



Examination : Regular
 Date : 07/11/2023
 Time : 10.00 to 1.00 pm

Seat No : _____
 Day : Tuesday
 Max. Marks : 60

INSTRUCTIONS:

1. Answer each section in separate answer book.
2. Figures to the right indicate maximum marks for that question.
3. The symbols used carry their usual meanings.
4. Assume suitable data, if required & mention them clearly.
5. Draw neat sketches wherever necessary.

SECTION - I**Q.1 Do as directed.**

- CO1 U (a) Consider the relation as in Fig 1 where A is primary key and C is foreign key referring A with on delete cascade. If tuple (2,4) is deleted then what are the extra tuples deleted to preserve the referential integrity? Justify your answer. [10]
 [2]
- CO5 R (b) Explain Lost Update problem of Concurrency Control with example. [2]
- CO4 E (c) State true or false and justify with example: Every Cascadeless schedule is Recoverable but there may be some Recoverable schedule which is not Cascadeless. [2]
- CO1 A (d) Suppose that we have an ordered file of 25,000 records and these records are stored on a disk and block size is 1024 bytes. Data file records are of fixed length and unspanned of size 100 bytes and suppose that we have created a **Secondary index** on a key field of size 9 bytes and a block pointer of size 6 bytes then find the average number of block access required **with indexing**. [2]
- CO3 N (e) What is the need of B+- Tree in storage of records? How is it better than Binary Search tree? What are the minimum and maximum number of keys of Internal and Leaf nodes, given order of B+-Tree? [2]

Q.2 Attempt Any TWO from the following questions.

- CO6 N (a) Consider the Log records as shown below: [10]
 [5]

1)<T1 start>	7)<T3 start>	13)<Checkpoint : L1 >	19)<T2 abort>
2)<T1.B1,100,300>	8)<T4 start>	14)<T1 B1,5069,4000>	20)<Checkpoint : L2 >
3)<T2 start>	9)<T3.B4,500,380>	15)<T5 start>	21)<T5 B6,300,5069>
4)<T2.B2,405,293>	10)<T4.B5,390,600>	16)<T3 Commit>	22)<T6 start>
5)<T1.B3,'D','C'>	11)<T1 Commit>	17)<T2.B2,293>	23)<T5 commit>
6)<T1 B1,300,5069>	12)<T2.B2,293,1000>	18)<T2.B2,405>	# SYSTEM CRASH

- i. List transactions in L1 and L2 during Checkpoint operation.
 - ii. Assume that after line 23 system is crashed, list and explain in detail the steps performed by recovery algorithm. Display status of the Log record after the execution of algorithm.
- CO1 C (b) Construct B+Tree **index on account_no** attribute for relation **account(account_no, branch_name, balance)** as given in Fig 2. Follow the order of rows for insertion. Assume Order=3. Perform following operation on B+Tree: (i) Deletion of "A-217" (ii) Deletion of "A-222" [5]
- CO5 A (c) Give definitions of Conflict and View Serializable schedules. Consider the schedule of Fig 3. Answer the following questions by creating necessary graphs and give justification for each. [5]
1. Check whether the schedule is Conflict Serializable or not?
 2. Check whether the schedule is View Serializable or not?

Q.3 Attempt the following questions.

CO3 A (a) Consider the following common relational schema for both (Q.3 and OR Q.3) [10]
and write SQL queries. [10]

Student (snum, sname, major, level, age) Enrolled (snum, cname)
Class (name, meets_at, room, fid) Faculty (fid, fname, deptid)

The meaning is straight forward here; for example, Enrolled table has one record per student-class pair such that the student is enrolled in the class.

- Find the names of all Juniors (Level = Junior) who are enrolled in a class taught by Ramanujan.
- Find the age of the oldest student who is either a History major or is enrolled in a course taught by Pushpak.
- Find the names of all classes that either meet in Room 4 or have 5 or more students enrolled.
- Find the names of all students who are enrolled in two classes that meet at the same time.
- Find the names of faculty members who teach in every room in which some class is taught.

OR

Q.3 Attempt the following questions.

CO3 A (a) vi. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than 5. [10]

- Print the Level and the average age of students for that Level, do it for each level.
- Find the names of students who are enrolled in the maximum number of classes.
- Find the names of students who are not enrolled in any class.
- For each age value that appears in Students, find the level value that appears most often. For example, if there are More X Level students aged 18 than Level Y,Z,W students aged 18, you should print the pair (18, X).

