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Sri Sivasubramaniya Nadar College of Engineering, Kalavakkam – 603 110

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department of Computer Science and Engineering

Continuous Assessment Test – II

Answer Key

Degree & Branch	BE & Computer Science and Engineering					**Semester**	VII
Subject Code & Name	UCS1701- Distributed Systems					**Regulation:**	**2018**
Academic Year	2023-2024 ODD	**Batch**	2020-2024	**Date**	**11.10.2023**		**FN / ~~AN~~**
Time: 08:10 - 09:40 A.M (90 Minutes)	**Answer All Questions**					**Maximum: 50 Marks**	

COURSE OUTCOMES

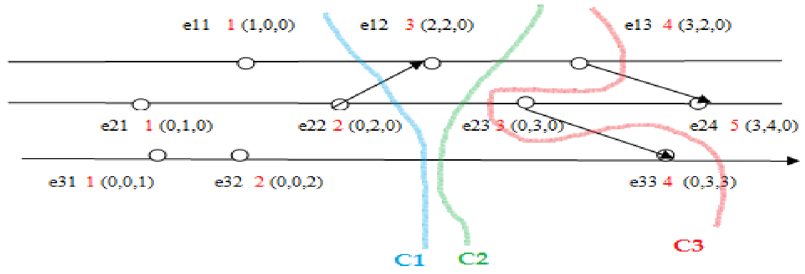
CO1- Realize the foundations of Distributed Systems [K2]
CO2- Able to solve synchronization and state consistency problems [K3]
CO3- Demonstrate the resource sharing techniques in Distributed systems [K3]
CO4- Comprehend the working model of consensus and reliability of Distributed Systems [K3]
CO5- Identify the fundamentals of Peer-to-Peer Systems [K2].
CO6- Formulate a synchronization problem for an ad-hoc distributed system and adapt its solution [K6]

Part – A (6×2 = 12 Marks)

K1	1. Define a Cut in global state of distributed system **Ans**: Cut in the time space diagram divides the time space diagram into past and future events.	CO1	3.1.1
K1	2. What is a transit message in distributed system? **Ans**: Message in the communication channel which is yet to be received at the destination node.	CO2	3.1.1
K1	3. Why does path pushing algorithm detect phantom deadlocks? **Ans**: Lengthy messages have to pushed to construct the global WFG at every site which is time consuming. This would result in detecting phantom deadlocks.	CO3	2.3.2
K1	4. What is idle token in mutual exclusion problem? **Ans:** A process having token and executing outside critical section.	CO3	2.3.2
K2	5. Outline the Fairness and Liveness properties in Distributed Mutex algorithms. **Ans**: **Liveness Property:** This property states the absence of deadlock and starvation. Two or more sites should not endlessly wait for messages which will never arrive. **Fairness:** Each process gets a fair chance to execute the CS. Fairness property generally means the CS execution requests are executed in the order of their arrival (time is determined by a logical clock) in the system.	CO3	2.3.2
K3	6. Identify the number of control messages to be exchanged to achieve one round of mutex in Suzuki Kasami's token based Distributed Mutex algorithm. **Ans**: (n-1) + 1 for token Totally n where n is the number of nodes.	CO3	1.4.1

Part – B (3×6 = 18 Marks)

K2	7. What is a global state in distributed system. What are the three types of global states and illustrate three different types of cuts using a space time diagram. Global state is the collection of local states of all processes and the local state of all communication channels.	CO1	2.2.3

	Global state could be 3 types. **Inconsistent Global State:** Receive of message is recorded at receiver local state but corresponding send is not recoded at sender local state. **Consistent Global State**: Message send was recorded at sender's local state and it is yet to be received at receiver. The message recorded in the communication channel. **Strongly Consistent Global state:** Both send and receive events are recorded at sender and receiver local state.  C1 is consistent Cut C2 is Strongly Consistent Cut C3 is Inconsistent Cut		
K3	8. Consider **Chandy Lamport's Global State Recording Algorithm (GSRA).** Identify how GSRA avoids inconsistent snapshot. Illustrate this scenario with an example. **Ans**: Inconsistent State is avoiding by sending an empty marker along all outgoing channels before sending any application messages. The receiver state should be recorded before recording all the messages in the channel. This ensures message is recorded either at the channel or at the receiver but not at both ends.	CO2	2.2.2 2.3.2
K4	9. Considering the **non-token based distributed mutex approach, show how Ricart Agrawala's DMutex algorithm is optimal**. Inspect your answer with an example by considering 2 processes in a distributed system. Lamport's DMutex – 3(N-1) – Request, Reply and Release Messages. Ricart Agrawala's DMutex – 2(N-1) – Request and Reply messages. Ricart Agrawala's DMutex algorithm maintains a request deffered array to know which all processes a process had not replied and while exiting the CS, reply will be sent to the corresponding processes.	CO3	1.3.1 1.4.1

Part – C (2×10 = 20 Marks)

K3	10. Apply the **Lamport's non-token based distributed mutual exclusion** algorithm for the scenario in which the order of request for critical section is as follows. **P2 → (P2 || P3) → P1→ P3.** *Note: || Represents concurrent request to CS.* ➔ *Represents the sequential request to CS.* ➔ There will be request , reply and release messages. So, 3(N-1) messages. CS will be given to the process in the order P1 → P2 → P3 → P1 → P3	CO3	1.3.1 1.4.1 2.3.1
	(OR)		
K3	11. Apply the **token based distributed mutual exclusion algorithm** for the scenario in which the order of request for critical section is as follows. **P1 → (P3 || P2 || P1) → (P1 || P3)** *Note: Initially the token is held by process P3* *|| Represents concurrent request to CS.* *Represents the sequential request to CS.* CS will be given to the process in the order P1 → P1 → P3 → P2→ P1 → P3	CO3	1.3.1 1.4.1 2.3.1
K3	12. Apply **Chandy Misra Haas Algorithm with AND resource model** for the given scenario and identify the presence of deadlocks. Does this algorithm detect any phantom deadlocks? Interpret your answer.	CO3	1.3.1 1.4.1 2.3.1

