Spring 2019: Advanced Topics in Numerical Analysis: High Performance Computing Assignment 5 Kaizhe Wang (kw2223)

1. **MPI ring communication.** Write a distributed memory program that sends an integer in a ring starting from process 0 to 1 to 2 (and so on). The last process sends the message back to process 0. Perform this loop N times, where N is set in the program or on the command line.

   - In the file `int_ring.c`, use `mpirun`, it will first do the single integer ring sending process for 1000 loops, each loop has 4 process; then do a large array ring sending process.
   - To run the code in one processor, please use:
     `mpirun -n 4 ./int_ring`
   - To run the code in multiple (`snappy2` and `snappy3`) processors, please use:
     `mpirun -np 4 --map-by node --hostfile nodes ./int_ring`
   - If I do the single integer ring communication on one node (say, `snappy2` at CIMS), the latency is about 1.33×10^{-3} ms. If I do the same thing on two CIMS nodes (`snappy2` and `snappy3`), the latency is about 1.98×10^{-1} ms. Messages sent through network is slower.
   - For the large array ring communication, the length of the array is 300000. If the communication is done in one node, the bandwidth is about 1.80 GB/s; If it's done through two nodes, the bandwidth is about 2.88×10^{-2} GB/s.

2. **Provide details regarding your final project.**

Project: Parallel computing of Galaxy Correlation Functions		
Week	Work	Who
04/15-04/21	Read papers underlying ideas, learn about the mesh lattice algorithm used here.	Yucheng, Kaizhe
04/22-04/28	Write the serial code.	Yucheng, Kaizhe
04/29-05/05	Parallelize the code with OpenMP. Verify the implementation.	Yucheng, Kaizhe
05/06-05/12	Test the performance of OpenMP, try MPI and CUDA. Discuss with Prof. for any problems.	Kaizhe, Yucheng
05/13-05/19	Write report and prepare for presentation.	Kaizhe, Yucheng