

- 1 - Suppose relations $R(A,C)$ and $S(B,C,D)$ have the following tuples:

A	C
5	4
6	4
8	4
3	5
7	6

B	C	D
5	1	6
1	5	8
4	3	9

A	B	C	D
3	1	5	8

Compute the natural join of R and S (i.e. $R \bowtie S$) and show the resultant table. [1]

- 2 - Write a relational algebra expression using cross product to obtain the same result (Same number of columns and rows) as in Q1. [1]

$$\pi_{(A,B,C,D)} (\sigma_{R.C=S.C} (R \times S))$$

- 3 - Suppose relations $R(A,B,C)$ has the following tuples:

A	B	C
3	2	3
4	2	4
4	5	6
3	5	3
1	2	6

A	C
3	3
4	4
3	3

Compute the projection $\pi_{A,C} (\sigma_{A=C} (R))$. [1]

- 4 - Write a query to rename the table name (R to X) and its attribute to x, y, z . (using the same relation as in Q3) [1]

$$\rho_{(x,y,z)} (X)$$

- 5 - Suppose relations $R(A,B)$ and $S(B,C,D)$ have the following tuples:

A	B
1	2
3	4
5	6

B	C	D
2	4	6
4	6	8
4	7	9

Compute $R \bowtie S$ with the condition $R.A < S.C$ AND $R.B < S.D$. [1]

A	B	C	D
1	2	4	6
3	4	6	8
5	6	7	7

- 6 - Write a relational algebra expression using cross product to obtain the same result (Same number of columns and rows) as in Q5 [1]

$$(\sigma_{R.A < S.C \wedge R.B < S.D} (R \times S))$$

7. [CLO2] Suppose relations R(A,B,C) and S(A,B,C) have the following five and four tuples respectively.

A	B	C
1	2	3
4	2	3
4	5	6
2	5	3
1	2	6

A	B	C
2	5	3
2	5	4
4	5	6
1	2	3

A	B	C
1	2	3
4	2	3
4	5	6
2	5	3
1	2	6

Compute $R - (S - R)$. [1]

8. Given is the relation (Employees), understand the relation and solve the following queries.

EMPLOYEE	MIN	MAX	SSN	DATE	ADDRESS	SEX	SALARY	SUPER	DEPT
James	E	Borg	888665555	10-NOV-37	450 Stone, Houston, TX	M	55000		
Franklin	T	Wong	333445555	08-DEC-55	638 Aves, Houston, TX	F	40000	888665555	5
John	B	Smith	123456789	09-JAN-65	731 Funderb, Houston, TX	M	30000	333445555	5
William	S	Wallace	987654321	20-JUN-41	200 Bay, Houston, TX	F	40000	888665555	1
Alfred	I	Zelinka	980637777	14-JAN-44	123456789, Houston, TX	F	20000	888665555	1
Richard	S	Narvaiz	986081111	15-JUL-72	987654321, Houston, TX	M	40000	888665555	2
James	A	Smith	453456789	11-JUL-72	7654321, Houston, TX	M	40000	888665555	2
William	A	Smith	987654321	11-JUL-72	7654321, Houston, TX	M	40000	888665555	2

i- Find the no of employees, sum of the salary of all employees, maximum salary, minimum salary, and their average salary. [1]

$T(\text{count ssn, sum-salary, max-salary, min-salary, average-salary (Employees)})$

ii- Write a query to retrieve the no of employees for each dept and their average salary. [1]

$T(\text{count ssn, Average-salary (Employees)})$
 select count ssn, Average-Salarys
 From Employees;

9. In this question, you are provided a sample database containing two relations: [1]

Student(student_id, student_name) // student_id is the key

EnrolledIn(student_id, course_code) // (student_id, course_code) is the key

You have also been provided instances of each of the above relations.

student_id	student_name	student_id	course_code
1234	Ahmad	1234	CS1500
4000	Ali	1234	CS1200
2000	Usman	1234	CS2001
		4000	CS3010
		4000	MA3000

For the following resultant relation, think of a relational algebra expression that can produce the same result? [2]

Student.student_id	student_name	EnrolledIn.student_id	course_code
4000	Ali	1234	CS1500
4000	Ali	1234	CS1200
4000	Ali	1234	CS2001
4000	Ali	4000	CS3010
4000	Ali	4000	MA3000

$\left(\frac{6}{\text{Student-ID=4000}} (\text{Student} \times \text{EnrolledIn}) \right)$