SRM VALLIAMMAI ENGINEERING COLLEGE
SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

QUESTION BANK

SUBJECT : CS8603-DistributedSystems
SEM / YEAR: VI / III

UNIT I - INTRODUCTION			
Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – 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 – Cuts –Past and future cones of an event –Models of process communications. **Logical Time**: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.			
PART – A			
Q. No	**Questions**	**BT Level**	**Competence**
1.	**Define** distributed systems.	BTL 1	Remember
2.	**What** is middleware?	BTL 1	Remember
3.	**Explain** distributed execution/computation or run.	BTL 5	Evaluate
4.	**List** middleware standards in distributed systems.	BTL 1	Remember
5	**Develop** hamming distance with example.	BTL 3	Apply
6	**Illustrate** coupling.	BTL 2	Understand
7	**Describe** parallelism/concurrency in distributed systems.	BTL 2	Understand
8	**Compare** centralized and distributed system.	BTL 4	Analyze
9	**State** the various classes of multiprocessor/multicomputer operating systems.	BTL 2	Understand
10	**Compare** shared memory Vs distributed shared memory.	BTL 2	Understand
11	**Compose** different forms of load balancing.	BTL 6	Create
12	**List** the issues arise in determining the performance of DS.	BTL 1	Remember
13	**Analyze** briefly on ubiquitous computing.	BTL 4	Analyze
14	**What** is happened before or causal precedence?	BTL 3	Apply
15	**Illustrate** five reasons why to build distributed System.	BTL 3	Apply
16	**Define** granularity.	BTL 1	Remember
17	**Discuss** about peer-to-peer computing.	BTL 6	Create
18	**Measure** some examples of problems requiring synchronization.	BTL5	Evaluate
19	**Classify** the security challenges faced by the distributed systems.	BTL 4	Analyze
20	**What** is distributed data mining?	BTL 1	Remember
PART – B			
1.	**Design** in detail about application domains where distributed system is applied. (13)	BTL 6	Create

2.	i) **Explain** the characteristics of distributed systems. (7) ii)List the features of distributed systems(6)	BTL 4	Analyze
3.	i) **Summarize** the distributed computer system components (7) ii) Explain the requirements of distributed systems (6)	BTL 5	Evaluate
4.	**Write** a brief note on the key algorithmic challenges in distributed computing. (13)	BTL 1	Remember
5.	i)**Draw** the omega and butterfly networks for n = 16 inputs and outputs. (7) ii) **Elaborate** the functions need to address while designing a distributed computing system. (6)	BTL 2	Understand
6.	**Discuss** the primitives for distributed communication.(13)	BTL 3	Apply
7.	i) **What** are the processing modes of flynn taxonomy? (7) ii) Examine various MIMD architectures in terms of coupling.(6)	BTL 1	Remember
8.	**Explain** about the synchronous versus asynchronous executions in a message-passing system with examples. (13)	BTL 2	Understand
9.	i) **Describe t**he capabilities and rules for implementation of logical clocks. (7) ii) Define lamport scalar time (6)	BTL 1	Remember
10.	**Identify** and explain the basic properties of scalar time.(13)	BTL 3	Apply
11.	**List** and explain the basic properties of vector time.(13)	BTL 1	Remember
12.	**i) Point out** in detail the recent trends in distributed Systems. (6) ii) What are the design issues to be considered in designing distributed system? Explain in detail about each of them. (7)	BTL 4	Analyze
13.	**Discuss** about load balancing.(7) Describe Performance metrics in DS. (6)	BTL 2	Understand
14.	**Summarize** NTP for synchronizing system of physical clocks in distributed systems.(13)	BTL 4	Analyze
	PART – C (15 MARKS)		
1	A user arrives at a railway station that she has never visited before, carrying a PDA that is capable of wireless networking. Suggest how the user could be provided with information about the local services and amenities at that station, without entering the station's name or attributes. What technical challenges must be overcome? **Discuss** in detail. (15)	BTL 4	Analyze
2	**Explain** the practical applicability of the load –balancing approach as a scheduling scheme for the following types of distributed systems: a) A LAN-based distributed system b) A WAN-based distributed system c) A distributed system based on the processor-pool model. d) A distributed system based on the workstation-server model.(15)	BTL 4	Analyze
3	**Design** the requirements and aspects needed for reliable and fault-tolerant distributed systems.(15)	BTL 6	Create
4	Show that all events on the surface of the past cone of an event are message send events. Likewise, show that all events on the surface of the future cone of an event are message receive events.(15)	BTL 5	Evaluate

UNIT II - MESSAGE ORDERING & SNAPSHOTS

SYLLABUS- Message **ordering and group communication:** Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. **Global state and snapshot recording algorithms:** Introduction –System model and definitions –Snapshot algorithms for FIFO channels.

