VISION AND MISSION OF INSTITUTION

Vision

Building RNSIT into a World Class Institution

Mission

To impart high quality education in Engineering, Technology and Management with a Difference, Enabling Students to Excel in their Career by

1. Attracting quality Students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions.
2. Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class Professionals with social responsibility.
3. Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students.
4. Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development.
5. Providing freedom of action and choice for all the Stake holders with better visibility.

VISION AND MISSION OF CSE DEPARTMENT

Vision

Preparing better computer professionals for a real world

Mission

The Department of Computer Science and Engineering will make every effort to promote an intellectual and an ethical environment in which the strengths and skills of Computer Professionals will flourish by

1. Imparting Solid foundations and Applied aspects in both Computer Science Theory and Programming practices.
2. Providing Training and encouraging R&D and Consultancy Services in frontier areas of Computer Science with a Global outlook.
3. Fostering the highest ideals of Ethics, Values and creating Awareness on the role of Computing in Global Environment.
4. Educating and preparing the graduates, highly Sought-after, Productive, and Well-respected for their work culture.
5. Supporting and inducing Lifelong Learning practice

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SYALLABUS

SEMESTER V

DBMS LABORATORY WITH MINI PROJECT

Sub Code	**: 21CSL55**	**CIE Marks**	**: 50**
Hrs/ Week	**: 02**	**SEE Marks**	**: 50**
Credits	**: 01**	**Exam Hours**	**: 03**

Course Learning Objectives:

This course (21CSL55) will enable students to:

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

LABORATORY DATABASES

PART A

SQL Programming

1. Consider the following schema for a Library Database:

BOOK(Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS(Book_id, Author_Name)
PUBLISHER(Name, Address, Phone)
BOOK_COPIES(Book_id, Branch_id, No-of_Copies)
BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date)
LIBRARY_BRANCH(Branch_id, Branch_Name, Address)

Write SQL queries to

1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the following schema for Order Database:

SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

Write SQL queries to

1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesman who had more than one customer.
3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

3. Consider the schema for Movie Database:

ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

Write SQL queries to

1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

4. Consider the schema for College Database:

STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec)
CLASS(USN, SSID)
SUBJECT(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to

1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
   If FinalIA = 17 to 20 then CAT = 'Outstanding'If FinalIA = 12 to 16 then CAT = 'Average'
   If FinalIA< 12 then CAT = 'Weak'
   Give these details only for 8th semester A, B, and C section students.

5. Consider the schema for Company Database:

EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)
DLOCATION(DNo, DLoc)
PROJECT(PNo, PName, PLocation, DNo)
WORKS_ON(SSN, PNo, Hours)

Write SQL queries to

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10

percent raise.

3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department
4. Retrieve the name of each employee who works on all the projects controlledby department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

PART B (MINI-PROJECT)

For any problem selected, write the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process.

Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include; health care, education, industry, transport, supply chain, etc.

Laboratory Outcomes: The student should be able to:

- **CO1**: Demonstrate DDL commands [create,drop,alter] on Database.
- **CO2**: Create ER diagrams and conceptual schema for the problems given.
- **CO3**: Apply Integrity constraints on relations.
- **CO4**: Demonstrate Update operations.
- **CO5**: Demonstrate more complex SQL queries.
- **CO6**: Implement, analyze and evaluate the project developed for an application.

Assessment Details (both CIE and SEE):

Continuous Internal Evaluation (CIE): CIE marks for the practical course is 50 Marks.

Internal Assessment Number	Write up	Conduction	Viva	Total	Average of IA-1 and IA-2	Final IA Marks Scale down to
IA-1	20	40	40	100	(100+100)/2 =100	**20**
IA-2	20	40	40	100		
Average of CIE of all Databases (A)		**Record (B)**	**Mini Project Evaluation (C)**		**Total (A+B+C)/2**	**30**
20		10	30		30	
					Total IA Marks for Lab	**50**

Semester End Evaluation (SEE): SEE marks for the practical course is 50 Marks

Part A	Write up	Conduction	Viva	Total	Scale down	Final SEE marks scale down to
Part A: SQL Programming	20	60	20	100	60	**50**
Part B	**Abstract**	**Demonstration**	**Viva**	**Total**	**Scale down**	
Part B: Mini Project	20	60	20	100	40	

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Departments of CSE

DBMS LABORATORY WITH MINI PROJECT [21CSL55]

