CS 475/575 -- Spring Quarter 2022

Project #1

OpenMP: Monte Carlo Simulation

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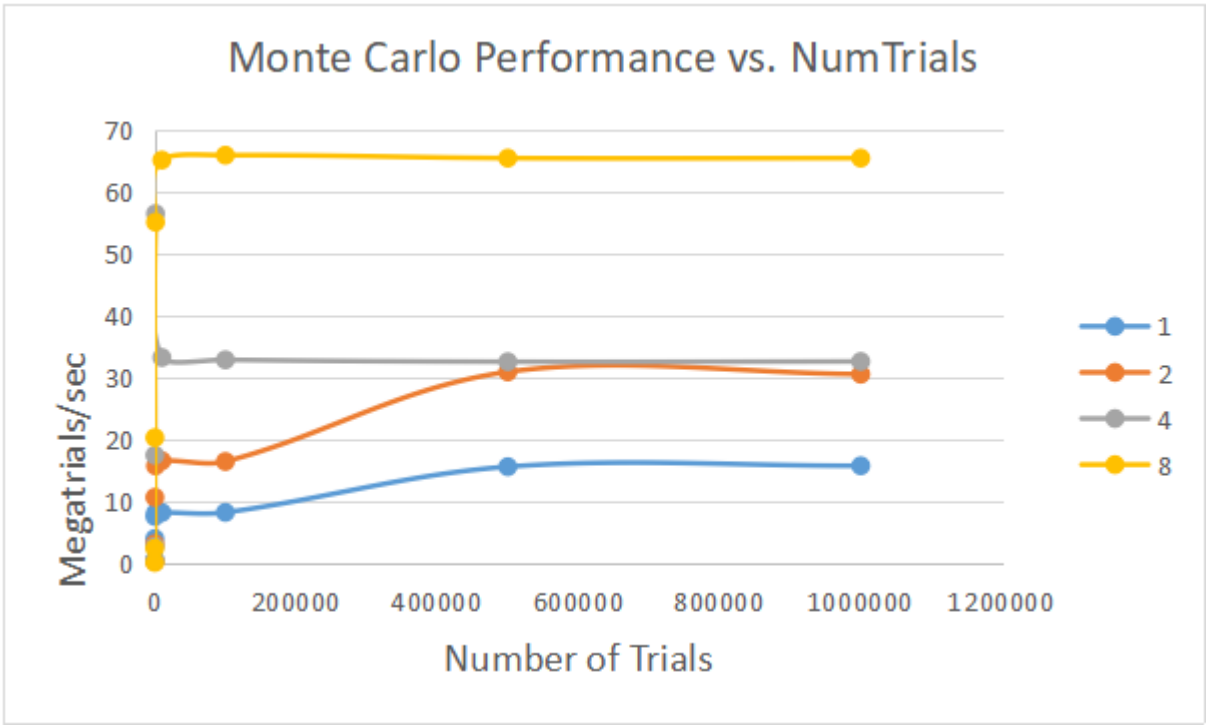
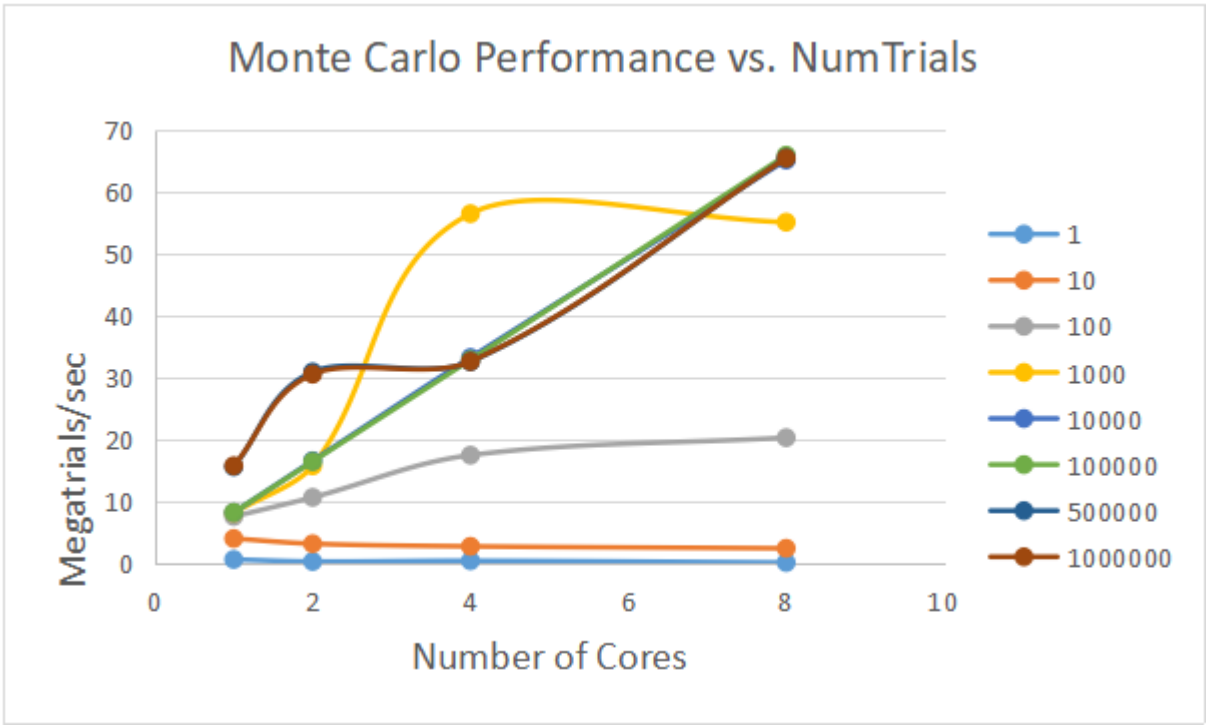
Graph of performance vs. number of trials
Graph of performance vs. number of threads





