



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UEA Act, 1987)

REG.NO.:

SCHOOL OF COMPUTER SCIENCE ENGINEERING & INFORMATION SYSTEMS
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: D1

Programme Name & Branch : BTech-IT
Course Code and Course Name : BITE 402L-Distributed Computing
Faculty Name(s) : Dr. Sudha.M, Dr. Bhavani.S, Dr.S. Prasanna
Class Number(s) : VL2024250503036, 3054, 3047.
Date of Examination : 19.03.2025
Exam Duration : 90 minutes
Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes (CO)
 1. Identify the core concepts of distributed systems: the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way.
 2. Analyse the core architectural concepts to meet the challenges in implementing distributed systems.
 3. Examine important approaches in distributed systems to support synchronization and fault tolerance.

Q.No.	Question	Max Marks	CO	BL
1.	Differentiate between Distributed Components and Distributed Objects in terms of state management, communication methods, and lifecycle oversight within distributed systems. Analyse how these distinctions influence scalability, maintainability, and fault tolerance. Furthermore, pinpoint certain situations where one approach is more advantageous than the other in extensive distributed frameworks, including specific examples. Lastly, when designing a banking application utilizing a microservices architecture, would you choose a distributed component model, or would you opt for a distributed object model, like CORBA or RMI? Provide a rationale for your selection.	10	CO2	BL4
2.	A company, TechNova Solutions, is developing a secure online banking system that allows customers to check their account balance, transfer funds, and view transaction history. To enable communication between the frontend web application and the backend banking server, they decide to implement a SOAP-based web service due to its security, reliability, and standardized messaging format. Identify the key components of the SOAP-based web service that TechNova Solutions, should implement, If a SOAP-based	10	CO4	BL3



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	web service transaction involved in TechNova Solutions sends a request containing the following XML payload as in the soap construct below: <pre><Request> <User>JohnDoe</User> <Action>GetBalance</Action> <Account>123456</Account> </Request></pre> Each character in the XML message takes 1 byte for storage. The additional SOAP envelope overhead adds 250 bytes to the total size. What would be the total SOAP request message size in bytes. If the server's response message is twice the size of the request, what is the total data exchanged in this single client-server interaction?																							
3.	A company runs a stock trading system where precise time synchronization is essential for recording trades in real-time. One of the trader's workstations (Client C) needs to align its clock with multiple NTP servers to guarantee accurate timestamps for financial transactions. The client device synchronizes its clock with three distinct NTP servers (S1, S2, and S3). It logs the timestamps for requests and responses from each server in the table below. <table> <tr> <th>Server</th><th>T1 Request sent client</th><th>T2 Request received Server</th><th>T3 Response sent by server</th><th>T4 Response received by client</th></tr> <tr> <td>S1</td><td>10:00:05.200</td><td>10:00:05.400</td><td>10:00:05.450</td><td>10:00:05.650</td></tr> <tr> <td>S2</td><td>10:00:06.000</td><td>10:00:06.150</td><td>10:00:06.200</td><td>10:00:06.350</td></tr> <tr> <td>S3</td><td>10:00:07.100</td><td>10:00:07.250</td><td>10:00:07.280</td><td>10:00:07.430</td></tr> </table> Compute the Round-Trip Delay (RTT) and Clock Offset for each NTP server. Determine which NTP server offers the most precise time and exemplify why.	Server	T1 Request sent client	T2 Request received Server	T3 Response sent by server	T4 Response received by client	S1	10:00:05.200	10:00:05.400	10:00:05.450	10:00:05.650	S2	10:00:06.000	10:00:06.150	10:00:06.200	10:00:06.350	S3	10:00:07.100	10:00:07.250	10:00:07.280	10:00:07.430	10	CO3	BL5
Server	T1 Request sent client	T2 Request received Server	T3 Response sent by server	T4 Response received by client																				
S1	10:00:05.200	10:00:05.400	10:00:05.450	10:00:05.650																				
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S3	10:00:07.100	10:00:07.250	10:00:07.280	10:00:07.430																				
4.	In a distributed system, vector timestamps are used to capture the causal relationships between events. Consider a system with three processes P1, P2, and P3. The initial vector timestamps for all processes are (0,0,0). The following sequence of events occurs:	10	CO3	BL4																				



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	1. P1 executes an event E1. 2. P1 sends a message M1 to P2. 3. P2 executes an event E2 after receiving M1. 4. P2 sends a message M2 to P3. 5. P3 executes an event E3 after receiving M2. 6. P3 sends a message M3 to P1. 7. P1 executes an event E4 after receiving M3. Compute the vector timestamps for each event (E1, receiving and sending messages, E2, E3, E4). Show step-by-step updates to vector clocks. Demonstrate how vector timestamps help in detecting causality and prevent the "happened-before" relation violations in distributed systems.			
5.	A financial trading application relies on communication and invocation mechanism for real-time stock price calculations. A client application running on a trader's workstation invokes methods on a remote pricing server. The client sends a request for stock price computation, and the server returns the computed price after performing complex calculations. The system must ensure minimal invocation delay to maintain real-time responsiveness. Identify the significant components contributing to remote invocation delay in this scenario, apart from network transmission time. Explain how each component impacts the overall delay. Illustrate with a neat sketch the cross-address space invocation process, highlighting the critical stages that introduce latency in a distributed environment.	10	CO5	BL4