CS-751-Parallel Computing

Max. Marks: 60   **Date: November 12, 2007**
                                                 Duration 3.00 Hrs.

Note: 1. Attempt **any five** questions
          2. Figure to the right indicates maximum marks
          3. Draw neat diagrams, if needed
          4. In case of any doubt, mention your assumptions in the answer-book and proceed for your answers.

Q.1 (A) Devise a parallel algorithm for finding x^n (x power n) using doubling technique. What is the parallel time and processors complexity? **[6]**

(B) Write a multithreaded program to find numerical integration using trapezoidal rule (S = $\sum_{i=1}^{n} \frac{(f_i + f_{i+1})}{2} *h$). The different threads compute intermediate values, x_1 and x_2 are two end points of the interval where the function value of f_1 and f_2 is calculated, h is a step size. Use a condition variable to recognize when each thread completed its designated computation. **[6]**

Q.2 (A) Develop a row-oriented parallel program for multiplying two $n \times n$ matrices. Obtain it computational and communication complexities. Explain different possible MPI calls you can use to implement this procedure. **[8]**

(B) Explain Foster's design methodology with a proper example. **[4]**

Q.3 (A) What criteria are used to understand effectiveness in implementing efficient parallel algorithms on real architecture? **[4]**

(B) With a proper diagram explain the *cluster system architecture*. **[4]**

(C) Explain the concept of reducing the number of processors in a computation. **[4]**

Q. 4(A) Explain the OpenMP Programming Model. Write an OpenMP π- **[6]** finding code with reduction clause.

(B) Explain the P-RAM model of computation. Show that p-processors **[6]** PRIORITY PRAM can be simulated by a p-processor EREW PRAM with the time complexity increased by a factor of (log n).

Q.5 (A) Show that the total number of processors in a Pyramid Network of **[4]** size k^2 is $(4/3)k^2 - (1/3)$.

(B) What is *race condition*? Explain in context to shared memory **[3]** programming.

(C) Explain the working behavior of the following program segment **[5]** and write your comments. Assume that there is no syntax error in the program segment.

```
int a[10], b[10], npes, myrank;
MPI_status status;
...
MPI_Comm_size(MPI_COMM_WORLD, &npes);
MPI_Comm_rank(MPI_COMM_WORLD, &myrank);
MPI_Send(a, 10, MPI_INT, (myrank+1)%npes, 1, MPI_COMM_WORLD);
MPI_Recv(b, 10, MPI_INT, (myrank-1+npes)%npes, 1, MPI_COMM_WORLD);
...
```

Q. 6(A) Discuss issues involved in parallelizing compilers. **[4]**

(B) What are the lock routines and runtime environment routines used **[4]** in OpenMP?

(C) How do various PRAM models differ in handling the read or write **[4]** conflicts?

Q.7 (A) Explain the cube connected cycled network of processors. **[4]**

(B) What are the alternatives for programming shared memory **[4]** multiprocessors. Which one is better and why?

(C) Discuss the role of work sharing constructs in OpenMP. **[4]**

------Best of Luck------