INTRODUCTION TO SQL

Pronounced as SEQUEL: Structured English QUERY Language

- Pure non-procedural query language
- Designed and developed by IBM, Implemented by Oracle
- 1978 System/R IBM- 1st Relational DBMS
- 1979 Oracle and Ingres
- 1982 SQL/DS and DB2 IBM
- Accepted by both ANSI + ISO as **Standard Query Language** for any RDBMS
- SQL86 (SQL1) : first by ANSI and ratified by ISO (SQL-87), minor revision on 89 (SQL-89)
- SQL92 (SQL2) : major revision
- SQL99 (SQL3) : add recursive query, trigger, some OO features, and non-scholar type
- SQL2003 : XML, Window functions, and sequences (Not free)
- Supports all the three sublanguages of DBMS: **DDL, DML, DCL**
- Supports Aggregate functions, String Manipulation functions, Set theory operations, Date Manipulation functions, rich set of operators (IN, BETWEEN, LIKE, IS NULL, EXISTS)
- Supports REPORT writing features and Forms for designing GUI based applications

DATA DEFINITION, CONSTRAINTS, AND SCHEMA CHANGES

Used to CREATE, ALTER, and DROP the descriptions of the database tables (relations)

Data Definition in SQL

CREATE, ALTER and DROP

table..... relation

row .....tuple

column…..... attribute

DATA TYPES

- Numeric: NUMBER, NUMBER(s,p), INTEGER, INT, FLOAT, DECIMAL
- Character: CHAR(n), VARCHAR(n), VARCHAR2(n), CHAR VARYING(n)
- Bit String: BLOB, CLOB
- Boolean: true, false, and null
- Date and Time: DATE (YYYY-MM-DD) TIME(HH:MM:SS)

- Timestamp: DATE + TIME
- USER Defined types

CREATE SCHEMA

Specifies a new database schema by giving it a name

Ex: CREATE SCHEMA COMPANY AUTHORIZATION Jsmith;

CREATE TABLE

- Specifies a new base relation by giving it a name, and specifying each of its attributes and their data types

  Syntax of CREATE Command:

  CREATE TABLE <*table name*> (<Attribute *A*1> <Data Type *D*1> [< Constarints>],
  <Attribute *A*2> <Data Type *D*2> [< Constarints>],
  …….
  <Attribute *A*n> <Data Type *D*n> [< Constarints>],
  [<integrity-constraint1>, <integrity-constraint k>]);

  - A constraint NOT NULL may be specified on an attribute

  A constraint NOT NULL may be specified on an attribute

  Ex: CREATE TABLE DEPARTMENT (
  DNAME VARCHAR(10) NOT NULL,
  DNUMBER INTEGER NOT NULL,
  MGRSSN CHAR(9), MGRSTARTDATE CHAR(9));
- Specifying the unique, primary key attributes, secondary keys, and referential integrity constraints (foreign keys).

  Ex: CREATE TABLE DEPT (
  DNAME VARCHAR(10) NOT NULL,
  DNUMBER INTEGER NOT NULL,
  MGRSSN CHAR(9),
  MGRSTARTDATE CHAR(9),
  PRIMARY KEY (DNUMBER),
  UNIQUE (DNAME),
  FOREIGN KEY (MGRSSN) REFERENCES EMP(SSN));
- We can specify RESTRICT, CASCADE, SET NULL or SET DEFAULT on referential integrity constraints (foreign keys)

  Ex: CREATE TABLE DEPT (
  DNAME VARCHAR(10) NOT NULL,

DNUMBER INTEGER NOT NULL,
MGRSSN CHAR(9), MGRSTARTDATE CHAR(9),
PRIMARY KEY (DNUMBER),
UNIQUE (DNAME),
FOREIGN KEY (MGRSSN) REFERENCES EMP
ON DELETE SET DEFAULT ON UPDATE CASCADE);

DROP TABLE

- Used to remove a relation (base table) and its definition.
- The relation can no longer be used in queries, updates, or any other commands since its description no longer exists

Example: DROP TABLE DEPENDENT;

ALTER TABLE:

- Used to add an attribute to/from one of the base relations drop constraint -- The new attribute will have NULLs in all the tuples of the relation right after the command is executed; hence, the NOT NULL constraint is *not allowed* for such an attribute.
  Example: ALTER TABLE EMPLOYEE ADD JOB VARCHAR2 (12);
- The database users must still enter a value for the new attribute JOB for each EMPLOYEE tuple. This can be done using the UPDATE command.

