Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CSE)/SEM-7/CS-704C/2012-13

2012

PARALLEL PROGRAMMING

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Objective Type Questions)

1. State *true* or *false* for the following : 10 × 1 = 10

   i) All prefix sums of list of n values can be computed in $\lceil \log n \rceil$ addition steps on a EREW PRAM.

   ii) Bisection width of Shuffle-exchange network is 2^{k-1}.

   iii) Amdahl's law states that the maximum speed-up s achievable by parallel computer with p processors performing the computation is $s < (1 - f)/p$, where f be the fraction of work performed sequentially.

iv) Truth table for the bit-serial addition on CM-200 processor array :

	Input Bits		***Output Bits***	
Memory	***Memory***	***Flag***	***Memory***	***Flag***
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

v) Binomial trees of height greater than 4 can be embedded in 2-*D* mesh without increasing the dilation beyond 1.

vi) The parallel section pragma precedes *K* blocks of code that may be executed concurrently by *K* threads, if it has this syntax :

pragma omp parallel sections

vii) Inverting loops into parallel “for loops” can actually increase a program execution time.

viii) s_lock and s_unlock are the two functions used in a primitive stack monitor to be implemented in Sequence C.

ix) MPI is used in SAS architecture.

x) Barrier is the only way through which synchronization is possible.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain the terms 'Linear speed-up' and 'Super linear speed-up'. Why is sub-linear speed-up achieved for most of the problems ? 3 + 2

3. Overhead has an important role is parallel programming. Explain. List the different classes of overheads. 2 + 3

4. With a suitable diagram, explain the PRAM model for parallel processing. 5

5. Compare the RAM model of serial computation with PRAM model of parallel computation. 5

6. What is omega network ? Explain briefly with a suitable diagram. 5

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Derive a EREW PRAM algorithm to sum n elements using $\frac{n}{2}$ processors. Derive the time complexity of the algorithm. 6

   b) Write a PRAM algorithm to merge two sorted lists. The two lists and their unions have disjoint values. 4

   c) Prove that a p-processor priority RAM can be simulated by a p-processor EREW PRAM algorithm. Determine the factor by which the time complexity is increased. 5

8. a) Discuss Flynn's classification for multiprocessor systems. What are its short-comings ? 7

   b) What is cache coherence ? Why is cache coherence important in case of multiprocessors ? 4

   c) Describe a superscalar architecture. 4

9. a) What are the different design requirements for the distributed systems ? Discuss the different challenges that need to be addressed while designing distributed system. 2 + 3

   b) What are the diameter and bisection width of a hypercube with 16 nodes ? What is the difference between a hypercube and a cube connected cycle network ? 5

   c) Compare centralised and distributed shared memory architecture. 5

10. a) What is self scheduling and indirect scheduling ? 5

    b) Explain effectiveness of cache. 5

    c) What is understood by granularity of a program ? How does it affect the efficiency of parallel processing ? 5

11. Write short notes on any *three* of the following : 3 × 5 = 15

    a) Parallel sorting algorithm

    b) C* Programmer's model

    c) Foster's methodology for parallel algorithm

    d) MPI programming technique

    e) Data parallelism.