Code No: R1932052 **R19** SET - 1

III B. Tech II Semester Regular Examinations, June-2022

DISTRIBUTED SYSTEMS

(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

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UNIT-I

1. a) Define distributed computers. Explain their characteristic features and relate them to the components of the computer systems. [8M]
   b) Differentiate the scalar time and vector time, and their properties in detail. [7M]

(OR)

2. a) Identify some distributed applications in the scientific and commercial application areas. For each application, determine the motivating factors of distributed computing. [8M]
   b) What is global state of distributed systems? With time-space diagram of a distributed execution, explain in detail. [7M]

UNIT-II

3. a) Explain the steps of the algorithm which optimally implements the causal ordering of messages in detail. [8M]
   b) Explain the properties of recorded global state. And explain the steps of snapshot algorithms used for FIFO channels. [7M]

(OR)

4. a) What is total order? Illustrate the three-phase total ordering algorithm step-by-step. [8M]
   b) Describe the concept of Rendezvous. Write the algorithmic steps to enforce synchronous order in Rendezvous. [7M]

UNIT-III

5. a) Present Maekawa's algorithm to execute requesting, executing and releasing the critical section and prove that it achieves mutual exclusion. [8M]
   b) Explain the hierarchy of deadlock detection algorithms based on the complexity of the resource requests they permit. [7M]

(OR)

6. a) Write about four classes of distributed deadlock detection algorithms: path-pushing, edge-chasing, diffusion computation, and global state detection. [8M]
   b) Explain the system model of mutual exclusion in distributed systems and discuss the requirements and performance metrics in detail. [7M]

UNIT-IV

7. a) What is communication induced check pointing? Explain the two types of communication-induced check pointing. Relate with mini-process non blocking check pointing. [8M]
   b) Write the Byzantine generals algorithm with recursive formulation. [7M]

(OR)

8. a) Explain the concepts of local check point, consistent system states, interaction with outside world, different types of messages and issues in failure recovery. [8M]
   b) Describe the problem of consensus and agreement. Discuss various issues to be addressed by it. [7M]

UNIT-V

9. a) Explain the implementation of processor consistency and causal consistency in detail. [8M]
   b) What is a content addressable network? Explain its working principle and phases. [7M]

(OR)

10. a) How to enforce shared memory mutual exclusion? Explain Lamport's n-process bakery algorithm for shared memory mutual exclusion. [8M]
    b) Describe the applications of Chord. Explain its operations in P2P networks in detail. [7M]

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UNIT-I

1. a) Describe the motivational issues of distributed systems and relate them with parallel multiprocessor and multicomputer systems. [8M]
   b) How the set of events in the distributed computation classified into a Past and a Future with cut? Explain past and future cones of an event. [7M]

(OR)

2. a) Explain synchronous versus asynchronous executions? How to emulate them on failure free systems? Elaborate. [8M]
   b) Define the system of logic clocks and its implementation in distributed systems. [7M]

UNIT-II

3. a) Present the three phases of the distributed algorithm that enforces total and causal order for closed groups. [8M]
   b) Explain the concept of executions realizable with synchronous communication in asynchronous execution. [7M]

(OR)

4. a) Explain the hierarchy of message ordering paradigms. How it represents a trade-off between concurrency, ease of use and implementation? Discuss. [8M]
   b) Describe the concept of causal order? Explain its necessary and sufficient conditions for causal ordering. [7M]

UNIT-III

5. a) Present and prove the correctness of Lamport algorithm. Discuss its performance optimization in terms of number of messages required to execute the critical section. [8M]
   b) Explain the single resource model, the AND model, the OR model and the AND-OR model of deadlocks in distributed systems. [7M]

(OR)

6. a) Discuss the role of Request and Reply messages and FIFO channels in Ricart-Agrawala algorithm. [8M]
   b) Discuss the deadlock handling strategies and design issues in distributed systems. [7M]

UNIT-IV

7. a) Explain the phases, correctness and optimization of the check pointing algorithm and the rollback recovery algorithm. [8M]
   b) What is Byzantine agreement problem? Explain Consensus algorithms for Byzantine failures in synchronous system. [7M]

(OR)

8. a) Relate and explain deterministic and non deterministic events with pessimistic logging, optimistic logging, and causal logging protocols. [8M]
   b) Describe consensus problem and explain overview of the results and lower bounds on solving the consensus problem under different assumptions. [7M]

UNIT-V

9. a) Explain the concepts of P2P systems and desirable characteristics and performance features of P2P systems. [8M]
   b) Explain the working principle of strict consistency model/ atomic consistency model. [7M]

(OR)

10. a) Explain the concepts of overlay and routing in Tapestry in detail. [8M]
    b) Write the algorithm and explain the implementation of sequential consistency memory model. [7M]

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Code No: R1932052 **R19** SET - 3

