	32	10442.3202	22.58%
2097152	32	13094.1055	22.46%
4194304	32	15182.6714	22.51%
1024	128	31.25	23.05%
4096	128	117.6471	22.17%
16384	128	470.5882	22.55%
65536	128	1810.7869	22.62%
262144	128	5906.2727	22.61%
1048576	128	12745.2352	22.53%
2097152	128	17031.1852	22.50%
4194304	128	20393.9636	22.53%

Graphs:

- This graph shows the Performance based on the Number of trials for all three block sizes.



- This graph shows the Performance based on its block size for all eight number of trial tests.



Patterns:

- I am seeing a similar trend for both graphs. It seems as though as you increase the number of trials, the rate of performance increases with the block size and vice versa. You can see this in graph 2 and how the slope of each line positively increases as the Number of Trials increase. You can see a similar trend in graph 1 but with the Block Sizes. The rate at which the performance increases over the number of trials increases as the Block Size increases.

- I would assume this pattern is because both the Block Size and the Number of Trials have a positive effect on the overall performance. This would mean that increasing both the Block Size and the Number of Trials at the same time would greatly boost the performance.

- This is why Block Size of 8 is so much worse than the others. Having a low Block size reduces the overall impact the Number of Trials has on the performance. This is why Block Size of 8 has generally no change in performance in both graphs.

Project #1 Comparison:

- Compared to my results from project 1, this data has a much larger range. The highest performance I recorded for project 1 was in the 50s(MegaTrials per Second) compared to performances of over 20,000 MegaTrials per Second in this project. My Project 1 results also seem to be less consistent, making it harder to notice trends and patterns. I would assume this has something to do with DGX and the CUDA functionalities of this project. But the overall and general trends of these two projects seem to be similar.

- I would say this means that GPU parallel programming should be used with block size of at least 32. It would also be best to use GPU parallel programming only when the desired block size isn't two small. Using GPU is highly effective with regular data which is why it has an increase in performance compared to a CPU.