EX/IT/T/323/2018

BE Information Technology 3rd Year 2nd Semester Examination – 2018

Subject: **Distributed Systems: Algorithms**

Time : Three hours **Full Marks: 100**

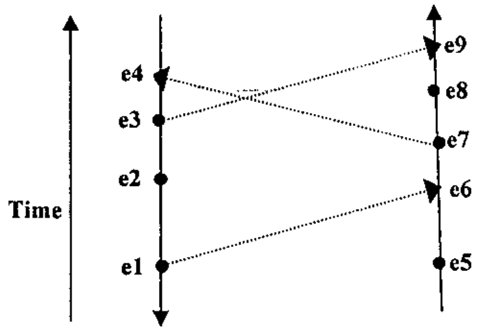
Different parts of the same question should be answered together.

CO1 [20]

Answer any one from (a)and (b) in this block

Q.1a)

i) In many distributed systems, resource sharing is a major goal. Provide examples of distributed systems, where the shared resource is (i) a disk (ii) network bandwidth and (iii) a processor.



ii) Using the above space time diagram list all pairs of concurrent events according to the happened before relation.

iii) Add a message sending event to the space time diagram that is concurrent to events e5, e6 and e7. Now add a non message sending event that is concurrent to events e1,e2 and e3.

iv) Explain the mechanism how causal communication has been enforced in vector clocks.

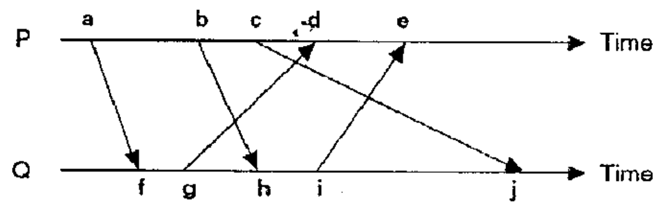
6+4+4+6 =20

Q.1b)

i) What is the difference between synchronous and asynchronous DS?

ii) Explain how logical clocks can be used to mark a unique time-stamp for each event across different nodes in a distributed system.

iii) Calculate the logical clock values of events **a–j** in the communication between two processes P, Q (Shown in Figure).



iv) Calculate the vector clock values of the ten events **a–j** in the diagram. Use the vector clock values to prove that **(d, h)** are concurrent events, but **f** is causally ordered before **e**.

v) Describe an application in which the lack of synchronization among physical clocks can lead to a security breach.

3+3+5+6+3=20

CO2 [20]

Q.2

i) In a network of processes, every process knows about itself and its immediate neighbors only. Suggest a suitable algorithm using which these processes can exchange information to gain Knowledge about the global topology of the network.

ii) A distributed system is charged with the responsibility of counting number of tokens rotating in a ring. The system has a fixed number of processes. Informally describe what each process will do, what interprocess messages will be exchanged ? Is it possible to get a correct result? If not why?

	iii) What are the possible difficulties in global calculation ? How does that can be solved ? 7+7+6=20
CO3 [20]	Q.3 i) Justify how does HS algorithm can use lesser number of messages than LCR algorithm to select a leader in a distributed ring topology. ii) Find the message complexity for LCR algorithm. iii)What is the most significant difference between a synchronous and an asynchronous distributed system? iv) Can you suggest any algorithm to find a leader in an anonymous ring of known size? If not why? 7+4+4+5=20
CO4 [20]	Q.4 i) How can you compute active and passive processes? ii) Consider a unidirectional ring of n processes 0, 1, 2, · · · , n − 1, 0. Process 0 wants to detect termination, so after the local computation at 0 has terminated, it sends a token to process 1. Process 1 forwards that token to process 2 after process 1's computation has terminated, and the token is passed around the ring in this manner. When process 0 gets back the token, it concludes that the computation over the entire ring has terminated. Is there a fallacy in the above argument? Explain. iii) Give the termination detection mechanism used by Dijksta Scholten. iv) What are the roles played by public and private variables in Mitchell-Merritt's algorithm? v) Do you consider Chandy Lamport's algorithm as an example of diffusion computation? 4+3+6+4+3=20
CO5 [20]	Answer any one from (a) and (b) in this block Q.5a) i) Mention the principles followed in Quorum based approach for mutual exclusion. ii) How does Quorum-based mutual exclusion principle is different from other mutual exclusion algorithm. iii) What is liveliness property? With suitable example explain the properties of liveliness. iii) Give a situation where Maekawal's algorithm can enter into a deadlock. 5+5+5+5=20 Q.5b) i) In the Suzuki–Kasami algorithm, prove the liveness property that any process requesting a token eventually receives the token. ii) Compute and compare an upper bound on the number of messages exchanged in the system before the token is received iii) Prove that in Suzuki-Kasami's Broadcast Algorithm a requesting site enters the CS in finite time. iv) Give the performance metrics of mutual exclusion algorithms in DS. 5+5+5+5=20

CO1: Express Distributed Systems software & hardware infrastructure issues, design goals, challenges and discuss causality and general framework of logical clocks in distributed systems. (K2, A2)
CO2: Illustrate algorithms for distributed message passing system and solve related problems. (K3, A3)
CO3: Sketch different leader election algorithms and their analysis in uniform/non-uniform, asynchronous/synchronous rings. (K3, A3)
CO4: Describe and analyze the concept of Global States and snapshot Recording Algorithms and extend them to solve distributed deadlock detection, termination detection (K4, A3)
CO5: Analyze, compare and distinguish different distributed mutual exclusion algorithms and Wave Traversal Algorithms and solve problems (K4, A3)