ROLL NO. _____

ALCCS – OLD SCHEME

Code: CS45 **Subject: PARALLEL COMPUTING**
Time: 3 Hours **Max. Marks: 100**

AUGUST 2011

NOTE:

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**
- **All calculations should be up to three places of decimals.**

Q.1 a. How Effective Memory Latency can be improved using Caches?

b. What are the major differences between Distributed and Shared memory computers? Also outline the advantages and disadvantages of the two.

c. Of the four PRAM models (EREW, CREW, ERCW, and CRCW), which model is the most powerful? Why?

d. What is Amdahl's Law?

e. Explain Bernstein Condition for Execution in Parallel.

f. What is linear, sublinear and superlinear speedup? Explain briefly.

g. Prove that task scheduling in Multiprocessor systems is an NP-class of problems.

(7 × 4)

Q.2 a. What is a dependency graph? Explain WAW, RAW and WAR dependencies. **(8)**

b. Write a parallel algorithm for odd-even transposition sort, to sort an array of n elements on linear array containing n processors. Discuss the cost of the algorithm.

(10)

Q.3 a. Explain temporal, data and control parallelism with examples. **(8)**

b. For the following sequence of instructions
(i) S1 : A = B + C
(ii) S2 : B = A + E
(iii) S3 : D = A * F
(iv) S4 : G = I / F + A
(v) S5 : H = B – D
(vi) S6 if D = 3

(vii) S7 K= G * 2 + I

Form the dependence graph and apply Bernstein's condition to show the sets of instructions which can be executed in parallel. **(10)**

Q.4 a. Compute the speedup in execution of the following computation:

$A \times B + C$

With chaining and without chaining, on a vector processor with two pipeline functional units, one for floating point multiply and the other for add, which are seven stages and six stages long respectively. Let us suppose that A, B and C are three vectors each of 64 elements. **(10)**

b. What are Systolic Array Processors? How it is different than SIMD and pipelined processors? **(8)**

Q.5 a. Write the PRAM algorithm to compute depth of each node in a given binary tree using Euler Tour techniques. **(8)**

b. Write an MPI program for addition of all the elements of an array. **(10)**

Q.6 a. Write Bitonic Merge sort algorithm. Explain the order of comparaters being used in a Bitonic Merge sort algorithm for "n" data values. **(10)**

b. Write a parallel Algorithm to multiply two matrices both of the order of $n \times n$ using n processors. Also discuss its complexity. **(8)**

Q.7 a. Parallelize Prim's sequential minimum spanning tree algorithm. Discuss the time complexity of the parallel algorithm. **(12)**

b. Write Parallel prefix algorithm, on any architecture by explaining the working of the algorithm. **(6)**