Question Paper

Exam Date & Time: 07-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

DEPRATMENT OF INFORMATION AND COMMUNICATION TECHNOLOGY
COMPUTER AND COMMUNICATION ENGINEERING
END SEMESTER EXAMINATION, APRIL 2024

DATABASE MANAGEMENT SYSTEMS [ICT 2225]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

All questions are mandatory.
Assume missing data

1A) Verify if the following schedule S can be converted to a serializable schedule. Provide the same if one exists. S: r1 (X); r2 (Z); r3 (X); r1 (Z); r2 (Y); r3 (Y); w1 (X); w2 (Z); w3 (Y); w2 (Y); (5)

1B) Consider the log in Figure Q1b. Suppose there is a crash just before the (3)

< *T0* abort> log record is written out. Explain what would happen during

recovery.

Step	
1	T0 start
2	T0, B, 2000, 2050
3	T1 start
4	Checkpoint{T0, T1}
5	T1, C, 700, 600
6	T1 commit
7	T2 start
8	T2, A, 500, 400
9	T0, B, 2000
10	T0 abort
11	T2, A, 500
12	T2, abort

Figure Q1b

1C) Illustrate how different levels of abstraction in a database system can be linked to navigating through a library with varying levels of access to information for other users. (2)

2A) Consider the following database schema for managing student participation in cultural programs: (5)

Students (student_id: varchar(20), name: varchar(50), department: varchar(20), dob: date)

Programs (program_id: int, program_name: varchar(50), organizer: varchar(50))

Participation (student_id: varchar(20), program_id: int, year: int)

Performances (program_id: int, performance_id: int, performance_name: varchar(50))

Solve the following by writing **nested subquery concepts**:
i.List the programs where more than one performance is scheduled.
ii. List the departments whose students have participated in all programs organized by a 'specific organizer'.
iii. Find the students who have participated in programs from more than one organizer.
iv. Produce a list of students who have not participated in any program.
v. List the organizers who have organized programs in all departments.

2B) Consider you were to set up a display in a science museum showcasing experiments conducted by notable scientists in the year 2023, specifically those performed in the Laboratory Wing, how would you implement a query to select these experiments and create a view for this special exhibit in the museum (3)

Scientists:

scientist_id	scientist_name
101	Isaac Newton
102	Marie Curie
103	Albert Einstein
104	Rosalind Franklin

Experiments

experiment_id	scientist_id	year	lab_room
1	101	2023	Laboratory A
2	102	2023	Laboratory B
3	103	2023	Laboratory Wing
4	104	2023	Laboratory Win

2C) Consider a group of employees joined in TCS company and you want to find all the employees who started their jobs between January 1, 2024, and April 30, 2024, develop a query without using BETWEEN comparator in sql. (2)

3A) What is a canonical cover. Consider the following set of functional dependencies, F= ($A \rightarrow BCD$; $BC \rightarrow DE$; $B \rightarrow D$; $D \rightarrow A$), on the relation schema R (A, B, C, D, E, H) (5)

i. Find the candidate key for the relation R.

ii. Compute a canonical cover for the above set of functional dependencies F. Give each step of your derivation with a suitable justification.

3B) Illustrate the difference between INNER JOIN and OUTER JOIN. (3)

3C) Consider the following schema constructs: STUDENT (sid, sname, deptname); ENROLL (courseid, sid, semester). Using Nested Query concept write a SQL query that displays the total number of courses that each student has enrolled for. (2)

4A) Consider an Indian railway application scenario: (5)

Trains comprise multiple coaches, each with a unique coach number.

Passengers can book tickets for specific train journeys.

Stations serve as stops along the train routes.

Each train follows a schedule, stopping at various stations.

Passengers have the flexibility to board and alight at different stations.

i. List the entities along with their associated attributes with clearly indication of primary keys and describe their relationships, including cardinalities.

ii. Create an ER diagram that visualizes these entities and their relationships.

4B) Design a generalization-specialization hierarchy for a motor vehicle sales company. The company sells motorcycles, passenger cars, vans, and buses. Justify your placement of attributes at each level of the hierarchy. Explain why they should not be placed at a higher or lower level. (3)

4C) Verify if the following decomposition is lossless or lossy decomposition: R1 (A1, A2, A3, A5); R2 (A1, A3, A4); R3 (A4, A5) with FD1: A1-> A3, A5; FD2: A5-> A1, A4; FD3: A3, A4-> A2. Show each step. (2)

5A) Consider the relation R, which has attributes that hold schedules of courses and sections at a university; R = {Course_No, Sec_No, Offering_Dept, Credit_Hours, Course_Level, Instructor_ssn, Semester, Year, Days_hours, Room_No, No_of_Students}. (5)

Suppose that the following functional dependencies hold on R:

FD1: {CourseNo} -> {OfferingDept, CreditHours, CourseLevel}

FD2: {CourseNo, SecNo, Semester, Year} -> {Days_Hours, RoomNo, NoOfStudents, InstructorSSN}

FD3: {RoomNo, Days_Hours, Semester, Year} -> {InstructorSSN, CourseNo, SecNo}

Determine the candidate keys of R. Normalize the relation upto the highest possible normal form.

5B) Apply Time Stamp based Protocol for the schedule below , assuming the timestamp of start of T1 is 1, T2 is 2, T3 is 3, T4 is 4 and T5 is 5. Also state the reasons for the transactions that are aborted or committed. Also justify if the schedule is recoverable or not. (3)
S: R5(X) R2(Y) R1(Y) W4(Y) W4(Z) W5(Z) R4(X) W1(Z) W2(X) W5(K) W3(K)

5C) With a suitable example demonstrate the benefits of Two-Phase Protocol. (2)

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