PART –A

Q.No	Questions	BT Level	Competence
1.	**What** are the message ordering paradigms?	BTL 1	Remember
2.	**Compare** closed group Vs open group algorithm.	BTL 4	Analyze
3.	**State** crown criterion theorem.	BTL 4	Analyze
4.	**Explain** message broadcast.	BTL 5	Evaluate
5.	**Define** time stamp.	BTL 1	Remember
6.	**Discuss** multiway rendezvous and binary rendezvous.	BTL 2	Understand
7.	**Design** the roles and responsibilities of distributed systems.	BTL 6	Create
8.	**What** are the characteristics of multicast communication?	BTL 1	Remember
9.	**Differentiate** multicasting Vs unicasting.	BTL 2	Understand
10.	**Identify** the two popular orders for the delivery of messages in group communication.	BTL 3	Apply
11.	**Identify** consistent snapshot.	BTL 3	Apply
12.	**Evaluate** the criteria that must be met by a causal ordering protocol.	BTL 5	Evaluate
13.	**What** are the necessary conditions to satisfy the consistent global state?	BTL 6	Create
14.	**State** the property for causal delivery of messages.	BTL 4	Analyze
15.	**Sketch** an interpretation in terms of a cut.	BTL 2	Understand
16.	**What** is consistent cut?	BTL 1	Remember
17.	**Outline** marker sending rule.	BTL 2	Understand
18.	**What** is marker receiving rule?	BTL 1	Remember
19.	**What** is complexity?	BTL 1	Remember
20.	**Show** how to prove the correctness of the algorithm.	BTL 3	Apply

PART - B

1.	**i)Design** FIFO and non-FIFO executions.(7) ii)Discuss on causally ordered executions (6)	BTL 6	Create
2.	**Show** with an equivalent timing diagram of a synchronous execution on an asynchronous system.(13)	BTL 1	Remember
3.	**Show** with an equivalent timing diagram of a asynchronous execution on a synchronous system.(13)	BTL 2	Understand
4.	**Illustrate** realizable with synchronous communication (RSC) execution.(13)	BTL 3	Apply
5.	i) **Explain** the hierarchy of execution classes. (7) ii) Examine the crown test to determine the existence of cyclic dependencies among messages.(6)	BTL 1	Remember
6.	**Explain** the channels to simulate an execution using asynchronous primitives on a synchronous system.(13)	BTL 4	Analyze

7.	**Analyse** the channels to simulate an execution using synchronous primitives on an asynchronous system.(13)	BTL 5	Evaluate
8.	**Explain** a simple algorithm defined by Bagrodia.13)	BTL 2	Understand
9.	**Explain** chandy and lamport algorithm (13)	BTL 1	Remember
10.	**Examine** the two possible executions of the snapshot algorithm for money transfer.(13)	BTL 3	Apply
11.	**Examine** the necessary and sufficient conditions for causal ordering. (13)	BTL 4	Analyze
12.	**Analyze** in detail about the centralized algorithm to implement total order and causal order of messages. (13)	BTL 4	Analyze
13.	**Discuss** in detail about the distributed algorithm to implement total order and causal order of messages. (13)	BTL 2	Understand
14.	**i) Describe** any two issues need to be addressed in recording of a consistent global snapshot of a distributed system.(7) ii) How to record a consistent global state of a distributed system with a banking example.(6)	BTL 1	Remember
	PART-C		
1	**Create** a simplified implementation of synchronous order. Develop the for the process Pi ,1 ≤ i≤ n.(15)	BTL 6	Create
2	**Illustrate** the asynchronous executions and of crowns. (a) Crown of size 2. (b) Another crown of size 2. (c) Crown of size 3. (15)	BTL 4	Analyze
3	Consider a distributed system where every node has its physical clock and all physical clocks are perfectly synchronized. **Develop** an algorithm to record global state assuming the communication network is reliable.(15)	BTL 5	Evaluate
4	What good is a distributed snapshot when the system was never in the state represented by the distributed snapshot? **Give an application** of distributed snapshots.(15)	BTL 5	Evaluate

UNIT III DISTRIBUTED MUTEX & DEADLOCK

SYLLABUS- Distributed **mutual exclusion algorithms:** Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala algorithm – Maekawa's algorithm – Suzuki–Kasami's broadcast algorithm. **Deadlock detection in distributed systems:** Introduction – System model – Preliminaries – Models of deadlocks – Knapp's classification – Algorithms for the single resource model, the AND model and the OR model.

