Project#1: OpenMP: Monte Carlo Simulation

The program ran on Flip2 server. The number of tries (NUMTRIES) is set to 10.

1. Do a table and two graphs showing performance versus trials and threads.

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| --- | --- | --- | --- |
| Number of Threads | Number of Trials | Probability | MegaTrialsPerSecond |
| 1 | 100 | 0.21 | 15.3118 |
| 1 | 10000 | 0.1926 | 17.6531 |
| 1 | 100000 | 0.1922 | 16.8979 |
| 1 | 1000000 | 0.1901 | 17.0501 |
| 2 | 100 | 0.1941 | 19.1313 |
| 2 | 10000 | 0.1902 | 33.2853 |
| 2 | 100000 | 0.1901 | 33.77 |
| 2 | 1000000 | 0.1907 | 33.7104 |
| 4 | 100 | 0.16 | 23.9808 |
| 4 | 10000 | 0.1919 | 65.6371 |
| 4 | 100000 | 0.1902 | 66.596 |
| 4 | 1000000 | 0.1905 | 67.1818 |
| 8 | 100 | 0.24 | 23.6299 |
| 8 | 10000 | 0.1849 | 96.4552 |
| 8 | 100000 | 0.1888 | 95.8428 |
| 8 | 1000000 | 0.1901 | 100.1074 |

In the ‘Performance vs. Numbers of Trials’ chart, the vertical axis indicates the number of trials, the horizontal axis indicates the performance using ‘Mega Trials Per Second’ as a unit and the lines indicates the number of threads.

In the ‘Performance vs. Number of Threads’ chart, the vertical axis indicates the number of threads, the horizontal axis indicates the performance using ‘Mega Trials Per Second’ as a unit and the lines indicates the number of trials.

When the number of threads increases, the performance increases and the speedup is less than n (the number of threads). The probability calculation process of each trial has nothing to do with each other, so the speed will increase using parallel programming. But there are some fractions of the total operation that are inherently sequential and can’t be parallelized. So the speedup for n threads will always be less than n.

When the number of trials is small, the performance will increase rapidly. When the number of trials increases after 100,000, the performance will keep stable. As the number of trials increases, the proportion of overhead in parallel programming is getting smaller and the speed will be faster. But there is still an upper bound of the computing capacity of CPU and the speed will not increase without limit.

1. Choosing one of the runs (the one with the maximum number of trials would be good), tell me what you think the actual probability is.

When the number of trials is 1,000,000 and the number of threads is 8, the probability is 0.1901. I think the actual probability is the probability of and and .

1. Compute Fp, the Parallel Fraction, for this computation.

When the number of trials is 100,

When the number of trials is 10,000,

When the number of trials is 100,000,

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