Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CSE)/SEM-7/CS-704C/2009-10

2009

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
(Multiple Choice Type Questions)

1. Choose the correct alternatives of the following : 10 × 1 = 10

   i) In a shuffle exchange network which function creates self loop in the communicating processor ?

   a) Shuffle b) Exchange

   c) Both (a) and (b) d) No self loop is present.

   ii) Serialization is achieved among the multi-processor using

   a) semaphore b) barrier contention

   c) spin lock d) monitor.

iii) In a pyramid type network, having P^2 number of nodes in the lowest level, contain in total ..... number of nodes.

a) $K^2 + \log k$ b) $(k + 1) \infty 2^k$

c) k^3 d) $(4/3) k^2 - 1/3$.

iv) In a k-ary hyper tree network has bisection width of

a) $2 \infty k$ b) 2^{k+1}

c) $K \infty (k + 1)$ d) k.

v) The time complexity of computing parallel sum of n elements in SIMD having P processor organized in hypercube network is

a) n b) n/p

c) $\log n + p$ d) $n/p + \log p$.

vi) Consider a parallel algorithm for merging of two sorted array having $n/2$ elements each. If one element is in the second array stores elements $n/2$ to n and location in the second array is I and it is greater than J number of element then its position in the merged array will be

a) $I + n/2 - J$ b) $I + J - n/2$

c) $I + J$ d) $I + J - 1$.

vii) Which memory access method is most useful and efficient without using any further synchronization tool but that may causes data loss ?

a) EREW b) ERCW

c) CREW d) CRCW.

viii) If a parallel algorithm has computation time *t*, number of computation *m* and number of processor involve *p* then execution time of the algorithm is

a) $t + (m - t) / p$ b) t

c) $t + p * t$ d) $t + \log p$.

ix) In a NUMA multiprocessor architecture to reduce the average latency time to access data or instruction

a) use block oriented access

b) increase locality

c) row condition

d) maximize grain size.

x) Which of the following is not a synchronizing technique ?

a) Barrier b) Exclude directive

c) Spin lock d) Critical directive.

GROUP – B
(Short Answer Type Questions)

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

2. Does two concurrent processes may cause dead lock ? If yes, what are the necessary conditions for that ? Explain.

3. What do you mean by seedup in a multi-processor system ? What will be the speed up of a computer having P number of processor executing a program A ? Does this speed up may exceed in any situation ?

4. What is barrier synchronization ? Why is synchronization necessary ?

5. What is dynamic load balancing on mulii-processor system ? Why is it required ? What is the different way to distribute the tasks dynamically ?

6. Given a set of vertices and a non-negative cost C_{IJ} associated with each pair of vertices I and J, find an circuit containing each vertex in the graph suitable for multi processor system so that the cost of the entire tour is minimized.

GROUP – C

(Long Answer Type Questions)

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

7. a) Given a list of task order by their relative priority, suggest a way to assign the unassigned tasks to the available processors whose predecessor task have already finish execution. 5

b) Following the Coffman-Graham scheduling algorithm show how the tasks shown in the following task graph can be scheduled. Draw the Gantt chart for the task graph. 10

8. a) In an array there are 16 elements stored. How the sum of these numbers can be calculated following a parallel algorithm if the processors are organized in a hypercube network. Write the algorithm and show each steps with a neat sketch. 10

   b) What may be the lower bound of time complexity for parallel sorting algorithm if processors are organized in one-dimensional mesh or two-dimensional mesh network ? 5

9. a) Without fork-join construct no parallel program can run concurrently. Why ? 3

   b) In a multi-processor system for correct result any critical section may have to execute in a serialized way. Ensure that how that can be achieved by using any synchronizing tool. 6

   c) In a multi-computer system different computer communicate with each other by sending message. In each of these computers a process is running. These processes should not proceed beyond a fixed point until all other process reaches to that point. How that can be achieved ? 6

10. a) Write an algorithm to find the result of multiplication of two matrixes in SIMD computer where processors are organized in a two-dimensional mesh network. Also explain the algorithm with required figure. 3 + 5

    b) Show how Bitonic merge sort can be done on shuffle exchange network. 1 + 6

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

    a) Super pipelined super scalar architecture

    b) Granularity and parallelism

    c) Write once and write invalidate protocol

    d) Shared memory access and synchronization methods.