PART - A

Q.No	Questions	BT Level	Competence
1.	**What** are the three basic approaches for implementing distributed mutual exclusion?	BTL 1	Remember
2	**Explain** idle token.	BTL 4	Analyze
3	**Discuss** the conditions for maekawa's algorithm.	BTL 2	Understand
4	**List** the three types of messages for Deadlock handling.	BTL 4	Analyze
5	**What** is deadlock?	BTL 3	Apply
6	**Define** the two design issues for suzuki–kasami's.	BTL 1	Remember
7	**How** ricart–agrawala algorithm achieves mutual exclusion.	BTL 2	Understand
8	**Explain** maekawa's algorithm achieves mutual exclusion.	BTL 4	Analyze
9	**Express** in diagram the wait for graph (WFG).	BTL 2	Understand
10	**What** are the states in a process.?	BTL 1	Remember

11	**Explain** the three strategies for handling deadlocks.	BTL 5	Evaluate
12	**What** is broadcast algorithm?	BTL 1	Remember
13	**Give** the conditions to satisfy deadlock detection algorithm.	BTL 2	Understand
14	**What** is deadlock resolution?	BTL 1	Remember
15	**Develop** the facts of global state detection-based deadlock detection?	BTL 6	Create
16	**Define** the features of Mitchell and Merritt's algorithm.	BTL 1	Remember
17	**Apply** how maekawa's algorithm handles deadlocks?	BTL 3	Apply
18	**Formulate** the advantage of edge-chasing algorithms?	BTL 6	Create
19	**List** the four classes of knapp's classification of distributed deadlock detection algorithms.	BTL 5	Evaluate
20	**Demonstrate** the basic idea for Chandy–Misra–Haas algorithm.	BTL 3	Apply
	PART – B		
1.	i) **List and Explain** the following properties to satisfy a mutual exclusion algorithm. (7) ii) **What** are the performance metrics of mutual exclusion algorithms? (6)	BTL 1	Remember
2	**Explain** about the lamport distributed mutual exclusion algorithm.(13)	BTL 5	Evaluate
3	**Illustrate w**ith a case study explain ricart–agrawala algorithm. (13)	BTL 3	Apply
4	**Analyze** in detail about maekawa's quorum-based mutual exclusion algorithm. (13)	BTL 4	Analyze
5	i) S**tate** the Example of a WFG. (7) ii)Discuss the Issues in deadlock detection.(6)	BTL 2	Understand
6	**Examine** suzuki–kasami's broadcast algorithm.(13)	BTL 1	Remember
7	What is deadlock? **Explain** the models of deadlocks.(13)	BTL 4	Analyze
8	**Formulate** the mitchell and merritt's algorithm for the single-resource model. (13)	BTL 6	Create
9	**Describe** the distributed deadlock detection algorithms in detail. (13)	BTL 2	Apply
10	**Conclude** in brief about knapp's classification of distributed deadlock detection algorithms.(13)	BTL 4	Analyze
11	Briefly describe about the chandy–misra–haas algorithm for the AND model (13)	BTL 1	Remember
12	**Define** and explain the following: i) AND Model(3) ii) OR Model(3) iii) AND – OR Model(3) iv) (p/q) Model(4)	BTL 1	Remember
13	**Express** with neat sketch and explain chandy–misra–haas algorithm for the OR model.(13)	BTL 2	Understand
14	**i) Discuss** on unrestricted model with necessary examples.(10) ii) Discuss the single resource model.(3)	BTL 3	Understand
	PART-C		

1	Show that in the ricart–agrawala algorithm the critical section is accessed in increasing order of timestamp. **Does** the same hold in maekawa's algorithm?(15)	BTL 4	Analyze
2	What is the purpose of a REPLY message in lamport's algorithm? Note that it is not necessary that a site must always return a REPLY message in response to a REQUEST message. **State the condition** under which a site does not have to return REPLY message. Also, give the new message complexity per critical section execution in this case.(15)	BTL 5	Evaluate
3	Suppose all the processes in the system are assigned priorities which can be used to totally order the processes. **Modify** chand *yet al.*'s algorithm for the AND model so that when a process detects a deadlock, it also knows the lowest priority deadlocked process.(15)	BTL 4	Analyze
4	Consider the following simple approach to handle deadlocks in distributed systems by using "time-outs": a process that has waited for a specified period for a resource declares that it is deadlocked and aborts to resolve the deadlock. **Explain** what are the shortcomings of using this method?(15)	BTL 5	Evaluate

UNIT IV RECOVERY & CONSENSUS

SYLLABUS- Check **pointing and rollback recovery:** Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated check pointing algorithm – Algorithm for asynchronous check pointing and recovery. **Consensus and agreement algorithms:** Problem definition – Overview of results – Agreement in a failure –free system – Agreement in synchronous systems with failures.