Data(Correce of probability):

```
[paoh@flip2 ~/CS575-1$] . loop.sh
 1 threads :        1 trials ; probability = 100.00% ; megatrials/sec =   1.34
 1 threads :       10 trials ; probability =  10.00% ; megatrials/sec =   4.39
 1 threads :      100 trials ; probability =  25.00% ; megatrials/sec =   7.42
 1 threads :     1000 trials ; probability =  31.00% ; megatrials/sec =   8.35
 1 threads :    10000 trials ; probability =  29.74% ; megatrials/sec =   8.30
 1 threads :   100000 trials ; probability =  29.14% ; megatrials/sec =   8.35
 1 threads :   500000 trials ; probability =  29.09% ; megatrials/sec =  15.88
 1 threads :  1000000 trials ; probability =  29.11% ; megatrials/sec =  15.82
 2 threads :        1 trials ; probability =   0.00% ; megatrials/sec =   0.42
 2 threads :       10 trials ; probability =  10.00% ; megatrials/sec =   3.01
 2 threads :      100 trials ; probability =  28.00% ; megatrials/sec =  15.52
 2 threads :     1000 trials ; probability =  29.70% ; megatrials/sec =  18.91
 2 threads :    10000 trials ; probability =  29.38% ; megatrials/sec =  19.43
 2 threads :   100000 trials ; probability =  29.14% ; megatrials/sec =  17.95
 2 threads :   500000 trials ; probability =  29.19% ; megatrials/sec =  29.17
 2 threads :  1000000 trials ; probability =  29.20% ; megatrials/sec =  30.36
 4 threads :        1 trials ; probability =   0.00% ; megatrials/sec =   0.36
 4 threads :       10 trials ; probability =  30.00% ; megatrials/sec =   4.47
 4 threads :      100 trials ; probability =  30.00% ; megatrials/sec =  21.29
 4 threads :     1000 trials ; probability =  28.60% ; megatrials/sec =  30.18
 4 threads :    10000 trials ; probability =  29.47% ; megatrials/sec =  33.22
 4 threads :   100000 trials ; probability =  29.08% ; megatrials/sec =  33.13
 4 threads :   500000 trials ; probability =  29.23% ; megatrials/sec =  32.79
 4 threads :  1000000 trials ; probability =  29.04% ; megatrials/sec =  32.84
 8 threads :        1 trials ; probability =   0.00% ; megatrials/sec =   0.31
 8 threads :       10 trials ; probability =  30.00% ; megatrials/sec =   3.26
 8 threads :      100 trials ; probability =  32.00% ; megatrials/sec =  27.13
 8 threads :     1000 trials ; probability =  28.80% ; megatrials/sec =  56.57
 8 threads :    10000 trials ; probability =  29.70% ; megatrials/sec =  65.77
 8 threads :   100000 trials ; probability =  28.97% ; megatrials/sec =  66.05
 8 threads :   500000 trials ; probability =  29.08% ; megatrials/sec =  65.45
 8 threads :  1000000 trials ; probability =  29.05% ; megatrials/sec =  64.68
```

