Master of Computer Applications (MCA)
MCAC-402: Parallel and Distributed Computing
Unique Paper Code: 223401402
Semester: IV
May 2023
Year of admission: 2021

Time: 3 Hours

Instructions for the Students: Max. Marks: 70

Attempt all questions. Parts of a question should be answered together.

1. a. Write a C/C++ program to calculate the value of π (pi) using openMPI.   4

    b. What is meant by Bernstein condition? Using Bernstein's condition, detect   6
        maximum parallelism between the instructions of the following code:

$$P_1 : A = B * C$$
$$P_2 : P = Q - A$$
$$P_3 : R = T + A$$
$$P_4 : A = S + P$$
$$P_5 : V = Q \div C$$
$$P_6 : W = V - R$$

2. a. Compute the diameter and bisection width for 3D mesh with P=64 processors.   4

    b. With the help of a neat diagram, illustrate the procedure for matrix multiplication   6
        using Hypercube SIMD model for the following matrices.

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$B = \begin{bmatrix} -5 & -4 \\ 7 & 8 \end{bmatrix}$$

3. a. Construct an 8-input Omega network using 2x2 switch modules in multiple   4
        stages. Show the routing of the message from input 010 to output 110.

b. Write pseudocode for performing an even-odd transportation 6
sort on a linear array of n processors. What is the overall time complexity?
Illustrate the sorting process for the following sequence of 8 numbers:
3, 1, 9, 7, 5, 2, 0, 6

4. a. Explain Process Migration. What are the different steps involved in process 5
migration? Also list the advantages of Process migration.

   b. A program has only two modes of operation; purely sequential mode for 30% of 5
the program and fully parallel for the remaining program. The program is run on
a multiprocessor system having only 16 processors. Find the maximum speed
up?

5. a. Suppose that two processes detect the demise of the coordinator simultaneously 5
and both decide to hold an election using the bully algorithm. What happens?

   b. Write a pseudocode program using Message Passing Interface (MPI) for remote 5
computation where client submits a string to the server and server returns the
reverse of it to the client.

6. a. Differentiate the structured and unstructured naming in distributed system. 5

   b. Write brief notes on each of the following:
   (i) Remote procedure call   5*3=15
   (ii) Object orientated middleware
   (iii) Message orientated middleware
   (iv) Event-based middleware
   (v) Publish–subscribe systems
   Your notes should highlight the significant differences between these forms of
middleware and should mention any application areas for which each is
especially suited.