DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
THIRD SESSIONAL
SUBJECT: (CE317) DATABASE MANAGEMENT SYSTEM

Examination	: B.Tech Semester - III	Seat No.	: 31
Date	: 10/10/2023	Day	: Tuesday
Time	: 09:15 a.m.to 10:30a.m.	Max. Marks	: 36

INSTRUCTIONS:
1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1 Do as directed. [12]

CO4 A (a) Find canonical cover for the relation R(V, W, X, Y, Z). The functional dependencies {V→W, VW→X, Y→VX, Y→Z} hold true for the relational schema R. [2]

CO4 N (b) Assume basic timestamp ordering protocol and time starts from 1, each operation takes a unit amount of time. Start of a transaction T_i is denoted as S_i. **Table 1** has relevant details. Find RTS(a), WTS(a), RTS(b), WTS(b) at the end. [2]

CO4 C (c) The resource allocation graph for System S is given in **Fig. 1**. Is S in deadlock or not? Justify your answer. [2]

CO3 A (d) Consider a B+ tree in which the search key field is 13 B, the block size is 1024 B, a record pointer is 9 B and a block pointer is 8 B. What is the order of the internal node and leaf node? [2]

CO3 C (e) Consider the following schedule involving two transactions T1 and T2 with initial value of A is 1000. Write log records for this schedule with respect to deferred database modification. [2]
S: R1(A); A = A - 500; W1(A); Commit(T1); R2(A); A = A + 1000; W2(A); Commit(T2)

CO3 U (f) Differentiate Clustering Index and Secondary Index. [3]

Q.2 Attempt any THREE from the following questions. [12]

CO1 U (a) Consider the following transactions T_1 and T_2 for an initial value of A=100 and B=200. [4]
T_1:lock-X(B), read(B), B=B-50, Write(B), unlock(B), lock-X(A), read(A), A=A+50, Write(A), unlock(A)
T_2:lock-S(A), read(A), unlock(A), lock-S(B), read(B), unlock(B), display(A+B)
Is there a concurrent schedule comprising T_1 and T_2 leading to inconsistent state? If yes then show such schedule and later make necessary modifications to T_1 and T_2 for resolving the issue.

CO4 N (b) Consider the schedule S_1 and check whether it is feasible under 2PL, and rigorous 2PL and explain. [4]
S_1=> T1:R(X), T1:R(Y), T1:W(X), T2:R(Y), T3:W(Y), T1:W(X), T2:R(Y).
Consider the schedule S_2 and check whether it is feasible under strict 2PL and explain.
S_2=> T2:R(A), T2:W(A), T3:R(C), T2:W(B), T3:W(A), T3:W(C), T1:R(A), T1:R(B), T1:W(A), T1:W(B).

CO4 R (c) State true or false and justify: [4]
I. 2 phase locking protocol is sufficient condition for conflict serializability.
II. Thomas' write rule is a necessary condition for conflict serializability.
Note: A condition A is said to be necessary for a condition B, if (and only if) the falsity of A guarantees the falsity of B. A condition A is said to be sufficient for a condition B, if (and only if) the truth of A guarantees the truth of B.

CO4 A (d) In a database system, unique timestamps are assigned to each transaction. T_1 holds a lock on the resource R, and T_2 has requested a conflicting lock on the same resource R. The wound-wait algorithm is used to prevent deadlocks in the [4]

database assuming that a rolled back transaction is restarted with the new timestamp. Assume any transaction that is not rolled back terminates eventually. Is the database system deadlock-free? Is the database system starvation-free? Justify your answer.

Q.3 Attempt the following questions. [12]

CO3 C (a) Construct B+ tree for 7, 23, 30, 35, 73, 75, 50, 42, 80, 85, 92, 12 with P=4 (Order is 4). [6]

CO4 N (b) Write the restart recovery algorithm. Apply this algorithm for the following log records: [6]

1. <T1, Start>
2. <T2, Start>
3. <T1, A, 500, 600>
4. <T1, Commit>
5. <T2, B, 200, 400>
6. **<Checkpoint L>**
7. <T3, Start>
8. <T2, Commit>
9. <T3, C, 200, 500>
10. <T4, Start>
11. <T4, D, 600, 1000>
12. <T4, Commit>
13. CRASH

OR

Q.3 Attempt the following questions. [12]

CO3 C (a) Perform Extendible Hashing on the following elements: [6]

11, 26, 20, 31, 35, 49, 34, 53, 54, 57, 16

Bucket Size: 2

Hash Function: Suppose the global depth is X, then the Hash Function returns X LSBs.

CO4 N (b) Explain Immediate Database Modification and apply this modification for the following log records: [6]

1. <T1, Start>
2. <T1, A, 100, 200>
3. <T1, Commit>
4. <T2, Start>
5. <T2, B, 500, 7000>
6. <T2, Commit>
7. <T3, Start>
8. <T3, C, 100, 900>
9. <T4, Start>
10. <T3, Commit>
11. <T4, D, 900, 600>
12. <T4, Commit>
13. <T5, Start>
14. CRASH

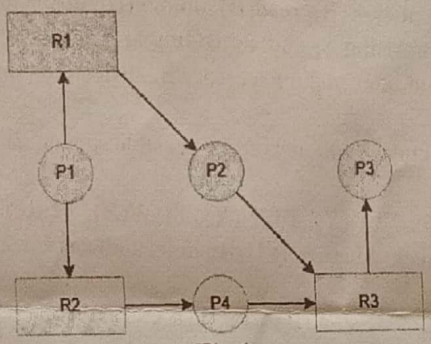

Fig 1

Table 1

Time	OP
1	S_1
2	$read_1(a)$
3	S_2
4	$read_2(b)$
5	$write_2(b)$
6	$write_1(a)$
7	S_3
8	$write_3(a)$
9	$write_3(b)$