WITS UNIVERSITY

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COMS4040A & COMS7045A: MPI Programming Exercise 2

May 28, 2020

Objectives

- Design and implement parallel algorithms for some common problems using the MPI point-to-point and collective communication functions. These problems include dense matrix-vector, dense matrix-matrix multiplications, sorting, and linear solvers.

Programming

1. Write an MPI program to compute the element-wise addition of two vectors. Consider the following instructions in your implementation:
   - To read in the dimension of the vectors, process 0 prompts the user, reads in the value, and broadcasts the value to the other processes;
   - Process 0 generates random values for two input vectors. Process 0 then sends the needed components of the input vectors to other processes by using `MPI_Scatter`, and collecting the addition results back using `MPI_Gather`.
2. Complete all the different MPI versions of the *trapezoidal rule* discussed in the class.
3. How would you design a parallel dense matrix-matrix multiplication using MPI?
4. Implement the odd-even transposition sort using MPI according to the parallel algorithm given in the class.
5. Design and implement the parallel version of *quicksort*, *hyperquicksort* and *mergesort* using MPI, respectively. (Reference: Chapter 14, Quinn's book).