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Project #1 OpenMP: Monte Carlo Simulation

- **Estimate of the actual probability:**

```
1       1000000 0.131180        18.404333
2       1000000 0.130504        36.441257
4       1000000 0.130813        72.330231
8       1000000 0.131071        144.559479
```

Above are the results of the 4 runs of 1, 2, 4, and 8 threads with the maximum number of trials (1000000). So, I think the actual probability is about 0.13.

- **Compute Fp, the Parallel Fraction:**

Use the results shown in last section of the 4 runs of 1, 2, 4, and 8 threads with the maximum number of trials (1000000) to calculate Fp.

According to the formula $Fp = \frac{n}{n-1} \cdot \frac{T_1 - T_n}{T_1}$, and we use Mega-Trials per second to calculate performance, so

$$Fp_2 = \frac{2}{2-1} \cdot \frac{36.441257 - 18.404333}{36.441257} \approx 0.990$$

$$Fp_4 = \frac{4}{4-1} \cdot \frac{72.330231 - 18.404333}{72.330231} \approx 0.994$$

$$Fp_8 = \frac{8}{8-1} \cdot \frac{144.559479 - 18.404333}{144.559479} \approx 0.997$$

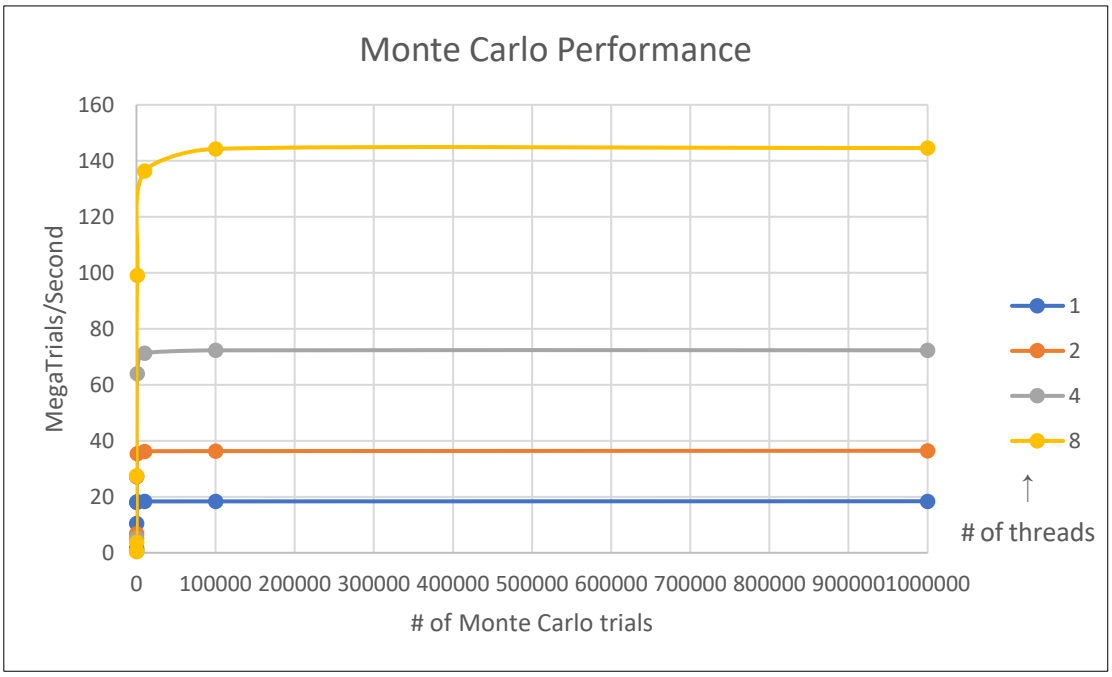
And according to formula $\overline{Fp} = \frac{\sum_{i=2}^{N} Fp_i}{N-1}$, $Fp = \frac{0.990+0.994+0.997}{3} \approx 0.99$.

Therefore, this computation's Parallel Fraction is 0.99.

- **Table showing performance versus trials and threads:**

# of Monte Carlo trials / # of cores	1	10	100	1000	10000	100000	1000000
1	1.64	10.46	17.99	18.29	18.35	18.36	18.41
2	0.81	6.81	27.18	35.35	36.25	36.33	36.44
4	0.61	5.26	27.35	63.94	71.32	72.31	72.33
8	0.41	3.67	27.49	99.09	136.35	144.27	144.56

- **Graph of performance vs. number of trials:**



- **Graph of performance vs. number of threads**