Indian Institute of Information Technology Sri City, Chittoor

(An Institute of National Importance under Act of Parliament)

End Semester Examination - Spring 2021

[23 April 2021 - 09:15 AM - 10:30 AM + 10 Mins for MCQs]

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.

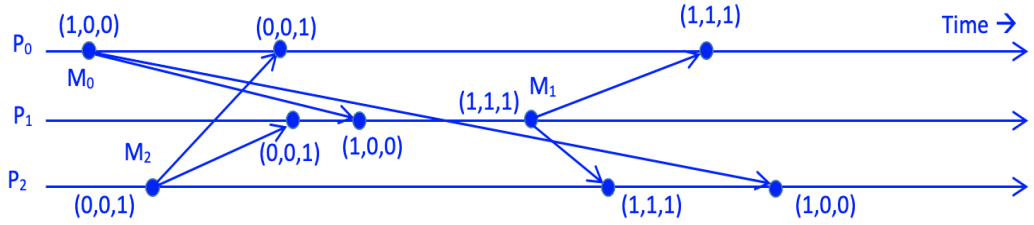
c) The file to be uploaded should be named as follows:
ABCD-**YYYY**-endsem-DC2021-**AYCOY**.pdf Where **ABCD** is the last 4 digits of your roll number; **YYYY** - year of admission (probably either 2017 or 2018); **AYCOY** - any 5 characters in CAPITAL letters (this may act as a secret key - Do not 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. [5 Marks]
Briefly describe Lamport's Logical clock approach. Assume that the clocks of P_1, P_2 and P_3 run at 5, 3, 8 time units respectively. Now illustrate the correction of clocks with the following events (local or send or receive event): e_1^1, e_2^1, $e_3^1 \rightarrow e_2^3$, $e_3^2 \rightarrow e_1^4$, e_2^4, $e_3^3 \rightarrow e_1^5$, $e_2^5 \rightarrow e_1^6$, $e_1^8 \rightarrow e_2^6$, e_3^5. Also mention at least 2 limitations of Lamport's logical clock approach.

2. [4 Marks]
Consider the following State-Time diagram. Illustrate a situation in which a message is put in a hold-back queue and eventually how is the message delivered?



3. [6 Marks]
   a) Describe any 4 possible failures that could be seen in a distributed system

   b) Briefly explain the design issues of group communication in distributed systems?

   c) Define (i) Synchronization Delay (ii) System Throughput

4. [4 Marks]
   Differentiate causal & concurrent dependencies in message ordering using the state-time diagram of suitable examples

5. [5 Marks]
   Explain Raymond's Tree based distributed mutual exclusion algorithm and state the average message complexity and synchronization delay of Raymond's Algorithm.

6. [6 Marks]
   Illustrate by applying Chen et al's self-stabilizing algorithm to construct a spanning tree rooted at node E

Hint:

(R0) $L(i) \neq n \wedge L(i) \neq L(p) + 1 \wedge L(p) \neq n \rightarrow L(i) := L(p) + 1.$

(R1) $L(i) \neq n \wedge L(p) = n \rightarrow L(i) := n.$

(R2) Let k be some neighbor of i,
$L(i) = n \wedge L(k) < n - 1 \rightarrow L(i) := L(k) + 1;\ P(i) := k.$

Initial configuration