PART – A

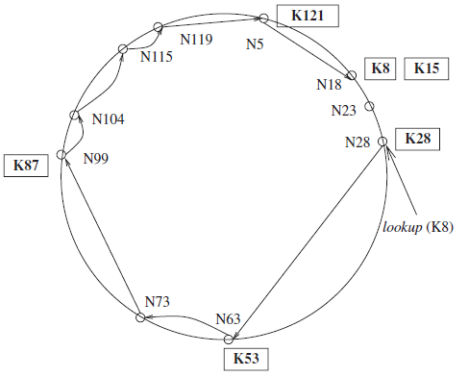
Q.No	Questions	BT Level	Competence
1.	**Define** the terms: rollback propagation.	BTL 1	Remember
2	**Describe** local check pointing?	BTL 2	Understand
3	**What** is meant by "outside world process (OWP)."?	BTL 1	Remember
4	**Point out** the phases of min-process check pointing algorithms.	BTL 4	Analyze
5	**Define** rollback recovery.	BTL 1	Remember
6	**Compare** coordinated check pointing versus uncoordinated check pointing.	BTL 2	Understand
7	**List** the categories of checkpoint-based rollback-recovery techniques.	BTL 5	Evaluate
8	**Give** the use of piggybacking.	BTL 2	Understand
9	**Formulate** the different types of messages.	BTL 6	Create
10	**Illustrate w**hat is concurrency control? Give its use.	BTL 3	Apply
11	**Point out** the phases of min-process check pointing algorithms	BTL 4	Analyze
12	**Define** Z-dependency.	BTL 1	Remember
13	**Discuss** the two types of log storage?	BTL 2	Understand
14	**What** are the two kinds of checkpoints for checkpoint algorithm?	BTL 1	Remember
15	**Explain** the two types of communication-induced check pointing?	BTL 4	Analyze

16	**State** the notation and data structure for recovery algorithm.	BTL 1	Remember
17	**Relate** between the agreement problem and the consensus problem.	BTL 3	Apply
18	**State** the conditions for byzantine agreement problem.	BTL 6	Create
19	**Explain** agreement.	BTL 5	Evaluate
20	**Illustrate** authenticated vs. non-authenticated messages.	BTL 3	Apply
	PART - B		
1.	**What** is rollback? and explain the several types of messages for rollback. (13)	BTL 1	Remember
2	**Examine** briefly about global states with examples. (13)	BTL 4	Analyze
3	**Describe** the issues involved in a failure recovery with the help of a distributed computation. (13)	BTL 2	Understand
4	**Elaborate** the various checkpoint-based rollback-recovery techniques.(13)	BTL 6	Create
5	**Describe** the pessimistic logging , optimistic logging and casual logging.(13)	BTL 4	Analyze
6	i) **What** are min-process check pointing algorithms? Explain it detail.(7) ii) Examine Deterministic and non-deterministic events. (6)	BTL 1	Remember
7	i) **Summarize** the koo–toueg coordinated check pointing algorithm.(7) ii) Explain the rollback recovery algorithm. (6)	BTL 2	Understand
8	**Demonstrate** in detail about the juang–venkatesan algorithm for asynchronous check pointing and recovery.(13)	BTL 3	Apply
9	**Discuss** in detail about some assumptions underlying the study of agreement algorithms. (13)	BTL 1	Remember
10	What is byzantine agreement problem? **Explain** the two popular flavours of the byzantine agreement problem.	BTL 2	Understand
11	**Develop** an overview of the results and lower bounds on solving the consensus problem under different assumptions.	BTL 3	Apply
12	**Explain** agreement in (message-passing) synchronous systems with failures.(13)	BTL 5	Evaluate
13	Give byzantine agreement tree algorithm and illustrate with an example. (13)	BTL 1	Remember
14	Analyze on phase-king algorithm for consensus.(13)	BTL 4	Analyze
	PART-C		
1	**Design** a system model of distributed system consisting of four processes and explain the interactions with the outside world.(15)	BTL 6	Create
2	**Explain** with examples of consistent and inconsistent states of a distributed system.(15)	BTL 5	Evaluate

