SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

QUESTION BANK

VI SEMESTER

AD3662 – DISTRIBUTED COMPUTING

Regulation – 2023

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Prepared by

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SUBJECT CODE & NAME : AD3662 & DISTRIBUTED COMPUTING

SEM / YEAR: VI Sem / III Year

UNIT I – INTRODUCTION

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

PART – A

Q.No	Questions	BT Level	Competence
1.	What is distributed system?	BTL1	Remembering
2.	What are the characteristics of distributed system?	BTL2	Understanding
3.	What are the advantages of distributed system?	BTL2	Understanding
4.	What are the characteristics of parallel systems?	BTL2	Understanding
5.	Define multi computer parallel system.	BTL1	Remembering
6.	Define MISD.	BTL1	Remembering
7.	Define MIMD.	BTL1	Understanding
8.	Define parallelism or speedup.	BTL1	Remembering
9.	What is concurrency of a program?	BTL1	Understanding
10.	What is granularity?	BTL1	Understanding
11.	What are synchronous primitives?	BTL2	Understanding
12.	What are asynchronous primitives?	BTL2	Understanding
13.	What are blocking primitives?	BTL2	Understanding
14.	What are non-blocking primitives?	BTL2	Understanding
15.	Define blocking synchronous send.	BTL1	Remembering
16.	Define non-blocking synchronous send.	BTL1	Remembering
17.	Define blocking asynchronous send.	BTL1	Remembering
18.	Define non-blocking asynchronous send.	BTL1	Remembering
19.	What is processor synchrony?	BTL1	Remembering
20.	Differentiate synchronous vs asynchronous executions.	BTL 3	Applying
21.	What is communication in the network?	BTL1	Understanding
22.	What are processes?	BTL1	Understanding
23.	What is naming?	BTL1	Understanding
24.	What is synchronization?	BTL1	Understanding

PART – B			
1.	Discuss motivation of distributed systems.	BTL 4	Analyzing
2.	Explain parallel multiprocessor/multicomputer systems.	BTL 3	Applying
3.	Explain in detail Flynn's taxonomy.	BTL 3	Applying
4.	Discuss primitives for distributed communication.	BTL 4	Analyzing
5.	Explain synchronization/coordination mechanisms.	BTL 4	Analyzing
6.	Explain applications of distributed computing and challenges.	BTL 4	Analyzing
7.	Explain a model of distributed computations.	BTL 3	Applying
8.	Explain models of process communication.	BTL 4	Analyzing
9.	Explain how a parallel system differs from a distributed system.	BTL 4	Analyzing
10.	Illustrate the difference between message passing and shared memory process communication model.	BTL 4	Analyzing
11.	Discuss the design issues and challenges in distributed system from a system perspective.	BTL 5	Evaluating
12.	Prove that in a distributed computation, for an event, the surface of the past cone (i.e., all the events on the surface) form a consistent cut. Does it mean that all events on the surface of the past cone are always concurrent? Give an example to make your case.	BTL 6	Creating
13.	Explain message passing systems and discuss on the message-oriented middleware and its types. Also explain the functionality in distributed computing	BTL 3	Applying
14.	Analyze the concepts of heterogeneity, openness, security, scalability impact of the distributed systems. How is the standardization of them make them effective?	BTL 4	Analyzing
15.	Explain blocking, non-blocking, synchronous and asynchronous primitives for distributed communication. Also summarize major libraries and standards for building distributed applications.	BTL 4	Analyzing
16.	Identify the requirements and aspects needed for reliable and fault-tolerant distributed systems.	BTL 5	Evaluating
17.	Describe distributed shared memory (DSM): its design issues, advantages and drawbacks.	BTL 6	Creating
UNIT II – LOGICAL TIME AND GLOBAL STATE			
Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.			
PART – A			
1.	What are the issues in distributed systems?	BTL 2	Understanding
2.	What is group communication?	BTL 1	Remembering
3.	Write an application of causal order.	BTL 3	Applying
4.	What is synchronous order?	BTL 1	Remembering
5.	Define scalar time.	BTL 1	Remembering
6.	Define message ordering.	BTL 1	Remembering
7.	Define empty-interval execution.	BTL 1	Remembering
8.	Define causality in synchronous execution.	BTL 2	Understanding
9.	What is synchronous execution?	BTL 1	Remembering

