**Assignment 2**

Due date : 24th Feb, 8 pm.

1. Work out the PRAM EREW parallel sum (see chapter 2, slide 54 onwards) and CREW prefix sum algorithms for an array containing 16 numbers :

1, 2, 3, 4, 5, 6, 9, 7, 5, 4, 3, 0, 4, 8, 8, 2

1. A cycle in a graph is defined as a path originating and terminating at the same node. The length of a cycle is the number of edges in the cycle. Show that there are no odd-length cycles in a d-dimensional hypercube.

OR

The labels in a d-dimensional hypercube use d bits. Fixing any k of these bits, show that processors whose labels differ in the remaining d-k bit positions form a (d-k)-dimensional subcube composed of 2(d-k) processors.

1. Chapter 2, (Text book) 2.17

Calculate diameter, bisection width and number of switches in a mesh of tree topology.

1. Given a matrix as an input, write an MPI program to add the elements of the matrix in parallel. The basic idea is to divide the rows among processes. In phase I, local sum of the local rows is produced by an individual process. In phase II, perform a global reduction on local sums.

You can start with the program matrix\_partition.c which is provided. It contains a 10 by 10 matrix.

e.g. 3 by 3 matrix.

|  |  |  |
| --- | --- | --- |
| 1 | 2 | 3 |
| 5 | 1 | 2 |
| 3 | 3 | 3 |

If number of processes = 3, then

Process 0 adds elements in one of the rows let us say 1st row = 3+3+3 = 9

Process 1 adds elements in the middle row = 5+1+2 = 8

Process 2 adds elements in the third row = 1+2+3 = 6

Then, do a reduction to three local sums to produce 23

If number of processes = 2, then you can assign two rows to one of the processes and the remaining row is assigned to the other process. Assuming process 0 gets 2 rows:

Process 0 produces 9 + 8 = 17

Process 2 adds the elements in remaining row = 6

Then, do a reduction on two local sums to produce 23.

In the qsub script, as shown below, use a single node (nodes=1:ppn=2), so that your job will finish faster. You can vary the ppn which means number of cores. Here ppn is 2. You can also change this string “yourname\_programname” to distinguish your job on PERE.

#!/bin/sh

#PBS -N yourname\_programname

#PBS -l nodes=1:ppn=2,walltime=00:10:00

#PBS -q dev

#PBS -j oe

#PBS -o $PBS\_JOBNAME-$PBS\_JOBID.log

cat $PBS\_NODEFILE

cd $PBS\_O\_WORKDIR

module purge mpich2/intel/1.4.1

module load openmpi/gcc/1.4.2

mpiexec -np 4 ./hello

A pseudo-code parallel Add algorithm