Indian Institute of Information Technology Sri City, Chittoor

(An Institute of National Importance under Act of Parliament)

Mid Semester Examination - Spring 2021

[19 February 2021 - 09:00 AM -10:15 AM]

Course Name: **Distributed Computing** Total Marks: **30 + 10 (MCQs) Marks**

Instructions:

a) The actual examination is scheduled for 60 minutes and another 15 minutes would be given for organizing the answer scripts, scanning and submitting over online.

b) Precisely answer the questions with relevant details. Avoid writing unnecessary explanations.

c) The file to be uploaded should be named as follows: **ABCD**-**YYYY**-midsem-DC2021-**AYCOY**.pdf Where **ABCD** is the last 4 digits of your roll number; **YYYY** - year of admission (probably either 2017 or 2018); **AYCOY** - any 5 characters in CAPITAL letters (this may act as a secret key - Do not share with others). Please use hyphen (-) and NOT the "underscore" (_).

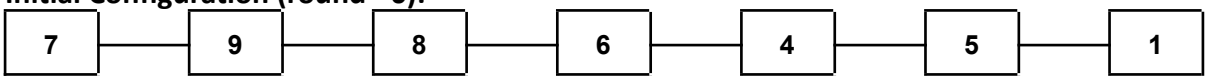
d) Submission portal: **http://smartmiss.iiits.ac.in/upload** and choose "**Distributed Computing**" as the course name.

Descriptive Questions:

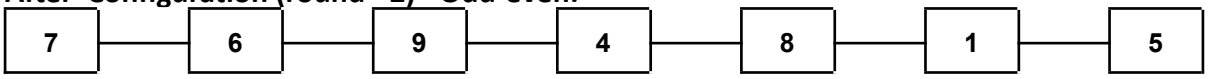
1. [4 Marks] Define a Distributed System. State and briefly describe the essential characteristics of a distributed system. How is a distributed system different from a parallel system?

2. [8 Marks] Let us consider n Processing Entities (PEs) arranged on a line network and without loss of generality, let us assume that one process is active in each PE. The intermediate states of processes in the execution of a distributed sorting algorithm are given below:

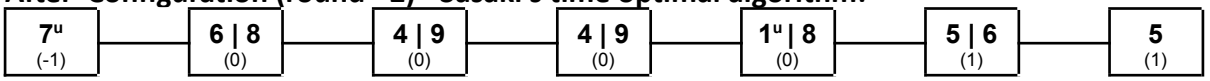
Initial Configuration (round - 0):



After Configuration (round - 2) - Odd-even:



After Configuration (round - 2) - Sasaki's time optimal algorithm:



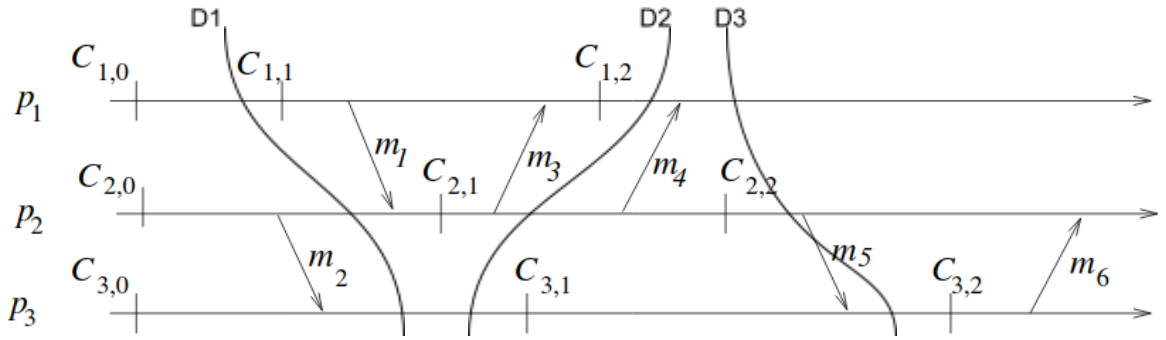
You are expected to apply the following distributed sorting algorithms on a line network and arrive at all steps until the final configuration (3 + 3 + 2 marks each) :

a) Odd-Even Transposition Sort

b) Sasaki's time-optimal algorithm

c) The final solution selection strategy for the given partial order "≥" in Sasaki's time-optimal sorting algorithm.

3. [6 Marks] Answer the following:
    a) Mathematically state two different ways of defining the consistent global state of a distributed system.
    b) Consider the following state-time diagram. There are 3 processes and $C_{i,k}$ denotes k^{th} event on the i^{th} process. Now D1, D2, and D3 are 3 different cuts. State and describe whether these cuts could lead to consistent states? Justify your answer.



4. [4 Marks] Explain Lamport's logical clock approach and illustrate it for performing the clock correction of the following clocks:
    a. There are n processes where n = 4 and all processes start at 0 at time t_o
    b. Clock 1 runs at the clock rate of 5 time units per tick
    c. Clock 2 runs at the clock rate of 4 time units per tick
    d. Clock 3 runs at the clock rate of 8 time units per tick
    e. Clock 4 runs at the clock rate of 6 time units per tick

5. [8 Marks] Answer the following:
    a. Describe Chandy and Lamport's Global snapshot recording algorithm with an example.
    b. State and describe the rules in the termination detection algorithm using distributed snapshots.