A	C
2	4
3	4
4	3
5	2
7	2
9	5

Fig 1

A-217	Brighton	750
A-101	Downtown	500
A-110	Downtown	600
A-215	Mianus	700
A-102	Perryridge	400
A-201	Perryridge	900
A-218	Perryridge	700
A-222	Redwood	700
A-305	Round Hill	350

account(account_no, branch_name, balance)

Fig 2

T1	T2	T3
R(D1); W(D1);	R(D3); R(D2); W(D2);	R(D2); R(D3);
R(D2); W(D2);	R(D1); W(D1);	W(D2); W(D3);

Fig 3

SECTION - II

Q.4 Do as directed.

CO1 R (a) List two reasons why null values might be introduced into the database. [10]

CO2 E (b) State true or false and justify: The weak entity set is said to be existence dependent on the identifying entity set. [2]

CO3 A (c) Write a relational algebra query for the following: [2]

Find the Id and Name of those instructors who earn more than the instructor whose id is 12121. Instructor(Id, Name, Salary, Dept_name, Designation)

CO2 N (d) Let $R(A,B,C,D,E)$ and $FDs = \{A \rightarrow B, A \rightarrow C, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$. Which of the following FDs are not implied by the above set? [2]

$CD \rightarrow AC$	$BD \rightarrow CD$	$BC \rightarrow CD$	$AC \rightarrow BC$
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CO4 U (e) Is it possible to avoid cascading rollbacks for transactions executing concurrently? Explain. [2]

Q.5 Attempt Any TWO from the following questions.

- CO2 U (a) Draw the ER diagram for the COMPANY database. The COMPANY database keeps track of a company's employees, departments, and projects. The company is organized into departments. Each department has a unique name, a unique number, and a particular employee who manages the department. We keep track of the start date when that employee began managing the department. A department may have several locations. A department controls a number of projects, each of which has a unique name, a unique number, and a single location. We store each employee's name, Social Security number, address, salary, gender, and birth date. An employee is assigned to one department, but may work on several projects, which are not necessarily controlled by the same department. We keep track of the current number of hours per week that an employee works on each project. We also keep track of the direct supervisor of each employee (who is another employee). We want to keep track of the dependents of each employee for insurance purposes. We keep each dependent's first name, sex, birth date, and relationship to the employee. [10]
[5]
- CO4 N (b) Explain two phase locking protocol (2PL). Consider the schedule S and check whether it is feasible under 2PL, and rigorous 2PL and explain. [5]
 $S \Rightarrow T1:R(X), T1:R(Y), T1:W(X), T2:R(Y), T3:W(Y), T1:W(X), T2:R(Y).$
- CO2 A (c) Decompose relation R till 2 NF. [5]
 $R(A,B,C,D,E,F,G,H,I,J)$ FDs $\{AB \rightarrow C, BD \rightarrow EF, AD \rightarrow GH, A \rightarrow I, H \rightarrow J\}$

Q.6 Attempt the following questions.

- CO2 U (a) Why is it important to check for FD preservation? Let $R(A,B,C,D,E)$ and FDs = $\{AB \rightarrow D, C \rightarrow E, E \rightarrow C, C \rightarrow A, A \rightarrow C\}$. R is decomposed into $R_1(A,B,C)$ and $R_2(A,B,D,E)$. Are all FDs preserved in the decomposition? Is the decomposition good? [10]
[5]
- CO4 R (b) Define: Deadlock. Discuss techniques for deadlock prevention and deadlock detection and recovery. [5]

OR

Q.6 Attempt the following questions.

- CO2 U (a) A relation staff(sid, location, department, position, doj) with FDs $\{sid \rightarrow location, position \rightarrow doj, location \rightarrow department\}$ and tuples as shown in Table I. What is the highest normal form for staff? Is it perfect? Justify. If not then decompose further to make it perfect. [10]
[5]

Table I

sid	location	department	position	doj
S101	L2	HR	P3	22-Sept-2021
S101	L6	IT	P7	11-Nov-2014
S102	L2	HR	P3	03-Mar-2016
S105	L7	IT	P6	22-Sept-2021
S103	L2	HR	P7	11-Nov-2014
S104	L6	IT	P4	01-Apr-2018

- CO4 R (b) What is the purpose of Timestamp ordering protocol? How to implement timestamp? Explain basic timestamp ordering protocol for read operation and write operation with a suitable example. [5]