Course Code : CST 401 **EVFU/MW – 18 /6103**

Seventh Semester B. E. (Computer Science and Engineering) Examination

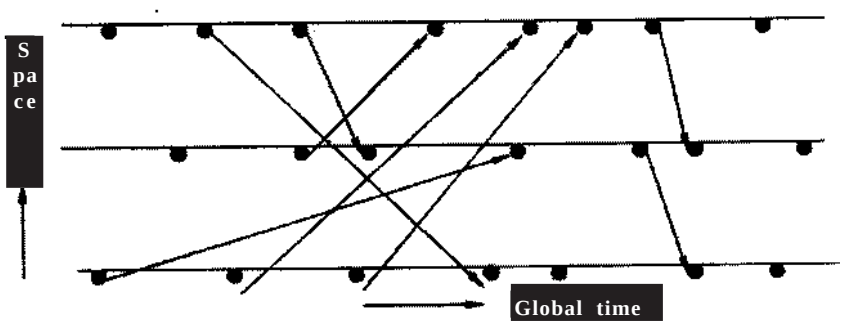
DISTRIBUTED SYSTEMS

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions carry marks as indicated against them.
(2) Number your answers properly.
(3) Assume suitable data and illustrate answers with neat sketches whereve necessary.

1. (a)



For the above space time diagram, Label each process and event and answer the following questions :—

(i) Using Lamport and Vector logical clock scheme, assign timestamp to each event.

(ii) List Concurrent events in the given diagram.

(iii) Identify any violation of causal ordering of messages. 6 (CO 1)

(b) Indicate which set of event is concurrent with justification

(i) (3 , 1 , 5 , 7) , (3 , 2 , 6 , 7) , (2 , 1 , 6 , 8)

(ii) (2 , 1 , 3 , 4) , (2 , 2 , 3 , 3) , (3 , 3 , 2 , 5)

(iii) (1 , 2 , 3 , 4) , (2 , 3 , 4 , 5) , (3 , 4 , 5 , 6)

(iv) (1 , 5 , 6 , 7) , (1 , 4 , 5 , 7) , (1 , 3 , 2 , 2) 4 (CO 1)

2. (a) Suppose Raymond's tree–based mutual exclusion algorithm is used for distributed mutual exclusion, and the 7 processes are arranged in the tree structure as shown below.
Process 1 is initially the token holder. If events take place in the following order :—

(1) P6 makes a request,

(2) P5 makes a request,

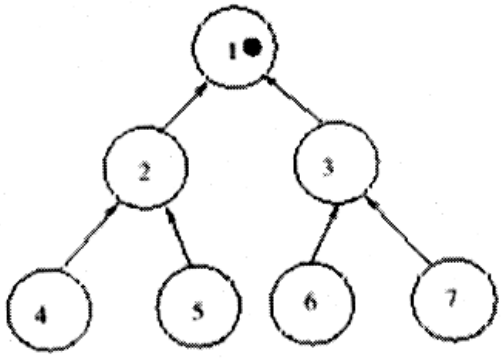
(3) P2 makes a request,

(4) P1 exits the critical section and releases the token,

(5) P3 makes a request,

(6) P6 exits the critical section and releases the token, and so on

Illustrate how each process updates its queue and how the token is being passed, until the entire requests have been served.

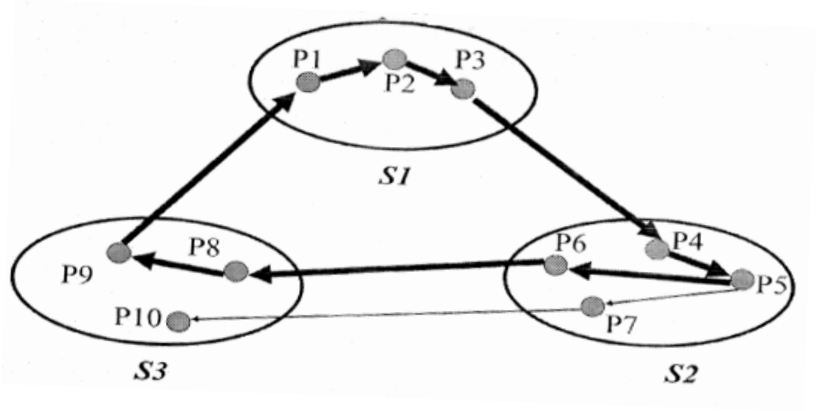


6 (CO 2)

(b) Implement Suzuki–Kasami broadcast Algorithm for following scenario.
Scenario : There are 5 sites in distributed system S1 , S2 , S3 , S4 and S5. Initially token is with S1. Meantime S4 and S5 request for critical section. When S5 enters into critical section, again S1 request for critical section.
What are the contents of Request array, token array and Request Queue when S1 releases critical section ? 4 (CO 2)

3. (a) Implement Chandy–Misra–Haas's edge – chasing algorithm for deadlock detection for the following scenario.

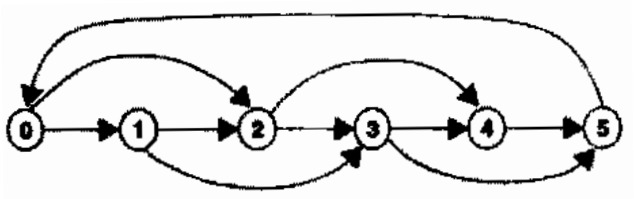
Consider wait for graph having 3 sites and 10 processes as shown in the following figure. Assume process P1 initiates deadlock detection by sending probe message, trace steps of the algorithm for deadlock detection in the following AND request model.



5 (CO 2)

OR

(b) Trace the deadlock detection algorithm proposed by Chandy et al for OR – model if node 1 initiates. State the values of num variable and wait variable at each node.



5 (CO 2)

(c) Prove that in Dolev et al.'s algorithm for case $n > 3m + 1$, if the active processors agree on the value 1, then the passive processors will also agree on the value of 1. Give suitable example for justification of proof. 5 (CO 2)

4. (a) Discuss cache coherence in PLUS system with neat sketch. 5 (CO 3)

OR

(b) Bring out the difference between

(i) Stateful and Stateless server

(ii) Write Invalidate and Write Update protocol. 5 (CO 3)

(c) Narrate the following algorithm for implementing Distributed Shared Memory

(i) Read – Replication Algorithm

(ii) Full – Replication Algorithm 5 (CO 3)

5. (a) Differentiate between

(i) Load Sharing and Load Balancing

(ii) Preemptive and Non Preemptive Transfer 4 (CO 3)

(b) Sender–initiated algorithm causes system instability at high system loads whereas Receiver–initiated algorithms are expensive because of preemptive task transfers. How these drawbacks are removed in Symmetrically Initiated Algorithm ? 6 (CO 3)

OR

(c) What is task migration ? Illustrate task migration process in V – System, Sprite, Accent. 6 (CO 3)

6. (a) Show that when checkpoints are taken after every K (K > 1) messages are sent, the recovery mechanism can suffer from domino effect. Assume that a process takes checkpoint immediately after sending K^{th} message but before doing anything else. 5 (CO 4)

OR

(b) Discuss Three–Phase Commit Protocol. Illustrate the behaviour of the protocol in case of site failure. Draw Finite state machine in terms of Failure and timeout transactions. 5 (CO 4)

(c) Discuss following model of protection

(i) The Take – Grant model

(ii) Bell – LaPadula Model 5 (CO 4)