EECS 739: Homework 2

Due: Friday, April 16, 2021 (at 5pm)

Questions:

1. (30 points; 15 points each) Implement two different parallel versions of the parallel Gaussian elimination method in MPI. Here different versions means they employ different orderings of the triple loop. Be certain to pay attention to efficiency of your implementations. This applies to various aspects, such as selection of which MPI commands to use, which layouts to use when partioning the data, how to assign tasks to processors, etcetera.

2. (30 points; 15 points each) For each implementation, conduct strong and weak scalability tests on the SLURM cluster. When running your scaling tests, be sure to run your code on sufficiently large matrix systems so that the communication overheads do not dominate the performance results. A good goal is to run your code on 1, 2, 4, and 8 cores at minimum (16 would be an even better target).

3. (20 points; 10 points each) Compare your experimental results for each implementation with those predicted theoretically via analytical modeling. Do the experimental and theoretical results agree? Why or why not? Explain your answer.

Getting started on the implementations: As a starting point, you can use the serial implmeentation of the LU factorization method I wrote which is posted on the class website. Consider making it more efficient before parallelizing the code.

Submitting your homework: Please submit your MPI and C/C++ code, sbatch scripts, experimental scaling results (timing results, scaling plots), and analytical modeling results (including the discussion) as a single PDF either in hard copy or via e-mail. In addition, you should submit your code and sbatch script via e-mail; this way I can run your code if need be while grading.