

# CPE 412/512

## Fall Semester 2010

### Homework Assignment Number 3

- 1 )Write a multiprocess message passing implementation of a matrix/matrix multiplication program where the first matrix is of size  $m \times n$  and the second matrix is of size  $n \times m$ . Assume that the quantities being multiplied are of type float. Write the program in a general manner to allow the number of message passing processes and threads to be independently varied between the numbers of 1 to 8. You can assume that the workload is evenly divisible between the processing entities (i.e.  $n / [\text{the number of message passing processes}]$  has a remainder of zero). Illustrate the correctness of this program for all values of processes from 2 to 8. Expand upon the reference program given at [http://www.ece.uah.edu/~wells/cpe412\\_512\\_fl\\_10/material/hw/hw3/mm\\_mult\\_serial.cpp](http://www.ece.uah.edu/~wells/cpe412_512_fl_10/material/hw/hw3/mm_mult_serial.cpp).
- 2 )Using the altix batch queuing system (see separate handout), measure the serial runtime characteristics of the original program that was given to you for square matrices of with dimension of 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, and 2000. Graph the runtime characteristics. How does the base algorithm behave? What order is this algorithm? Does the runtime data support this?
- 3 Repeat these measurements for the 2, 4 and 8 process MPI implementations. Create three separate graphs of the runtime characteristics. How do these implementations behave as the data size is increased? What is the order of these implementations?
- 4 Using the reference serial program as a base, on a single graph, show the speedup versus the data size for each of the 2, 4, and 8 process MPI implementation. Also create a graph the shows the Efficiency versus the data size for each of the 2, 4 and 8 process MPI implementations.

Follow the program turn-in procedure outline below. *Due date for In-class students is Tuesday September 21, 2010. Due date for DL students is Thursday September 23, 2010*

#### Homework Assignment Turn in Procedure

You are to turn in an electronic copy of the homework assignment on or before its due date. This copy should contain a printout of all source code and the resulting output of the program or some form of a log of interactive activity captured in a text file. Acceptable file formats include pdf, doc, and ascii text. All files should be sent as standard E-mail attachments and should include all source level files and brief instructions as how to compile and execute your code. No object code files should be included. The subject line of the E-mail should contain the following; CPE x12, HW #num, where x is 4 or 5, representing which course you are taking (412 or 512) and num is the homework assignment number (Example CPE 412 student would put CPE 412, HW #1 for the first homework assignment. The E-mail is to be set to [wellsbe@uah.edu](mailto:wellsbe@uah.edu).