10.	What is timestamping?	BTL 1	Remembering
11.	Define RSC execution.	BTL 1	Remembering
12.	Define crown criterion theorem.	BTL 2	Understanding
13.	What is non-separated linear extension?	BTL 2	Understanding
14.	Define cut and consistent cut.	BTL 2	Understanding
15.	What is purpose of Chandy-Lamport algorithm?	BTL 2	Understanding
16.	What is purpose of Venkatesan's incremental algorithm?	BTL 2	Understanding
17.	How messages tracked using explicit tracking?	BTL 3	Applying
18.	How messages tracked using implicit tracking?	BTL 3	Applying
19.	Define causal order execution.	BTL 1	Remembering
20.	What are characteristics of group communication?	BTL 2	Understanding
21.	What are the two phases of global snapshot?	BTL 1	Remembering
22.	What are the optimization techniques in Chandy-Lamport?	BTL 2	Understanding
23.	Condition for consistent global state.	BTL 2	Understanding
24.	What is Chandy–Lamport algorithm?	BTL 2	Understanding
	PART - B		
1.	Explain clock synchronization and discuss physical clock synchronization with NTP.	BTL 3	Analyzing
2.	Describe Lamport's logical clocks with examples and prove their correctness.	BTL 4	Applying
3.	Explain vector clocks and how they maintain partial ordering.	BTL 4	Applying
4.	Discuss happened-before relation and its use in distributed systems.	BTL 4	Applying
5.	Compare scalar clocks and vector clocks.	BTL 4	Applying
6.	Describe message ordering techniques: FIFO, causal, and total ordering.	BTL 4	Applying
7.	Explain reliable multicast and group communication semantics.	BTL 3	Applying
8.	Illustrate event ordering and time-stamping mechanisms.	BTL 4	Applying
9.	Explain the concept of global state and consistent cuts.	BTL 3	Analyzing
10.	Describe snapshot recording algorithms used in distributed systems.	BTL 4	Applying
11.	Explain distributed event ordering with proper diagrams.	BTL 4	Applying
12.	Discuss the process of achieving causal message delivery.	BTL 4	Applying
13.	Explain synchronous vs asynchronous logical time models.	BTL 4	Applying
14.	Discuss the limitations of logical clocks and vector clocks.	BTL 5	Evaluating
15.	Explain how global state helps in debugging and recovery.	BTL 5	Evaluating
16.	Analyze time synchronization challenges in large distributed systems.	BTL 5	Evaluating
17.	Discuss the significance of snapshot algorithms in deadlock detection and recovery.	BTL 5	Evaluating
	UNIT III – DISTRIBUTED MUTEX AND RECOVERY		
	Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.		
	PART – A		
1.	What is clock synchronization?	BTL 1	Remembering
2.	Explain the term mutual exclusion.	BTL 2	Understanding
3.	What is deadlock?	BTL 1	Remembering
4.	Name the two types of messages used in Ricart–Agrawala's algorithm.	BTL 1	Understanding