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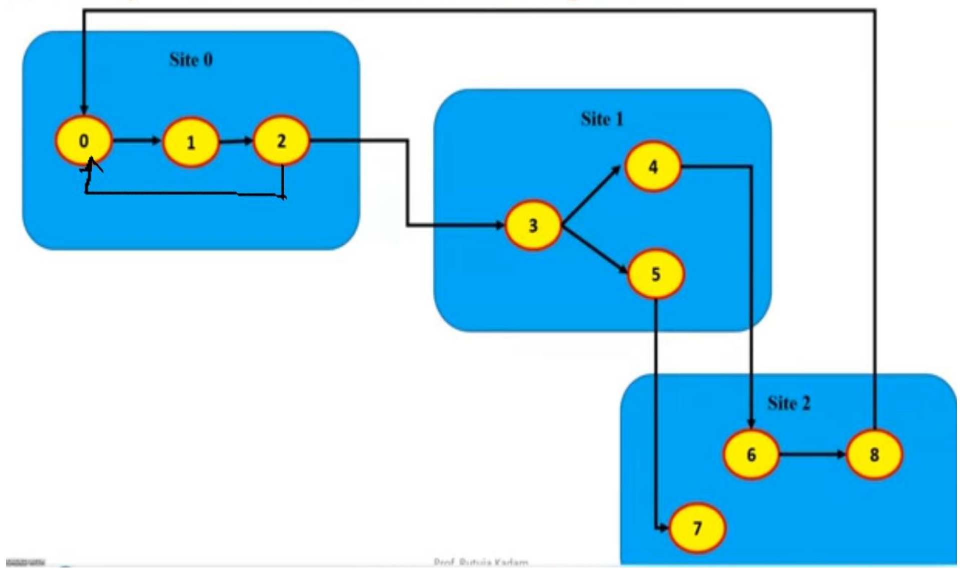
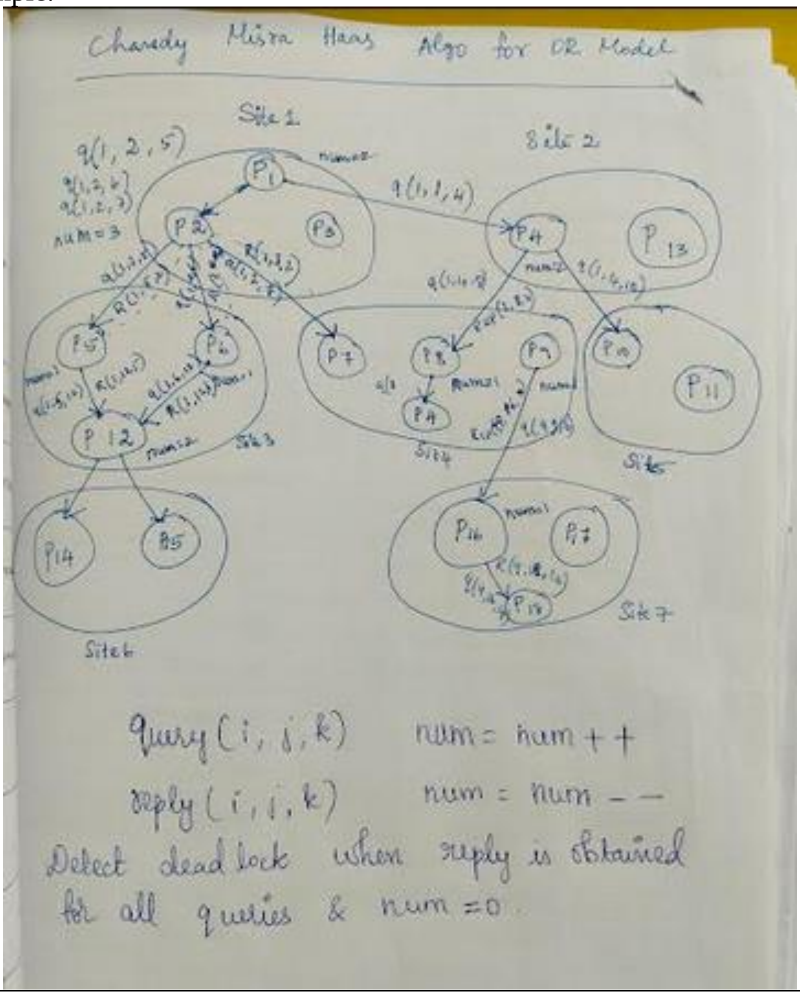
<tr><td></td><td>

Site 0
Probe(0,2,0) Local Deadlock
Probe(0,2,3) to Site 1

Site 1
Probe(0,5,7) to Site S2
Probe (0,4,6) to site 2

Site 2
Probe(0,8,0) to site 0 ; i= k Deadlock is detected.</td><td></td><td></td></tr>
<tr><td colspan="4">(OR)</td><td></td></tr>
<tr><td>K3</td><td>13. Apply Chandy Misra Haas Algorithm for OR resource model and demonstrate the process of distributed deadlock detection with an appropriate example.

</td><td>CO3</td><td>1.3.1
1.4.1
2.3.1</td></tr>
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