.cvs file:

	A	B	C	D
1	Threads	Trails	Probability	Megatrials/sec
2	1	1	0.00%	0.74
3	1	10	30.00%	4.12
4	1	100	28.00%	7.68
5	1	1000	25.20%	8.26
6	1	10000	29.32%	8.32
7	1	100000	29.32%	8.34
8	1	500000	29.10%	15.72
9	1	1000000	29.03%	15.87
10	2	1	0.00%	0.41
11	2	10	40.00%	3.28
12	2	100	34.00%	10.77
13	2	1000	31.60%	15.86
14	2	10000	29.22%	16.68
15	2	100000	29.13%	16.56
16	2	500000	28.96%	31.03
17	2	1000000	29.06%	30.66
18	4	1	100.00%	0.53
19	4	10	30.00%	2.86
20	4	100	29.00%	17.58
21	4	1000	28.70%	56.58
22	4	10000	28.85%	33.35
23	4	100000	29.29%	32.98
24	4	500000	29.12%	32.67
25	4	1000000	29.09%	32.71
26	8	1	0.00%	0.25
27	8	10	20.00%	2.54
28	8	100	31.00%	20.41
29	8	1000	28.40%	55.21
30	8	10000	29.02%	65.24
31	8	100000	28.87%	66.02
32	8	500000	28.95%	65.55
33	8	1000000	29.02%	65.55

Pivot Table:

Sum of Megatrials/sec	Trails								
Threads	1	10	100	1000	10000	100000	500000	1000000	Grand tot
1	0.74	4.12	7.68	8.26	8.32	8.34	15.72	15.87	
2	0.41	3.28	10.77	15.86	16.68	16.56	31.03	30.66	
4	0.53	2.86	17.58	56.58	33.35	32.98	32.67	32.71	
8	0.25	2.54	20.41	55.21	65.24	66.02	65.55	65.55	
Grand tota	1.93	12.8	56.44	135.91	123.59	123.9	144.97	144.79	

FP:

I choose 1000000 trails which was my 8-thread-to-1-thread speedup is S = (Execution time with one thread) / (Execution time with four threads) = (Performance with four threads) / (Performance with one thread), that is S = 65.55 / 15.87 = 4.130434783 In addition my Parallel Fraction, float Fp = (8./7.)*(1. - (1./S)) = (8./7.)*(1. - (1./65.55)) = 0.866165414

	1	10	100	1000	10000	100000	500000	1000000
1	0.74	4.12	7.68	8.26	8.32	8.34	15.72	15.87
8	0.25	2.54	20.41	55.21	65.24	66.02	65.55	65.55
S	0.337837838	0.616504854	2.657552083	6.68401937	7.841346154	7.916067146	4.169847328	4.130434783
Fp	-2.24	-0.710911136	0.712815847	0.971873625	0.997109573	0.998485307	0.868780647	0.866165414