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DISTRIBUTED SYSTEMS

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Answer any **FIVE** Questions **ONE** Question from **Each unit**
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UNIT-I

1. a) In detail explain the taxonomy of Flynn's and write about the concepts of coupling, parallelism, concurrency and granularity. [8M]
   b) What is global state? Illustrate the cuts of a distributed computation with space-time diagram. [7M]

(OR)

2. a) Discuss the primary challenges/ issues in designing distributed systems from a system building perspective. [8M]
   b) List and explain the problems solved with the knowledge of causal precedence relation among events in a distributed system [7M]

UNIT-II

3. a) Explain the following message ordering paradigms: (i) non-FIFO, (ii) FIFO, (iii) causal order, and (iv) synchronous order. [8M]
   b) What is causal order? Explain the use of causal order in updating replicas of a data item in the system. [7M]

(OR)

4. a) Explain the three phase distributed algorithm described from the viewpoint of the sender, and then from the viewpoint of the receiver. [8M]
   b) Write the importance of group communication? How it is related with message ordering in distributed systems? Explain in detail. [7M]

UNIT-III

5. a) Present Recart-Agrawala's algorithm to execute requesting, executing and releasing the critical section and prove that it achieves mutual exclusion. [8M]
   b) Explain deadlock handling through Knapp's classification of distributed deadlock detection algorithms. [7M]

(OR)

6. a) Describe the design issues of Suzuki–Kasami's broadcast algorithm with pseudo code and prove the correctness algorithm is based on a token. [8M]
   b) Write the basic idea and algorithm for Chandy–Misra–Haas's OR model for distributed deadlock detection. [7M]

UNIT-IV

7. a) Explain the role of consistent set of checkpoints in coordinated check pointing and recovery technique to avoid the domino effect and live lock problems during the recovery. [8M]
   b) Illustrate the Byzantine agreement problem and explain Agreement in a failure-free system with synchronous or asynchronous. [7M]

(OR)

8. a) Explain three types of Log-based rollback-recovery protocols in detail. [8M]
   b) Write the Byzantine generals algorithm with iterative formulation. [7M]

UNIT-V

9. a) Write about popular P2P system Napster and application layer overlays and distributed indexing mechanism. [8M]
   b) Discuss the abstraction and advantages of distributed shared memory in detail. [7M]

(OR)

10. a) Describe the working of CAN initialization, CAN routing, maintenance, Optimization and complexity. [8M]
    b) Present and explain the implementation of linearizability (LIN) using total order broadcasts in memory consistency. [7M]

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DISTRIBUTED SYSTEMS

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UNIT-I

1. a) Explain the given primitives for distributed communication like blocking/non-blocking and synchronous/asynchronous. [8M]
   b) How to model distributed executions with internal, message send and message receive events? Explain the role of Causal precedence relation in it. [7M]

(OR)

2. a) Briefly summarize the key algorithmic challenges in distributed computing. [8M]
   b) Explain the Physical clock synchronization with Network Time Protocol. Elaborate the concepts of motivation, terminology and clock inaccuracies. [7M]

UNIT-II

3. a) Present and explain the algorithm of Chandy-Lamport snapshot algorithm for FIFO channels. [8M]
   b) Write the importance of non determinism on Synchronous program order on an asynchronous system. Explain various concepts of it with respect to group communication. [7M]

(OR)

4. a) What is binary Rendezvous? Explain its algorithmic constraints and features for the simplified implementation of synchronous order. [8M]
   b) Define global state and consistent global state and discuss the issues which have to be addressed to compute consistent distributed snapshot. [7M]

UNIT-III

5. a) Explain the token based approaches for implementing distributed mutual exclusion. [8M]
   b) Describe steps of Chandy–Misra–Haas's distributed deadlock detection algorithm for the AND model based on edge-chasing. [7M]

(OR)

6. a) Explain distributed mutual exclusion algorithm developed by Lamport. [8M]
   b) Describe the system model of deadlocks in distributed systems. Explain the preliminaries and role of Wait-For-Graph with an example. [7M]

UNIT-IV

7. a) Write about asynchronous check pointing. Explain the basic idea of the recovery algorithm and present the algorithm. [8M]
   b) Define the problem of consensus and agreement protocols and state some assumptions underlying the study of agreement algorithms. [7M]

(OR)

8. a) Write the implementation coordinated check pointing and Uncoordinated check pointing in detail. [8M]
   b) Explain the phase king algorithm steps for consensus in synchronous systems and message patterns used in it. [7M]

UNIT-V

9. a) Describe the object publication and search in Tapster. [8M]
   b) Explain various types of memory consistency models in detail. [7M]

(OR)

10. a) How to map objects to their locations in the network using content-addressable network (CAN)? Explain in detail. [8M]
    b) Write a note on distributed shared memory working principle. [7M]

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