3	Consider the following simple check pointing algorithm. A process takes a local checkpoint right after sending a message. **Create** that the last checkpoint at all processes will always be consistent. What are the trade-offs with this method?(15)	BTL 6	Create
4	Give and **analyse** a rigorous proof of the impossibility of a min-process, non blocking check pointing algorithm.(15)	BTL 4	Analyze

UNIT V - P2P & DISTRIBUTED SHARED MEMORY			
SYLLABUS- Peer-**to-peer computing and overlay graphs:** Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. **Distributed shared memory:** Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	**Define** churn.	BTL 1	Remember
2	**Classify** the characteristics of peer to peer system.	BTL 3	Apply
3	**What** are the performance features of P2P systems?	BTL 1	Remember
4	**Draw** the pictorial representation of distributed hash table scheme.	BTL 1	Remember
5	**List** the P2P overlay and its types..	BTL 1	Remember
6	**What** are the two steps involved in chord protocol?	BTL 1	Remember
7	**Discuss** content addressable networks (CAN)?	BTL 6	Create
8	**List** the three core components of a CAN design.	BTL 1	Remember
9	**Analyze** the three basic operations which supports CAN.	BTL 4	Analyze
10	**Examine** the performance factors for CAN Optimizations?	BTL 4	Analyze
11	**Explain** distributed shared memory.	BTL 2	Understand
12	**Measure** the properties of weak consistency.	BTL 5	Evaluate
13	**Assess memory** consistency model.	BTL 5	Evaluate
14	**Give** memory coherence.	BTL 2	Understand
15	**Show** the detailed abstract view of DSM	BTL 3	Apply
16	**Discuss** the two instructions to perform hardware support for mutual exclusion.	BTL 2	Understand
17	**Point out** the three requirements of the critical section problem.	BTL 4	Analyze
18	**Show** how to provide barrier synchronization in release consistency?	BTL 3	Apply
19	**Discuss** the three properties of weak consistency.	BTL 2	Understand
20	**What** is entry consistency?	BTL 6	Create
PART - B			
1.	i) **What** is meant by napster legacy? Explain.(7) ii) Give a brief account on Indexing mechanisms. (6)	BTL 1	Remember

2	Explain the structured overlays and unstructured overlays in distributed indexing. (13)	BTL 5	Evaluate
3	**Examine** the chord protocol with simple key lookup algorithm.(13)	BTL 4	Analyze
4	**Illustrate** in detail about A scalable object location algorithm in chord.(13)	BTL 3	Apply
5	**Discuss** on managing churn in chord.(13)		Create
6	**Describe** briefly about the following: i) Content-Addressable Network (CAN) initialization (6) ii) CAN routing (7).	BTL 2	Understand
7	**Point out** tapestry P2P overlay network and its routing with an example. (13)	BTL 4	Analyze
8	**Discuss** the CAN maintenance and CAN optimizations. (13)	BTL 2	Understand
9	**State** about the consistency models: entry consistency, weak consistency, and release consistency.(13)	BTL 1	Remember
10	**Summarize** in detail how node insertion and node deletion are applied in tapestry. (13)	BTL 2	Understand
11	**i)Illustrate** the advantages and disadvantages of DSM.(6) ii) Point out the main issues in designing a DSM system (7)	BTL 3	Apply
12	**Examine** how to implement linearizability (LIN) using total order broadcasts.(13)	BTL 1	Remember
13	**Analyse** how to implement Sequential consistency in a distributed system.(13)	BTL 4	Analyze
14	Describe lamport's bakery algorithm lamport's WRWR mechanism and fast mutual exclusion. (13)	BTL 1	Remember
	PART C		
1	User 'A' in delhi wishes to send a file for printing to user 'B' in florida, whose system is connected to a printer; while user 'C' from tokyo wants to save a video file in the hard disk of user 'D' in london. **Analyze** and discuss the required peer-to-peer network architecture.(15)	BTL 4	Analyze
2	**Evaluate** a formal proof to justify the correctness of algorithm that implements sequential consistency using local read operations.(15)	BTL 5	Evaluate
3	**Develop** a detailed implementation of causal consistency, and provide a correctness argument for your implementation.(15)	BTL 6	Create

4	**Examine t**he steps for the query: lookup (K8) initiated at node 28, are shown in Figure for simple key lookup algorithm.(15)  	BTL 5	Evaluate