Module-2

1. Explain the characteristics of relations with an example for each.
2. Discuss the various restrictions on data that can be specified on a relational database in the form of constraints.
3. Explain ER to relational mapping algorithm with suitable example
4. Explain the following unary operations with syntax and example
   i) SELECT ii) PROJECT iii) RENAME
5. Explain the following binary operations with syntax and example
   i) UNION ii) INTERSECTION iii) MINUS iv) CROSS PRODUCT
6. Consider the two table T1 and T2. Show the results of the following operations.

T1

P	Q	R
10	a	5
15	b	8
25	a	6

T2

A	B	C
10	b	6
25	c	3
10	B	5

Show the results of the following operations

i) $T1 \bowtie_{T1.P=T2.A} T2$

ii) $T1 \bowtie_{T1.Q=T2.B} T2$

iii) T1 U T2

iv) $T1 \cap T2$

v) T1 – T2

vi) $T1 \bowtie_{T1.P=T2.A \text{ AND } T1.R=T2.C} T2$

vii) T1 X T2

viii) $\pi_{P, Q} (\sigma_{Q=a} (T1))$

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7. Consider the following Schema:
   EMP(Fname,Lname,SSN,Dno,Salary)
   DEPT(Dname,Dnum,Mgr_ssn)
   D_LOC(Dno,Loc)
   PROJECT(Pname,Pno,Dno,P_Loc)
   WORKS_ON(ESSN,Pno,Hours)

Develop the query in relational algebra for the following

a. Display the SSN, first name and last name of the employee working for the department 5.
b. Retrieve the location of the 'Accounts' Department.
c. Select the tuples for all employees who either work in department 4 and make over $25,000 per year, or work in department 5 and make over $30,000.
d. Retrieve the names of the project controlled by department no. 3.
e. Retrieve the names of employees working on project no. 4

8. Explain various types of Join operations with an example for each.
9. Consider the following schema for COMPANY database

EMPLOYEE (Fname, Lname, Ssn, Address,Bdate, Super-ssn, Salary, Dno)
DEPARTMENT (Dname, Dnumber, Mgr-ssn, Mgr-start-date)
DEPT-LOCATIONS (Dnumber, Dlocation)
PROJECT (Pname, Pnumber, Plocation, Dnum)
WORKS-ON (Essn, Pno, Hours)
DEPENDENT (Essn, Dependent-name, Sex, Bdate, Relationship)

Develop the queries in relational algebra for the following

a. Retrieve the birth date and address of the employee(s) whose name is 'John B.Smith'.
b. Retrieve the name and address of all employees who work for the 'Research' department.
c. Find the names of employees who work on all the projects controlled by department number 5.
d. Retrieve a list of names of each female employee's dependents.

Module-3

1. Illustrate informal design guidelines for relation schemas with an example for each.
2. Illustrate insertion, deletion and modification anomalies by considering the following schema diagram.

EMP_DEPT

ENAME	SSN	BDATE	ADDRESS	DNUMBER	DNAME	DMGRSSN

3. Illustrate how a relation can be normalized till 1NF and 2NF with an example for each.
4. For the given relation R(A,B,C,D,E) and its instance , check whether the FDs given hold or not. Give reasons

   i) A→B ii) B→C iii)D→E iv) CD→E v) AB→E

R

A	B	C	D	E
a1	b1	c1	d1	e1
a1	b2	c1	d1	e1
a2	b2	c1	d2	e3
a2	b3	c3	d2	e2

5. Consider the relation schema LOTS which describes parcels of land for sale in various counties of a state. Suppose that there are two candidate keys: Property_id# and {County_name, Lot#}; that is, lot numbers are unique only within each county, but Property_id# numbers are unique across counties for the entire state. Based on the two candidate keys Property_id# and {County_name, Lot#}, the functional dependencies FD1 and FD2 hold
   1. FD1: Property_id → { County_name,Lot#,Area,Price,Tax_rate}
   2. FD2:{County_name,Lot#} →{Property_id, Area,Price,Tax_rate}
   3. FD3: County_name → Tax_rate
   4. FD4: Area → Price
   5. FD5: Area→County_name

   Construct a relational schema for this database application that are each in BCNF.

6. Suppose that EMP_PROJ relation is represented as follows:

   EMP_PROJ(Ssn, Ename, {PROJS(Pnumber, Hours)})

   Ssn is the primary key of the EMP_PROJ relation and Pnumber is the partial key of the nested relation; that is, within each tuple, the nested relation must have unique values of Pnumber.Design a normalized relational schema that are each in 1NF and 2NF

7. Consider the following relation:

EMP_DETAILS(EmpID,BranchID,EName,Branch_Address,Position,Working_Hrs)

Assume that the primary key of the given relation is {EmpID,BranchID}, additional dependencies are:

EmpID→EName,Position

BranchID→Branch_Address

Construct a relational schema which is in 2NF and 3NF.

8. Consider the following relation for published books:

BOOK(BookTitle, AuthorName, BookType, ListPrice, AuthorAffiliation, Publisher)
Suppose the following dependencies exist:
BookTitle → BookType, Publisher
BookType → ListPrice
AuthorName → AuthorAffiliation

i) Based on the given primary key, is the relation in 1NF, 2NF? Why or why not?
ii) Apply normalization to successively normalize it till 3NF.

9. Consider the following relation:

CAR_SALE(Car#, DateSold, Salesman#, Commission%, DiscountAmount)

Assume that a car may be sold by multiple salesmen, and hence

{Car#, Salesman#} is the primary key.

Additional dependencies are:

Car# → DateSold

Car# → DiscountAmount

DateSold → DiscountAmount

Salesman# → Commission%

Based on the given primary key, is the relation in 1NF, 2NF, 3NF?

Why or why not?

How would you successively normalize it completely?