*Name* : .....

*Roll No.* : .....

*Invigilator's Signature* : .....

**CS/MCA/SEM-5/MCAE-501C/2011-12**

**2011**

# 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 for the following :

10 × 1 = 10

i) NUMA is a kind of

a) SISD b) MISD

c) SIMD d) MIMD.

ii) In which kind of processor architecture degree is fixed ?

a) Hypercube b) 2D-mesh

c) Pyramid d) Hyper tree.

iii) Matrix multiplication in hyper cube network takes time of

a) O ( $n^2$ ) b) O ( $n \log n$ )

c) O ( $n$ ) d) O ( $\log n$ ).

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

a) Barrier b) Exclude directive

c) Spin lock d) Critical directive.

v) Omega network is the other name of

a) Shuffle-exchange network

b) Butterfly network

c) Hyper tree network

d) De Bruijin's network.

vi) Which of the following is a biotonic sequence ?

a)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 4 | 3 | 7 | 8 | 3 | 6 | 4 |

b)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

c)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3 | 4 | 5 | 6 | 4 | 5 | 4 | 3 |

d)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | 7 | 1 | 8 | 2 | 6 | 9 | 3 |

vii) Which one of the following is a true data dependency ?

a) Flow data dependence

b) Anti-data dependence

c) Conditional dependence

d) Output data dependence.

viii)
```
for ( i = 0 ; i < 100 ; i++ )

for ( j = 0 ; j < 100 ; j++ )

{

a [ i ] [ i ] = b [ i ] [ j ] ;

}
```

This block has

a) good spatial and temporal locality

b) good spatial but bad temporal locality

c) good temporal but bad spatial locality

d) none of these.

ix) You have a 1024 number of integer array where each integer occupies two bytes. You have 32 processors in hand each having L2 cache ( 128 bytes ). How will you interleave the array ?

a) In single integer slices

b) In 64 integer slices

c) In 128 integer slices

d) In 32 integer slices.

x) Which of the following statements is true ?

a) Coarse granularity implies tight coupling

b) Granularity has no relation with coupling

c) Fine granularity implies tight coupling

d) Fine granularity implies loose coupling.

**GROUP – B**

**( Short Answer Type Questions )**

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

2. a) What are RAM and PRAM machines ? 2

   b) Explain the difference between the READ, WRITE and EXECUTE steps of a RAM and a PRAM. 3

3. a) Explain the instruction level pipelining mechanism used in parallel computing. 2

   b) Derive the ratio for pipelined execution versus non-pipelined execution. 3

4. a) What do we mean by the speed-up of a parallel computation ? What are the factors affecting the speed-up factor ? What are super-linear and sub-linear speed-ups ? 1 + 1 + 1

   b) State and prove the Amdahl's law. 2

5. a) Explain the need of cache-coherency in multiprocessor systems. 2

   b) Explain any one method of resolving the cache-coherency issue. 3

6. Draw the data flow graph of the following expression evaluation :

   F = ( a – b )* ( a + c ) / ( d - e ).


## GROUP – C

### ( Long Answer Type Questions )

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

7. a) What do we mean by concurrent memory access ? Can we read as well as write concurrently to a memory location ? 1 + 1

   b) Briefly explain the four categories into which concurrent memory accesses can be classified. 2

   c) What is a conflict concerning concurrent memory access ? Give examples. 2

   d) Briefly explain any three techniques used to resolve conflicts arising out of concurrent memory accesses. 4

   e) Write and explain, with a suitable example, the algorithm for the parallel implementation of the Enumeration Sort method. 5

8. a) What do we mean by Parallel Programming ? Why do we need it ? What is a Processing Element ? 2 + 2 + 1

   b) Explain all the categories of Flynn's classification of computer systems. Give suitable examples. 5

   c) How do we differentiate between tightly coupled and loosely coupled MIMDs ? 3

   d) What is parallel overhead ? 2

9. a) What is Prefix computation ? Give example. 2 + 1

   b) Write and explain, with a suitable example, the parallel implementation of the Prefix Computation method. Show the intermediate steps. Is the method cost optimal ? 2 + 4 + 1

   c) Draw and explain the basic Von-Neumann Computer architecture. 3

   d) How are multi-processors different from multi-computers ? 2

10. a) Explain the VLIW Architecture. Explain how pipelining is incorporated in VLIW Architecture for a degree $m = 3$. 7

    b) Make the dependence graph of the following program segment : 8

    S1 : C = D × E

    S2 : M = G + C

    S3 : A = B + C

    S4 : C = L + M

    S5 : F = G ÷ E.

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

    a) Parallel Odd-Even Transposition Sort

    b) Barrier Synchronization

    c) UMA and NUMA architectures

    d) Parallel Gaussian Elimination method

    e) Bernstein's conditions.