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Semester End Examination
Master of Computer Applications
MCAC 104: Database Systems
Unique Paper Code: 223421104
Semester I
January-2024
Year of admission: 2022 onwards

Time: 3 hours

Maximum Marks: 70

Instructions:

1. Parts of a question should be answered together.
2. Attempt all questions.

1. a. Consider the following relation:

6 marks

STUDENT COURSE

<u>StudentNo</u>	<u>CourseID</u>	SNAME	PHONE	AGE	CourseName
1	C1	RAM	9716271721	20	DBMS
2	C2	JATIN	9898291281	19	HTML
3	C1	SUJIT	7898291981	18	DBMS
4	C3	SUMAN	9899307318	21	C++

Which operations would result in insert/update/delete anomalies? Justify your answer.

- i. Insert a row with **StudentNo** = 7 and **CourseID** = 'C1'.
- ii. Delete a row with **StudentNo** = 2
- iii. Delete a row with **SNAME** = 'RAM'

- b. Write the relational algebra expressions to perform the following operations on the relational schema: **8 marks**

EMPLOYEE

Empno	EName	Address	Salary	Gender	Dno
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DEPARTMENT

Dnum	DName	Manager
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- i. Display names of the employees working in **Computer Science** department and having a salary of more than 50000.
- ii. Display the employee numbers and names of all employees along with their department numbers.
- iii. Display the name and the address of male employees.
- iv. Display the employee numbers and names of all employees, along with their department names and manager names.

2. a. Consider three tables: **Student**, **Course**, and **Assigned**:

Student			
<u>RollNo</u>	<u>Name</u>	<u>DOB</u>	<u>Percentage</u>
1	Amit	12-01-1995	66
2	Sahil	22-07-1993	95
3	Payal	02-04-1995	76
4	Palak	12-05-1994	66

Course

<u>CourseNo</u>	<u>CourseName</u>
101	Compiler Design
103	Data Mining
104	GPU Programming
105	Java Programming

Assigned

<u>RollNo</u>	<u>CourseNo</u>
1	101
1	103
3	104
2	10 5

Assume that RollNo, CourseNo, and {RollNo, CourseNo} are primary keys of Student, Course, and Assigned tables, respectively. Note that:

- RollNo of the Assigned table refers to the RollNo of the Student table.
- CourseNo of the Assigned table refers to the CourseNo of the Course table.

Will any constraint be violated for each of the following operations executed independently? Justify your answers in each case.

- INSERT INTO Student VALUES** (¹101, 'Rahul', '10-12-1993', 81);
- INSERT INTO Student VALUES** (⁵105, 'Rahul', '13-01-1994', 78);
- INSERT INTO Assigned VALUES** (3, 102);
- DELETE FROM Student WHERE** DOB = '22-07-1993';

- b. Consider a relation **R(A, B, C, D, E, F, G, H, I, J)** and the set of functional dependencies. **8 marks**

F = {AB → C, BD → EF, AD → GH, G → I, H → J}

Find all possible candidate keys of R. Also, give an example of a super key of R. Check whether R is in 2NF. If not, Decompose the relation R into a set of 2NF relations. Check whether R is in 3NF. If not, Decompose the relation R into a set of 3NF relations.

3. a. Consider the following SQL statement:

```
CREATE TABLE Flight
(flightNo CHAR(6),
seatNo INT CHECK(seatNo >=1 and seatNo <=200),
name VARCHAR(10),
arrivalTime DATETIME,
fare DECIMAL(8,2));
```

Which of the following values entered for the columns holds valid? Justify your answer for each case.

- '18-01-2024 10:40:32' for arrivalTime
- 1300000.23 for Fare
- 340 for seatNo

**4.5
marks**

- b. Consider the following relations **A** and **B**:

4.5
marks

Relation A

P	Q
1	2
3	4

Relation B

U	P	V
2	1	6
4	7	8
9	3	11

Give the result of the following relational algebraic expressions on A and B:

- $A \times B$
- $A \bowtie B$ on $A.P = B.P$

- c. Differentiate between the concept of Specialization and Generalization with the help of suitable examples. **5 marks**

4. a. Differentiate between physical and logical data independence, with an example of each. **5 marks**

- b. A university maintains data about the following entities: **9 marks**

- Courses including number, title, credits, syllabus, and prerequisites.
- Course offerings include course number, year, semester, section number, instructor(s), timings, and classroom.
- Students include student identification number, name, and program.
- Instructors include an identification number, name, department, and title.

Construct an E-R diagram for the university. Specify cardinality ratios and participation constraints. State any assumptions that you make for drawing an E-R diagram.

5. a. Consider two concurrent transactions, T_X and T_Y , executing simultaneously involving read and write operations on the data item A. The initial value of A is set at 500. **3 marks**

Time	T_X	T_Y
t_1	READ(A)	-----
t_2	$A = A + 50$	-----
t_3	WRITE(A)	-----
t_4	-----	READ(A)
t_5	SERVER DOWN ROLLBACK	-----

Identify the problem(s) that could arise in the above scenario. Justify your answer.

- b. Consider the following ER diagram for UNIVERSITY database: **5 marks**

- a) SELECT employeeName
FROM Employee
LEFT JOIN Assignment ON Employee.employeeID =
Assignment.employeeID
WHERE Assignment.employeeID IS NULL;
- b) SELECT employeeName
FROM Employee
JOIN Assignment ON Employee.employeeID =
Assignment.employeeID
GROUP BY employeeName
HAVING COUNT(Assignment.projectNo) > 1;
- c) SELECT DISTINCT *
FROM Employee E
WHERE NOT EXISTS(
SELECT P.projectNo
FROM Project P
WHERE P.projectNo NOT IN(
SELECT A.projectNo
FROM Assignment A
WHERE A.employeeID = E.employeeID));