Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India

(Autonomous College Affiliated to University of Mumbai)

End Semester Examination-Synoptic

2018-19

Max. Marks: 60

Class: M.Tech. (1st Year)

Course Code: CE922

Name of the Course: High Performance Computing
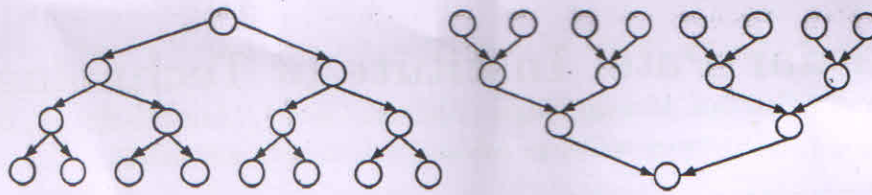
Duration: 180 Min

Semester: II

Branch: Computer Engineering

Instruction:

(1) All questions are compulsory

(2) Draw neat diagrams

(3) Assume suitable data if necessary

Q No.	Question	Max. Marks	CO
Q.1 (a)	Define the following terms : i) ServerNet address space and ii) ATM Adaption Layer. **Answer:** Definition of *ServerNet address space* carries 2 Marks. Definition of *ATM Adaption Layer* carries 2 Marks.	04	CO2
Q.1 (b)	Exemplify the matrix-vector multiplication using MPI. **Answer:** There are four steps: i)Partitioning, ii) Communication, iii) Agglomeration & iv)Mapping. Each step carries 2 Marks. (Total=2*4=8 Marks)	08	CO3
Q.2 (a)	Differentiate between User-Level and Kernel-Level Lightweight Communications Systems. **Answer:** Each correct difference carries 1 Marks. (Total=1*4=4 Marks)	04	CO2
Q.2 (b)	Summarize Kernels and the OpenCL Execution Model **Answer:** Summarization of Kernels carries 4 Marks. Summarization of OpenCL Execution Model carries 4 Marks.	08	CO4
Q.3 (a)	Elaborate Translation Table and Handler Table of Endpoint in the context of Active Messages. **Answer:** Elaboration of Translation Table carries 2 Marks. Elaboration of Handler Table of Endpoint carries 2 Marks.	04	CO2
Q.3 (b)	Consider the following two task graphs, Determine : i) Maximum degree of concurrency, ii) Critical path length, iii) Maximum achievable speedup over one process assuming that an arbitrarily large number of processes is available, and iv) The minimum number of processes needed to obtain the maximum possible speedup.	08	CO1

Answer:

Each sub-question(i to iv) carries 1 Mark for each task graph. (Total=1*4*2=8 Marks)

Q.4 (a)	Recall the following terms i) Global Memory & ii) Constant Memory in the context of OpenCL Memory Model. **Answer:** Details of Global Memory carries 2 Marks. Details of Constant Memory carries 2 Marks.	04	CO3
Q.4 (b)	Apply LU factorization algorithm to factor the following non-singular matrix A into the product of a lower triangular matrix L with a unit diagonal and an upper triangular matrix U. Also show decomposition of A matrix in multiple tasks. $$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$ **Answer:** Calculation of Lower Triangular Matrix, L, carries 4 Marks. Calculation of Upper Triangular Matrix, U, carries 4 Marks. **OR** Exemplify LU factorization algorithm to factor a non-singular square matrix. **Answer:** Calculation of Lower Triangular Matrix, L, in LU factorization algorithm carries 4 Marks. Calculation of Upper Triangular Matrix, U, in LU factorization algorithm carries 4 Marks.	08 08	CO1 CO1
Q.5 (a)	Define the following terms related to parallelism, dependence relations and various system interconnect architectures: i) Degree of parallelism, ii) Control Dependence, iii) Bernstein conditions, iv) I/O Dependence, v) Node Degree, vi) Network Diameter, vii) Bisection Bandwidth & viii) Multistage networks. **Answer:** Each definition carries 0.5 Mark. (Total=0.5*8=4 Marks)	04	CO2

Q.5 (b)	Draw *fine-grain* and *coarse-grain* program graphs for the following program.	08	CO1

Var $a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r$
Begin
1. $a := 1$
2. $b := 2$
3. $c := 3$
4. $d := 4$
5. $e := 5$
6. $f := 6$
7. $g := a \times b$
8. $h := c \times d$
9. $i := d \times e$
10. $j := e \times f$
11. $k := d \times f$
12. $l := j \times k$
13. $m := 4 \times l$
14. $n := 3 \times m$,
15. $o := n \times i$
16. $p := o \times h$
17. $q := p \times q$
18. $r := 5 \times q$

End

Answer:
Correct diagram of *fine-grain program graph* carries 4 Marks.
Correct diagram of *coarse-grain program graph* carries 4 Marks.

OR

Perform a data dependence analysis on each statements (S1–S5) of the following program fragments. Show the dependence graph among the statements with justification. **08   CO1**

S1 $a = b$
S2   , $b = c + d$
S3 $e = a + d$
S4 $b = 3$
S5 $f = b * 2$

Answer:
Dependence graph carries 5 Marks.
Data dependence analysis carries 3 Marks.