

Q1. How Distributed systems are different from Network and Parallel systems? Compare their properties. [14]

OR

What are Distributed systems? Write in detail the different issues in a Distributed computing system.

Q2. Write the architectural classification schemes with example of digital computers considering the data stream and instruction streams [14]

OR

Differentiate between:

i) Array Processors and Vector Processors

ii) Loosely Coupled Systems and Tightly Coupled Systems

Q3. a) Explain the design of the cube interconnection network. Show its implementation as a recirculating and multi-stage interconnection network. Write the routing functions for the same. [7]

b) Explain how data routing function works in an Array Processor for the following with  $N=16$

$$S(K) = \sum_{i=0}^k A_i \text{ for } k=0, 1, 2, \dots, n-1$$

Write the total number of steps required. [7]

OR

Design a mesh-connected ILLIAC network with  $N=16$ . Write the routing function and the upper bound on routing steps. [7]

Design a Shuffle Exchange interconnection network for  $N=16$ . Write perfect shuffle, inverse perfect shuffle, and apply the exchange function on both. [7]

Q4. a) Explain with diagram how the matrix multiplication takes place for a  $3 \times 3$  matrix in an ILLAC-IV involving all 64 PEs in synchronous lock-step fashion. Consider the case for  $N=64$ ,  $N>64$ , and  $N<64$ . [7]

b) Consider a BSP System consists of 7 memory modules and 6 arithmetic elements. Show the physical memory mapping of a  $4 \times 5$  matrix in that BSP system. Hence, Compute the module and offset for the second row of the array. [7]

OR

a) Write the  $O(N^2)$  algorithm for SIMD Matrix multiplication and explain the step of operation through a diagram. [7]

b) Draw the data flow graph for the computation of

$$U = f(x, y) = ((x + y) + x - \left(\frac{x*y}{y}\right) * (y + x) * x + \left(\frac{x*y}{x}\right)) \quad [7]$$

Q5. a) Derive the equation for performance analysis of Array Processors. Compute its speedup and efficiency. [7]

b) What is PRAM? Explain the subclasses of PRAM [7]

OR

a) Explain different parameters used for evaluating the static interconnection networks. Give a comparison table of characteristics considering the following static interconnection networks: completely connected, star, linear array, hypercube, bus [7]

b) What are the different protocols used to resolve concurrent writes in a PRAM machine. [7]