Course Code : CST 401 **CXDW/RW – 18 / 5102**

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

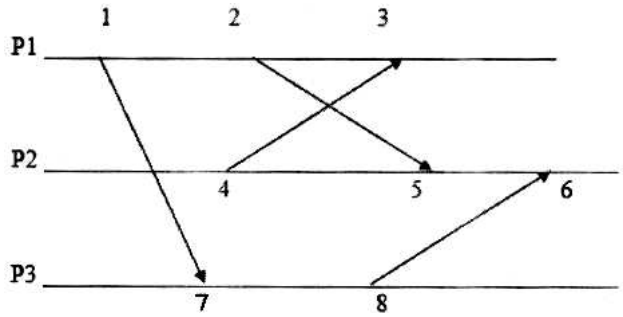
DISTRIBUTED SYSTEMS

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 wherever necessary.

1. (a) The following figure shows messages sent and received in a group composed of three processes P1, P2, P3 :—



(i) For each of the events 1, 2, 3, 4, 5, 6, 7, 8 write the concurrent events.

(ii) Give an example of strongly consistent cut, consistent cut and transit–less cut.

(iii) Draw a consistent cut that contains events 3 and 8, but not event 5. 5 (CO 1)

(b) Explain the working of Chandy Lamport's global state recording algorithm. Consider a system with 3 processes P1, P2, P3. Trace the working of the Chandy Lamport's global state recording algorithm. P1 sends a message to P2 and P3. After this, P1 initiates the algorithm. Show the sequence in which the states of the 3 processes and the communication channels between them will be recorded. 5 (CO 1)

2. (a) Explain the working of Suzuki Kasami's broadcasting algorithm with an example where n = 4, P2 and P4 want to enter CS with sequence numbers 2 and 4 respectively. Assume P1 is in the CS. List the contents of RN, LN and Q at each stage.

How are the following issues resolved in Suzuki–Kasami's broadcasting algorithm ?

(i) Distinguishing between outdated and current request messages.

(ii) Determining which site has an outstanding request for the CS. 6 (CO 2)

(b) What does a site Sj do when it receives a REQUEST (i, sn) message from site Si in Singhal's heuristic algorithm. (Hint : Show how data structures at Sj get updated) 4 (CO 2)

OR

(c) What is the purpose of a REPLY message in Lamport's algorithm for distributed mutual exclusion ? Note that a site need not necessarily return a REPLY message in response to a REQUEST message. Give an example to explain the condition under which a site does not have to return a REPLY message. Also, give the new message complexity per critical section execution in this case. 4 (CO 2)

3. (a) Demonstrate with the help of an example how the values of public and private labels are changed in Mitchell Merritt algorithm in :

(1) Block state.

(2) Activate state.

(3) Transmit state.

(4) Detect state. 6 (CO 2)

(b) What is Byzantine agreement problem ? Is agreement possible if n = 7 and m = 2 ? Prove your answer. 4 (CO 2)

4. (a) Write a short note on cache coherence in the PLUS system. 4 (CO 3)

OR

(b) Differentiate between weak consistency and release consistency. Which of the two will you prefer to use in the design of a distributed system ? Give reasons for your answer. 4 (CO 3)

(c) A distributed operating system designer is of the opinion that since both replication and caching of objects provide more or less similar advantages to a distributed system, both concepts need not be implemented in the same distributed system. Is he or she correct ? Give reasons for your answer. Now differentiate among the following types of distributed operating systems by listing their relative advantages and disadvantages :

(i) One that implements object caching but no object replication.

(ii) One that implements object replication but no object caching.

(iii) One that implements both object caching and object replication. 6 (CO 3)

5. (a) Explain the working of the Above Average algorithm with an example. 5 (CO 3)

(b) What type of learning occurs in stable symmetrically initiated algorithm ? Explain with the help of an example. 5 (CO 3)

6. (a) Processes in a distributed computation perform asynchronous checkpointing as follows : Each process takes a checkpoint immediately after sending a message. Prove with the help of an example that recovery using such checkpoints can be performed without encountering the domino effect. 5 (CO 4)

(b) Explain with an example the implementation of Access Control Lists and Capability Lists. 5 (CO 4)