

CS 303 - Databases & Information Systems  
Midsem exam  
Total marks - 36

**Instructions:**

1. There are 12 questions in this question paper. All questions are compulsory.
2. For each question, please justify how you arrived at your answer. Incomplete answers will lead to loss of marks.
3. DO NOT COPY.

**Questions:**

1. Predict the output: (2 Marks)

A relational database contains two tables Student and Performance as shown below:

Student	
Roll_no.	Student_name
1	Amit
2	Priya
3	Vinit
4	Rohan
5	Smita

Performance		
Roll_no	Subject_code	Marks
1	A	86
1	B	95
1	C	90
2	A	89
2	C	92
3	C	80

*Handwritten:* select last name, sum CP.Marks from employees where

*Handwritten:* S.Student\_name, sum

S.Student_name	sum (P.Marks)
Amit	271
Priya	188
Vinit	252
Rohan	252
Smita	252

What will be the output of the following query? How many rows are there in the output of the given query?

**SELECT S.Student\_name, sum (P.Marks) FROM Student S, Performance P WHERE P.Marks > 84 GROUP BY S.Student\_name;**

2. Given the following schema: (2 Marks)

employees(emp-id, first-name, last-name, hire-date, dept-id, salary)  
departments(dept-id, dept-name, manager-id, location-id)

You want to display the last names and hire dates of all latest hires in their respective departments in the location-ID 1700. Write a query which will do the concerned task.

- 3.. Explain the concept of physical data independence, and its importance in database systems. (2 Marks)

*Handwritten:* select last name, hire date from employees where hire-date in (select MAX(hire-date), dept-id from employees NATURAL join departments where loc-id = 1700)



4. SQL allows a foreign-key dependency to refer to the same relation, as in the following example: (3 Marks)

```
create table manager
(employee_name varchar(20) not null
manager_name varchar(20) not null,
primary key employee_name,
foreign key (manager_name) references manager
on delete cascade )
```

Here, **employee\_name** is a primary key to the table manager, meaning that each employee has at most one manager. The foreign-key clause requires that every manager also be an employee. Explain exactly what happens when a tuple in the relation manager is deleted.

5. Consider the following relation: (4 Marks)

StudentID	StudentName	StudentEmail	StudentAge	CPI
2345	Shankar	shankar@math	XXX	9.4
1287	swati	swati@ee	21	9.5
7853	Shankar	shankar@cse	19	9.4
9876	swati	swati@mech	21	9.3
8765	ganesh	ganesh@civil	17	8.7

Given that the key of the above relation is (**StudentName, StudentAge**), answer the following:

- What **should not** be the StudentAge value for the student with studentID 2345 such that it upholds the primary key constraint?
- Apart from the above, what other problems do you see in the above relation and how are you going to solve it?

6. Consider the banking database shown below: (7 marks)

```
branch(branch_name, branch_city, assets)
customer(customer_name, customer_street, customer_city)
loan(loan_number, branch_name, amount)
borrower(customer_name, loan_number)
account(account_number, branch_name, balance)
depositor(customer_name, account_number)
```

- Give an expression in the relational algebra for each of the following queries:
  - Find the names of all branches located in "Chicago".
  - Find the names of all borrowers who have a loan in the branch "Downtown".
- What are the appropriate primary keys? Given your choice of primary keys, identify appropriate foreign keys.
- Give an expression in the relational algebra for each of the following queries:
  - Find all loan numbers with a loan value greater than \$10,000.

*Handwritten notes:*  
 branch\_name (to branch\_name, branch\_city, assets)  
 = "Downtown"  
 loan\_number = loan\_number  
 borrower\_name (to borrower\_name, loan\_number)  
 = "Downtown"  
 customer\_name (to customer\_name, customer\_street, customer\_city)  
 = "Downtown"

*Handwritten notes:*  
 customer\_name (borrower)



- ii. Find the names of all depositors who have an account with a value greater than \$6,000.  
 iii. Find the names of all depositors who have an account with a value greater than \$6,000 at the "Uptown" branch.

7. Consider the following SQL query: (2 Marks)

```
select distinct a1, a2,....., an
from r1, r2,....., rm
where P → condition
```

What will be the equivalent relational algebraic expression of the above query? Please explain your answer.

8. Database table by name Loan\_Records is given below. (2 Marks)

Borrower	Bank Manager	Loan Amount
Ramesh	Sunderajan	10000.00
Suresh	Ramgopal	5000.00
Mahesh	Sunderajan	7000.00

σ → select  
 π → project

What is the output of the following SQL query? Explain your answer.

```
SELECT Count(*)
FROM ( ( SELECT Borrower, Bank_Manager
FROM Loan_Records) AS S
NATURAL JOIN ( SELECT Bank_Manager, Loan_Amount
FROM Loan_Records) AS T );
```

9. Consider the above tables A, B and C and answer the following questions: (2 Marks)

Table A

Id	Name	Age
12	Arun	60
15	Shreya	24
99	Rohit	11

Table B

Id	Name	Age
15	Shreya	24
25	Hari	40
98	Rohit	20
99	Rohit	11

Table C

Id	Phone	Area
10	2200	02
99	2100	01

What will be the output of the following SQL query? How many tuples does the result of the following SQL query contain? Hint: The string or character pattern value used for comparison is case sensitive.

```
SELECT A.Id FROM A WHERE A.age > ALL (SELECT B.age FROM B WHERE B.name = "arun")
```

10. List four significant differences between a file-processing system and a DBMS. (4 Marks)
11. Explain the difference between two-tier and three-tier architectures. Which is better suited for Web applications? Why? (4 Marks)
12. Describe the differences in meaning between the terms relation and relation schema. (2 Marks)

DBMS

- Data integrity constraints
- Redundancy reduction
- Views
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