

**Fall 2005 CS 441/632/732 Parallel Computing  
Homework-2**

**Individual work only. 150 points. Due Oct 11, 2005.**

1. Implement the collective communication primitive “barrier” using point-to-point message passing primitives provided by MPI using the following algorithms:
  - a. linear barrier (section 6.1.2, page 165)
  - b. ring barrier (described in class)
  - c. binary tree barrier (section 6.1.3, page 167)
  - d. butterfly barrier (section 6.1.4 page 167) [**Graduate Students Only**]

For each of the above algorithms plot the time taken by the barrier function and the speedup curve for different number of processes (use 1 through 8 processes). Use the sample program provided to test the barrier function and measure the time taken. Note that you cannot use any MPI collective function calls to implement the barrier function. **The program should take the number of processes as a command line argument.** Use the following table to include all the timing measurements:

| # of Process | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------------|---|---|---|---|---|---|---|---|
| Linear       |   |   |   |   |   |   |   |   |
| Ring         |   |   |   |   |   |   |   |   |
| Tree         |   |   |   |   |   |   |   |   |
| Butterfly    |   |   |   |   |   |   |   |   |

If  $t_m = t_{\text{send}} = t_{\text{recv}}$  is the time taken for sending/receiving a message between any two processes develop expressions to compute the total time spent in communication ( $t_{\text{comm}}$ ) for each of the above algorithms. [**Graduate Students Only**]

**General Comments:**

You must implement and test these programs on the CIS cluster (Everest) and use MPI for communication. Instructions for using the CIS cluster and submitting jobs to SGE can be found at: <http://www.cis.uab.edu/ccl/resources/everest/EverestGridNodeUserGuide.php>. While submitting to the queue you must request # of processors = # of processes.

**Submission:**

Email the source code along with any Makefile and scripts as a single tar file attachment to [puri@cis.uab.edu](mailto:puri@cis.uab.edu) with the subject “CS 441/632/732 Homework-2.” Turn-in a printed report in class using the format provided at <http://www.cis.uab.edu/cs441/report.html>. After submission, do not make any changes to your source code on Everest, you will be asked to demonstrate your program on Everest and the timestamp of the files will be used to determine late submissions.

**Grading:**

|   |            |
|---|------------|
| Correct implementation and testing of the programs (including collecting timing information for the tables above) | 115 points |
| Performance Analysis  | 25 points  |
| Lab report format/presentation  | 10 points  |