CSYE7105 HW1

Instructor: Dr. Handan Liu

2020-09-27

Part 1: 40 points

1. Give several reasons to use parallel computing. [4 pts]
2. On the CPU architecture, how many parallel programming models are there based on memory access methods? List them and explain briefly. [4 pts]
3. What is Flynn's Taxonomy? Please explain it. [4 pts]
4. What kind of classification in Flynn classification does GPU computing belong to? Please explain. [4 pts]
5. What is the embarrassingly parallel? [4 pts]
6. Give 3 popular math libraries for high performance computing. [4 pts]
7. How can we evaluate the speedup of parallel computing comparing with serial computing? Please explain in detail. [4 pts]
8. Provide 6 MPI necessary functions for MPI parallel computing. Only write the function name, no parameters. C is recommended here. [4 pts]
9. What are strong scaling and weak scaling? Or what difference between them. [4 pts]
10. Give several possible reasons why sometimes the computation time on multi-CPU on multiple nodes is slower than that of multi-CPU on a single node. [4 pts]

Part 2: 16 points

Please use OpenMP routines to complete the program hw1-part2.c according to the requirements.

Part 3: 22 points

Please implement OpenMP directives for the program hw1-part3.c.

Part 4: 22 points

A simple serial program of a dot product for two vectors is given as hw1-part4.c Please parallelize it with MPI routines.
Require:

1) Each MPI task performs the dot product of a and b based on the serial code to obtain its sum on each processor.
2) Print "Starting MPI for dot-product of a and b on <total number of processors> processors." on Master processor. Note: use MPI routine to get total number of processors.
3) Then calls MPI_Reduce to obtain the global sum.
4) After the dot product on each processor, perform a summation of results from each processor by using MPI_Reduce to obtain the global sum.
5) Print "Done. MPI execution to obtain global sum = ……". You should set a variable of global sum here to finish this formatting print statement. Note: print statement should be implemented on Master processor.

Review and Grade:

TA will review the homework and grade for my reference. No review time in person or on Zoom.

Submission through Canvas.

Deadline is by the end of October 5th.