

OpenMP Homework (Due 2/24, before class)

1. Simple matrix multiplication ($C[N] = A[N][N] \times B[N]$) (10points)

- 1.1 This was shared in class. Implement and run your code. Compare with the solution that was provided.
- 1.1 What is the speedup? Plot the strong scaling (as a function of number of threads) and the weak scaling (as a function of the number of points)

2. Compute π (10 points for code, 5 points for write-up)

- 2.1 In your previous homework, you computed PI using a Monte Carlo approach. Parallelize it using OpenMP. Compare the error with the value of $\pi = \cos^{-1}(-1.0)$
- 2.2 What is the speedup? Plot the strong scaling (as a function of number of threads) and the weak scaling (as a function of the number of points).

3. Matrix Multiplication (20 points for code, 5 points for writeup)

- 3.1 Multiply two NxN matrices. Use the example that I circulated to initialize the matrices. As shown in the example, check your results by comparing the outputs of a serial and a parallel version.
- 3.2 Plot the strong scaling (as a function of number of threads) and the weak scaling (as a function of the number of points). Use any optimization strategy that you can find, to run your code faster.
- 3.3 You are free to use the full OpenMP API, adjust your matrix multiplication strategy, and use any optimization strategy you can find. **In other words, write the fastest matrix multiplier.**

4. Bonus Points

You can earn bonus points for problems 2 and 3. You will need to provide me with the following:

- 4.1 **For Problem #2**, plot the time to compute vs. computed error. The student who computes the most accurate PI in the least amount of time can earn **5 points**.
- 4.2 **For Problem #3**, plot N (size of matrix) vs. Time. On your plot, record the N that you were able to compute in 60s. The student who is able to compute the largest N in 60s can earn **10points**.