Fall 2020

CSCI 6454: HW4 (12 points)

On Hybrid Parallel Computing

Breadth First Search

Problem 1: Write a serial program that performs Breadth-First Search (BFS) on an input graph. You can find this algorithm in your algorithm textbook. You may use any programming language of your choice. Your program should take a root vertex as input for starting the search. You may use an online data repository to find input graphs, e.g., snap.stanford.edu, networkrepository, etc. [2 points]

Problem 2: Using MPI, write a parallel program for BFS for distributed memory systems. [5 points]

Problem 3: Design and implement a hybrid parallel algorithm for BFS using MPI+OpenMP. Does this show better scalability than the distributed (MPI) version? [4 points]

Provide at least one set of sample input that you used and the corresponding output.

Comment on speedups for problem 2 and 3 over the serial implementation. Show related plots and discuss your findings in your report. Further, discuss how you distributed data and tasks among processes. [1 point]

Instructions:

1. For each implementation, follow good programming practices. Have plenty of comments in your source file. Even though I did not quite specify the input and output formats for some problems, you should have descriptive and intelligible prompts and outputs. You MUST have a README file for each problem specifying your input/output and how to run and any assumptions you made.
2. Your programs MUST compile and run. Otherwise, you will lose significant points.

3. **Report:** Provide an MS Word document (or similar) with the results, plots, and other discussions.
4. To develop you code and performance experimentation, you may want to use LONI or your own computer. Most modern computers have 4 cores or so. Thus, you should be able to get at least 4 data points for performance plots. Although, the logical number of processes can be higher than the number of physical cores.
5. If you want to use LONI, create an account with LONI. Mention my name as your collaborator. I can then have your request approved and share with you my own allocation. Let me know your intention.
6. Put the solution for each problem in a separate directory and zip them together and submit through Moodle. Email me your work ONLY IF Moodle is not working.
7. Name each directory as HW4_YourFirstName_YourLastName_X, where X is the problem number. The final zipped archive name should be HW4_YourFirstName_YourLastName.
8. All work must be your own. This is not a team assignment.
9. DEADLINE: 05 November 2020 Thursday 11:59pm. (will be accepted until Nov/07/20 11:59pm without penalty)