Sardar Patel Institute of Technology

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

(Autonomous College Affiliated to University of Mumbai)

(16)

End Semester Examination

Apr 2018

Max. Marks: 100 Duration: 180 Min

Class: M.Tech. (1^{st} Year) Semester: II

Course Code: CE922 Branch: Computer

Name of the Course: High Performance Computing

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)	List any five High Speed Network choices for High Performance Computing.	05	CO2
Q.1 (b)	Define the following terms in the context of Lightweight Messaging System: i) Latency, ii)End-to-end Asymptotic Bandwidth, iii) One-sided Asymptotic Bandwidth, v) Throughput and v) Message Delay.	05	CO2
Q.1 (c)	Define the terms : i) MIPS rate and ii) FLOPS	05	CO2
Q.1 (d)	List any five Kernel-level Lightweight Communications Systems.	05	CO2
Q.2 (a)	Discuss OpenCL Abstract Memory Model.	10	CO4
Q.2 (b)	Discuss the structure of *endpoint* communication port in *active messages*.	10	CO3
Q.3 (a)	Exemplify the detection of parallelism using Bernstein's conditions. OR Consider the following five statements labeled P_1, P_2, P_3, P_4 and P_5, in program order. Show the dependence graph for both data dependence and resource dependence of the five statements. $P_1 : C = D \times E$ $P_2 : M = G + C$ $P_3 : A = B + C$ $P_4 : C = L + M$ $P_5 : F = G \div E$	10 10	CO3 CO3
Q.3 (b)	Discuss the effect of fixing problem size (W) and fixing number of processing elements (p) on the efficiency (E) of parallel system. OR	10	CO1

	Consider a parallel system containing p processing elements solving a problem consisting of W units of work. Prove that if the isoefficiency function of the system is worse (greater) than $\Theta(p)$, then the problem cannot be solved cost-optimally with $p = (W)$. Also prove the converse that if the problem can be solved cost-optimally only for $p < \Theta(W)$, then the isoefficiency function of the parallel system is worse than linear.	10	CO1
Q.4 (a)	Suppose n pieces of work are allocated in cyclic fashion to p processes. i) Which pieces of work are assigned to process k, where $0 \leq k \leq p-1$? ii) Which process is responsible for piece of work j, where $0 \leq j \leq n-1$? iii) What are the most pieces of work assigned to any process? iv) Identify all processes having the most pieces of work? v) What are the fewest pieces of work assigned to any process?	10	CO3
	OR		
	Write a parallel variant MPI program of the classic "Hello, world" program. Each process should print a message of the form : `Hello, world, from process <i>` where <i> is its rank.	10	CO3
Q.4 (b)	Two types of data decomposition strategies namely i) *Interleaved Data Decomposition* and ii) *Block Data Decomposition* assign n elements to p processes such that each process is assigned either $\lceil n/p \rceil$ or $\lfloor n/p \rfloor$ elements. For each pair of values of n and p, use a table or an illustration to show how these two schemes would assign array elements to processes: i) $n = 15$ and $p = 4$ ii) $n = 15$ and $p = 6$ iii) $n = 16$ and $p = 5$ iv) $n = 18$ and $p = 4$ v) $n = 20$ and $p = 6$	10	CO1
	OR		
	Compare *Rowwise* and *Columnwise* Block-striped Decomposition of an $m \times n$ matrix for matrix-vector multiplication.	10	CO1
Q.5 (a)	Discuss the recursive decomposition for sorting a sequence of 12 numbers using Quicksort and then show the task-dependency graph of the decomposed 12 numbers. The sequence of 12 numbers are : $5, 12, 11, 1, 10, 6, 8, 3, 7, 4, 9, 2$.	10	CO4
Q.5 (b)	Exemplify One-to-All Broadcast and All-to-One Reduction operations for Mesh and Hypercube parallel algorithms.	10	CO3