Project #1 OpenMP: Monte Carlo Simulation

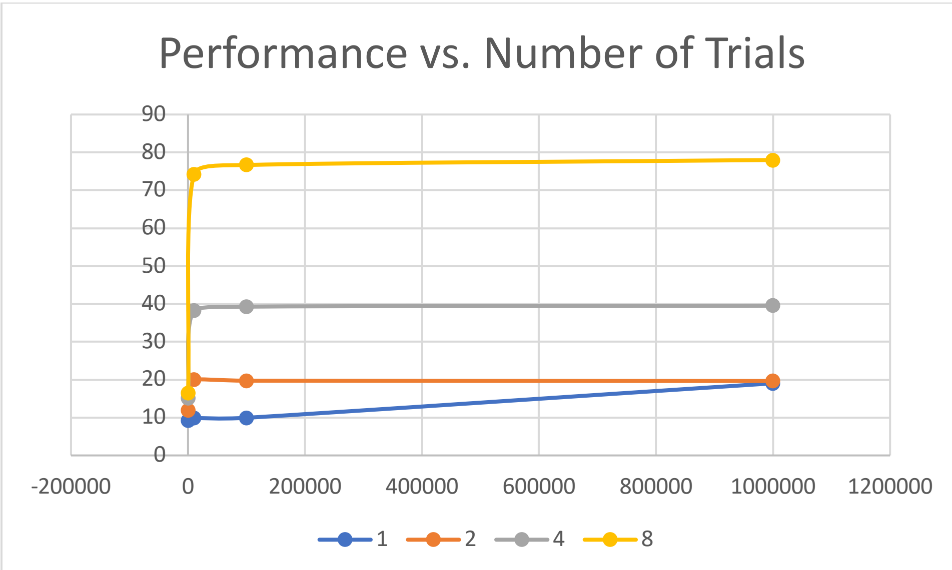
Qingxiao Yuan

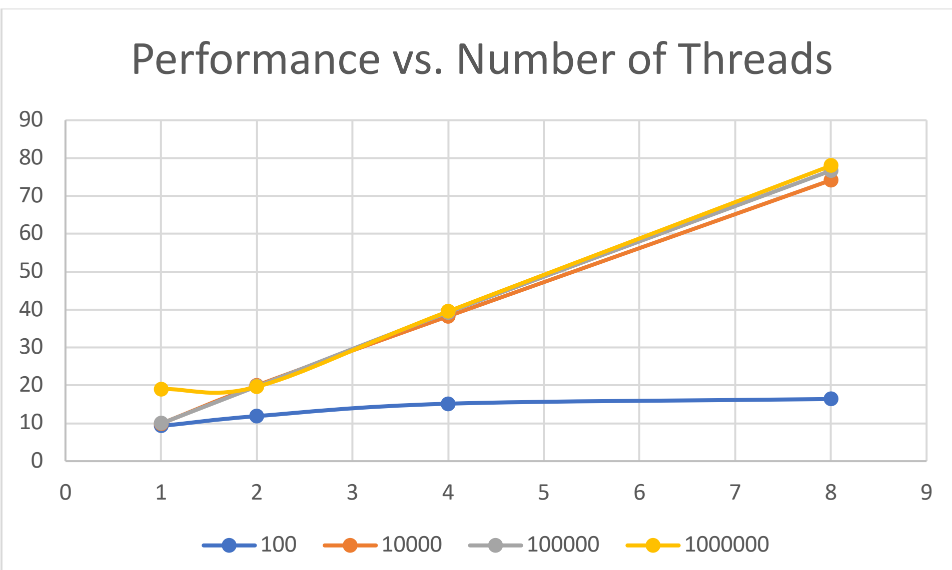
yuanqi@oregonstate.edu

To begin with, I run program 1 on flip2 of OSU.

1.The tables and related two graphs are showing below,

number of threads	number of trials	probability	MegaTrials PerSecond
1	100	0.13	9.2722
1	10000	0.1326	9.8886
1	100000	0.1304	9.9326
1	1000000	0.1311	19.0421
2	100	0.13	11.8819
2	10000	0.1303	19.9769
2	100000	0.1326	19.7317
2	1000000	0.1314	19.6418
4	100	0.15	15.1653
4	10000	0.138	38.2629
4	100000	0.1319	39.2728
4	1000000	0.1314	39.5291
8	100	0.13	16.3986
8	10000	0.1333	74.1674
8	100000	0.1332	76.6742
8	1000000	0.1314	77.9899





2. Explanation about the probability(Chose the largest trials one). When the number of trials is 1,000,000 and the number of threads is 8, the probability is 0.13. The actual probability, which is the case D happens, range from $x \in (0.0, 1.0)$ and $y > x$ and $r^2 < x^2 + y^2$.

3. Compute Fp, the Parallel Fraction. One of my result is pretty close to 1. According to professor Bailey (2020) in piaza, “this is usually the result of some background process interference making the 1-thread run of the program look slower than it really was, which then gives you a Speedup that is greater than the number of cores, which then makes you Fp > 1”. The Parallel Fraction is:

$$F_p = \frac{n}{n-1}\left(1 - \frac{1}{Speedup}\right) = \frac{n}{n-1}\left(1 - \frac{MegaTrialsPerSec_1}{MegaTrialsPerSec_n}\right)$$

To see the result clear, I rearranged the table. It shows below:

	100	10000	100000	1000000
1	9.2722	9.8886	9.9326	19.0421
2	11.8819	19.9769	19.7317	19.6418
4	15.1653	38.2629	39.2728	39.5291
8	16.3986	74.1674	76.6742	77.9899

When the number of trials is 100,

$$F_2 = \frac{2}{2-1}\left(1 - \frac{9.2722}{11.8819}\right) = 0.4393$$

$$F_4 = \frac{4}{4-1}\left(1 - \frac{9.2722}{15.1653}\right) = 0.5181$$

$$F_8 = \frac{8}{8-1}\left(1 - \frac{9.2722}{16.3986}\right) = 0.4967$$

When the number of trials is 10,000,

$$F_2 = \frac{2}{2-1}\left(1 - \frac{9.8886}{19.9769}\right) = 1.0099$$

$$F_4 = \frac{4}{4-1}\left(1 - \frac{9.8886}{38.2629}\right) = 0.9887$$

$$F_8 = \frac{8}{8-1}\left(1 - \frac{9.8886}{74.1674}\right) = 0.9905$$

When the number of trials is 100,000,

$$F_2 = \frac{2}{2-1}\left(1 - \frac{9.9326}{19.7317}\right) = 0.9932$$

$$F_4 = \frac{4}{4-1}\left(1 - \frac{9.9326}{39.2728}\right) = 0.9961$$

$$F_8 = \frac{8}{8-1}\left(1 - \frac{9.9326}{76.6742}\right) = 0.9948$$

When the number of trials is 1,000,000,

$$F_2 = \frac{2}{2-1}\left(1 - \frac{19.0421}{19.6418}\right) = 0.0611$$

$$F_4 = \frac{4}{4-1}\left(1 - \frac{19.0421}{39.5291}\right) = 0.6910$$

$$F_8 = \frac{8}{8-1}\left(1 - \frac{19.0421}{77.9899}\right) = 0.8638$$