
Introduction to Parallel Programming

Assignment #1

(Due: Thursday, September 29, 2022)

Objective:

To become familiar with parallel programming for distributed memories using MPI.

Requirements:

- (A) Write a parallel version of a pushing web service. Your program will create three processes, the master process loads a web page (hello.html), sends its contents to the other processes, which then “display” (print) their process numbers and the contents of the web page. **Just treat the html file as a text file, don’t parse it.**
- (B) Write a parallel program to multiply a $m \times n$ matrix and $n \times 1$ vector. Your program should read the matrix and the vector from a data file ([mv-data.txt](#)) and print the results on the screen (assuming you only have 2 core processors).
- (C) Write a program to (1) prompt user for two integers: m and n (**find proper values of m and n so your program does not run too short or too long**), (2) create an array of 1000; (3) fill each element of the array with an integer randomly generated between m and n ; (4) compute the factorial of the integers for each array element; (5) print out the time it takes to perform the computations (run-times); (6) repeat steps (3), (4) and (5) for array size of 2000, 4000, 8000, and 16000; (7) run the program with 1, 2, 4, and 8 processors; (8) record your run-times in performance.txt (**table 3.5 in the textbook**); (9) calculate and add into performance.txt: the speedup and efficiency of all of the above cases (**tables 3.6 & 3.7 in the textbook**); (10) **at the top of performance.txt, tell me what are the values of m and n you used, whether your program is scalable, if yes, then strongly or weakly. You can manually enter your result tables into performance.txt or let your program to append to it.**

Submission:

Name your code as pa1a.c, pa1b.c, and pa1c.c. Copy them along with your performance.txt to a directory named PA1 on YOUR COMPUTER. Zip PA1 and submit the zip file to BrightSpace.

Tips and Hints:

1. You need to use knuth to program MPI. Follow the instructions below to gain access to knuth.
<http://www.cs.uakron.edu/~xiao/lab-use.html>
2. Follow the instructions below to compile and run an example.
<http://www.cs.uakron.edu/~xiao/parallel/parallel-how-to.html>
3. Knuth runs [Linux](#), a version of [Unix](#) operating system. Follow the tutorials below to get familiar with UNIX commands.
<https://files.fosswire.com/2007/08/fwunixref.pdf>

<https://www.javatpoint.com/linux-commands>

<https://www.javatpoint.com/linux-tutorial>

<https://www.tutorialspoint.com/unix/unix-quick-guide.htm>

<http://www.ee.surrey.ac.uk/Teaching/Unix/>

4. Editor and Compiler: [Parallel-HowTo.zip](#)
5. Matrix multiplications.
<https://www.mathwarehouse.com/algebra/matrix/multiply-matrix.php>
<https://www.youtube.com/watch?v=sYlOjyPyX3g>

Learning Materials:

1. Textbook chapters 1 and 3.
 2. Code examples in Chapter 3.
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