5.	What are the conditions for deadlock?	BTL 1	Remembering
6.	Which are the three basic approaches for implementing distributed mutual exclusion?	BTL 1	Remembering
7.	What are the requirements of mutual exclusion algorithms?	BTL 2	Understanding
8.	What is response time?	BTL 1	Remembering
9.	What is wait-for graph?	BTL 1	Remembering
10.	What do you mean by deadlock avoidance?	BTL 2	Understanding
11.	Define deadlock detection in distributed system.	BTL 2	Understanding
12.	Define distributed mutual exclusion.	BTL 1	Remembering
13.	What are preliminaries for mutual exclusion?	BTL 1	Remembering
14.	Define Lamport's algorithm.	BTL 1	Remembering
15.	Define Ricart–Agrawala algorithm.	BTL 1	Remembering
16.	What are token-based algorithms?	BTL 1	Remembering
17.	What is Suzuki–Kasami algorithm?	BTL 1	Understanding
18.	Define deadlock.	BTL 1	Understanding
19.	What are deadlock models?	BTL 1	Understanding
20.	Define AND model.	BTL 1	Understanding
21.	Define OR model.	BTL 1	Understanding
22.	What is Chandy–Misra–Haas algorithm?	BTL 1	Understanding
23.	What is request set and release set?	BTL 1	Applying
24.	What is drift in token-based algorithms?	BTL 1	Understanding
	PART – B		
1.	Explain Ricart–Agrawala's Algorithm with an example.	BTL 4	Analyzing
2.	Analyse Suzuki–Kasami's broadcast algorithm for mutual exclusion in distributed systems.	BTL 4	Analyzing
3.	Discuss with suitable example to show that a deadlock cannot occur if any one of the four conditions is absent.	BTL 5	Evaluating
4.	Name and explain the different types of deadlock models in distributed system with the commonly used strategies to handle deadlocks with a neat diagram.	BTL 5	Evaluating
5.	Explain different types of failures and their models.	BTL 4	Analyzing
6.	Describe checkpointing and rollback recovery in detail.	BTL 4	Analyzing
7.	Compare coordinated and uncoordinated checkpointing.	BTL 5	Evaluating
8.	Explain domino effect and how it can be prevented.	BTL 4	Analyzing
9.	Describe message logging–based rollback recovery.	BTL 4	Analyzing
10.	Compare optimistic and pessimistic logging.	BTL 5	Evaluating
11.	Explain orphan processes and recovery line calculation.	BTL 4	Analyzing
12.	Discuss how stable storage is implemented and used.	BTL 4	Analyzing
13.	Illustrate recovery mechanisms used in distributed systems.	BTL 4	Analyzing
14.	Discuss failures, failure detectors, and their significance.	BTL 5	Evaluating
15.	Explain backward and forward recovery differences.	BTL 4	Analyzing
16.	Write steps involved in recovery using coordinated checkpoints.	BTL 3	Applying
17.	Analyze fault tolerance issues in large-scale distributed systems.	BTL 5	Evaluating
	UNIT IV – CONSENSUS AND RECOVERY		
	Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and		

Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm - - Algorithm for Asynchronous Checkpointing and Recovery.			
PART – A			
1.	Define consensus in distributed systems.	BTL 1	Remembering
2.	State the agreement property of consensus.	BTL 1	Remembering
3.	Define termination property.	BTL 1	Remembering
4.	Explain the need for consensus in distributed systems.	BTL 2	Understanding
5.	Distinguish between failure-free and failure-prone systems.	BTL 2	Understanding
6.	Define crash failure.	BTL 1	Remembering
7.	Explain Byzantine failure with a simple example.	BTL 2	Understanding
8.	Identify the type of failure where a process behaves maliciously.	BTL 3	Applying
9.	Define checkpointing.	BTL 1	Remembering
10.	Explain the purpose of checkpointing in recovery.	BTL 2	Understanding
11.	Define rollback recovery.	BTL 1	Remembering
12.	Illustrate rollback recovery using a simple scenario.	BTL 3	Applying
13.	Define coordinated checkpointing.	BTL 1	Remembering
14.	Explain how coordinated checkpointing avoids domino effect.	BTL 2	Understanding
15.	Define uncoordinated checkpointing.	BTL 1	Remembering
16.	Identify a situation where uncoordinated checkpointing causes domino effect.	BTL 3	Applying
17.	What is domino effect?	BTL 1	Remembering
18.	Explain the impact of domino effect on system recovery.	BTL 2	Understanding
19.	Define message logging.	BTL 1	Remembering
20.	Explain how message logging supports fault tolerance.	BTL 2	Understanding
21.	Define optimistic logging.	BTL 1	Remembering
22.	Apply pessimistic logging to avoid orphan processes.	BTL 3	Applying
23.	What is stable storage?	BTL 1	Remembering
24.	Explain why stable storage is essential for reliable recovery.	BTL 2	Understanding
PART - B			
1.	Discuss consensus algorithm requirements and challenges in distributed systems.	BTL 5	Evaluating
2.	Explain consensus in failure-free environments.	BTL 4	Analyzing
3.	Describe consensus in asynchronous systems with failure.	BTL 4	Analyzing
4.	Explain Byzantine failures and their impact on consensus.	BTL 4	Analyzing
5.	Explain different types of failures and their models.	BTL 4	Analyzing
6.	Describe checkpointing and rollback recovery in detail.	BTL 4	Analyzing
7.	Compare coordinated and uncoordinated checkpointing.	BTL 5	Evaluating
8.	Explain domino effect and how it can be prevented.	BTL 4	Analyzing
9.	Describe message logging–based rollback recovery.	BTL 4	Analyzing
10.	Compare optimistic and pessimistic logging.	BTL 5	Evaluating
11.	Explain orphan processes and recovery line calculation.	BTL 4	Analyzing
12.	Discuss how stable storage is implemented and used.	BTL 4	Analyzing
13.	Illustrate recovery mechanisms used in distributed systems.	BTL 4	Analyzing
14.	Discuss failures, failure detectors, and their significance.	BTL 5	Evaluating
15.	Explain backward and forward recovery differences.	BTL 4	Analyzing
16.	Write steps involved in recovery using coordinated checkpoints.	BTL 3	Applying

