EE/CSCI 451
Spring 2018
Programming Homework 2
Assigned: Feb 8, 2019
Due: February 16, 2019, before 11:59 pm
Total Points: 50

1 Login to HPC

- The host is: hpc-login**3**.usc.edu
- Username and password are the same as your email account
- **Do not** run your program in the login node. After login, use the 'srun' command to run your program on a remote node. For example:
  srun -n1 **-c**8 ./run

2 Parallel Matrix Multiplication [50 points]

- The matrix size is $4K \times 4K$. Print out the execution time and the value of $C[100][100]$ in your program.
- Report the execution time for different number of threads: $p = 1$ (the serial version you did in PA1)2 and 4. Draw a diagram to show the execution time under various p. An example diagram is shown in Figure 1. Briefly discuss your observation.

2.1 OpenMP

Parallelize the **naive** matrix multiplication which you implemented in PA 1 using OpenMP.

2.2 Pthread

Parallelize the **naive** matrix multiplication which you implemented in PA 1 using Pthread.

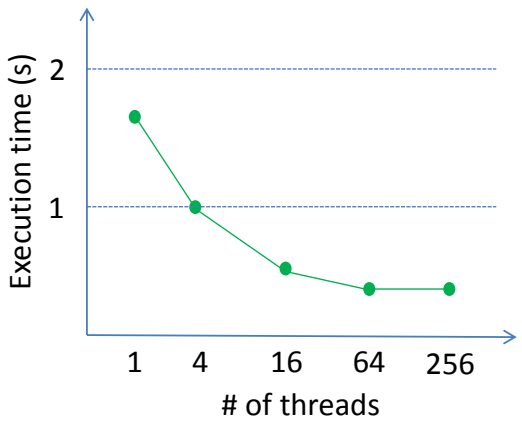

Figure 1: Example diagram

2.3 Examples

- Pthread example code, "print_msg_with_join.c", which prints hello message in each thread. To compile it, type: 'gcc -O3 -o run print_msg_with_join.c.c **-lpthread**'.
- OpenMP example code. "openmp_example.c" which implements parallel matrix-vector multiplication. To comple it, type "gcc -O3 -o run openmp_example.c **-fopenmp**".
- In order to run your parallel programs on multiple CPUs, you should use this slurm command to submit your program: "srun -n1 -c8 ./run". Here -c specifies the number of CPUs (threads) you will be using.
- Naive matrix-matrix multiplication code from your PA1.

3 Submission Instructions

- Two .c/.cpp files: 'problem1a.c' for OpenMP; 'problem1b.c' for PThread. Make sure your program is runnable. (10+20 pts)
- Report. Write clearly how to compile and run your code. Screenshot of the execution time and performance on hpc. (20 pts)

You may discuss the algorithms. However, the programs have to be written individually. Submit the code and the report via ee451spring2019@gmail.com. Please make sure to include your name, student ID and the homework number in the PDF, and name your PDF file lastname_firstname_pa#.

References

[1] "Command Line Parameter Parsing,"
http://www.codingunit.com/c-tutorial-command-line-parameter-parsing

[2] "Using make and writing Makefiles,"
http://www.cs.swarthmore.edu/~newhall/unixhelp/howto_makefiles.html

[3] "rand - C++ Reference"
http://www.cplusplus.com/reference/cstdlib/rand/

[4] "imageJ,"
http://rsb.info.nih.gov/ij/download.html