17.	Analyze fault tolerance issues in large-scale distributed systems.	BTL 5	Evaluating
UNIT V – CLOUD COMPUTING			
Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application.			
PART – A			
1.	Define cloud computing.	BTL 1	Remembering
2.	List the key characteristics of cloud computing.	BTL 1	Remembering
3.	Explain the need for cloud computing.	BTL 2	Understanding
4.	What is Infrastructure as a Service (IaaS)?	BTL 1	Remembering
5.	Differentiate between IaaS and PaaS.	BTL 2	Understanding
6.	What is Software as a Service (SaaS)?	BTL 1	Remembering
7.	Explain public cloud with an example.	BTL 2	Understanding
8.	Define private cloud.	BTL 1	Remembering
9.	Compare public and private cloud models.	BTL 2	Understanding
10.	What is hybrid cloud?	BTL 1	Remembering
11.	Explain community cloud and its use cases.	BTL 2	Understanding
12.	Define virtualization.	BTL 1	Remembering
13.	Explain the role of virtualization in cloud computing.	BTL 2	Understanding
14.	What is scalability in cloud computing?	BTL 1	Remembering
15.	Explain elasticity and how it differs from scalability.	BTL 2	Understanding
16.	Define cloud storage.	BTL 1	Remembering
17.	Explain replication in cloud systems.	BTL 2	Understanding
18.	What is load balancing?	BTL 1	Remembering
19.	Identify a suitable load-balancing technique for a web application.	BTL 3	Understanding
20.	Define multi-tenancy.	BTL 1	Remembering
21.	Explain the advantages of multi-tenancy.	BTL 2	Understanding
22.	What is containerization?	BTL 1	Remembering
23.	Apply containerization for deploying a microservice-based application.	BTL 3	Applying
24.	Explain the importance of monitoring in cloud platforms.	BTL 2	Understanding
PART – B			
1.	Explain cloud architecture and its major components.	BTL 4	Analyzing
2.	Describe IaaS, PaaS, and SaaS models with suitable examples.	BTL 4	Analyzing
3.	Explain virtualization and different types of virtualization used in cloud computing.	BTL 4	Analyzing
4.	Design a scalable and fault-tolerant cloud architecture for an e-commerce application, explaining the role of load balancing, replication, and autoscaling.	BTL 6	Creating
5.	Explain cloud load balancing mechanisms and their working.	BTL 4	Analyzing
6.	Describe replication and data distribution strategies in cloud systems.	BTL 4	Analyzing
7.	Explain storage architecture in cloud environments.	BTL 4	Analyzing
8.	Discuss public, private, hybrid, and community cloud deployment models.	BTL 5	Evaluating
9.	Explain autoscaling mechanisms in cloud computing with diagrams.	BTL 4	Analyzing
10.	Explain containerization and cloud-native deployment models.	BTL 4	Analyzing
11.	Compare traditional distributed systems and cloud-based distributed	BTL 5	Evaluating

	systems.		
12.	Propose a cloud migration strategy for a legacy enterprise application, explaining migration phases and challenges.	BTL 6	Creating
13.	Discuss scalability and elasticity in cloud computing.	BTL 5	Evaluating
14.	Discuss multi-tenancy, isolation, and security challenges in cloud environments.	BTL 5	Evaluating
15.	Discuss fault tolerance techniques used in cloud computing environments.	BTL 5	Evaluating
16.	Develop a cloud deployment model for a healthcare or banking system that ensures scalability, security, and fault tolerance. Justify your design.	BTL 6	Creating
17.	Create a cloud-based monitoring and resource management framework for large-scale distributed applications.	BTL 6	Creating