DROP A COLUMN (AN ATTRIBUTE)

- ALTER TABLE COMPANY.EMPLOYEE DROP ADDRESS CASCADE; All constraints and views that reference the column are dropped automatically, along with the column. ALTER TABLE COMPANY.EMPLOYEE DROP ADDRESS RESTRICT; Successful if no views or constraints reference the column. ALTER TABLE COMPANY.DEPARTMENT ALTER MGRSSN DROP DEFAULT;
- ALTER TABLE COMPANY.DEPARTMENT ALTER MGRSSN SET DEFAULT “333445555”;

BASIC QUERIES IN SQL

- SQL has one basic statement for retrieving information from a database; the SLELECT statement
- This is *not the same as* the SELECT operation of the relational algebra
- Important distinction between SQL and the formal relational model;
- SQL allows a table (relation) to have two or more tuples that are identical in all their attribute values

- Hence, an SQL relation (table) is a *multi-set* (sometimes called a bag) of tuples; it is *not* a set of tuples
- SQL relations can be constrained to be sets by using the CREATE UNIQUE INDEX command, or by using the DISTINCT option
- Basic form of the SQL SELECT statement is called a *mapping* of a *SELECT-FROM-WHERE block*

  SELECT <attribute list> FROM <table list> WHERE <condition>
- <attribute list> is a list of attribute names whose values are to be retrieved by the query
- <table list > is a list of the relation names required to process the query
- <condition> is a conditional (Boolean) expression that identifies the tuples to be retrieved by the query

SIMPLE SQL QUERIES

Basic SQL queries correspond to using the following operations of the relational algebra:

SELECT

PROJECT

JOIN

All subsequent examples uses COMPANY database as shown below:

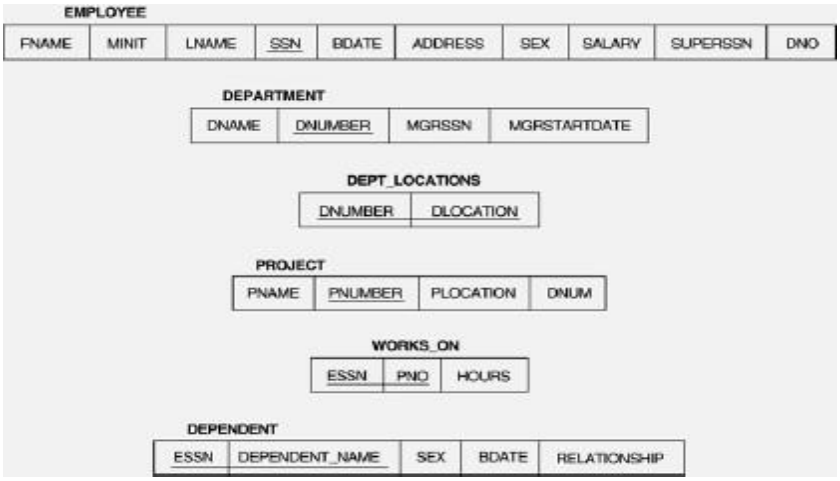
Example of a simple query on one relation

Query 0: Retrieve the birth date and address of the employee whose name is 'John B. Smith'.

Q0: SELECT BDATE, ADDRESS FROM EMPLOYEE

WHERE FNAME='John' AND MINIT='B' AND LNAME='Smith'

Similar to a SELECT-PROJECT pair of relational algebra operations: The SELECT-clause specifies the projection attributes and the WHERE-clause specifies the selection condition However, the result of the query may contain duplicate tuples



EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPT_LOCATIONS

DNUMBER	DLOCATION
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

WORKS_ON

ESSN	PNO	HOURS
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	null

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
333445555	Alice	F	1986-04-05	DAUGHTER
333445555	Theodore	M	1983-10-25	SON
333445555	Joy	F	1958-05-03	SPOUSE
987654321	Abner	M	1942-02-28	SPOUSE
123456789	Michael	M	1988-01-04	SON
123456789	Alice	F	1988-12-30	DAUGHTER
123456789	Elizabeth	F	1967-05-05	SPOUSE

Example of a simple query on two relations

Query 1: Retrieve the name and address of all employees who work for the 'Research' department.

Q1: SELECT FNAME, LNAME, ADDRESS FROM EMPLOYEE, DEPARTMENT WHERE DNAME='Research' AND DNUMBER=DNO

Similar to a SELECT-PROJECT-JOIN sequence of relational algebra operations (DNAME='Research') is a selection condition (corresponds to a SELECT operation in relational algebra) (DNUMBER=DNO) is a join condition (corresponds to a JOIN operation in relational algebra)

Example of a simple query on three relations

Query 2: For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.

Q2: SELECT PNUMBER, DNUM, LNAME, BDATE, ADDRESS FROM PROJECT, DEPARTMENT, EMPLOYEE WHERE DNUM=DNUMBER AND MGRSSN=SSN AND PLOCATION='Stafford'

In Q2, there are two join conditions The join condition DNUM=DNUMBER relates a project to its controlling department The join condition MGRSSN=SSN relates the controlling department to the employee who manages that department

ALIASES, * AND DISTINCT, EMPTY WHERE-CLAUSE

- In SQL, we can use the same name for two (or more) attributes as long as the attributes are in different relations
- A query that refers to two or more attributes with the same name must qualify the attribute name with the relation name by prefixing the relation name to the attribute name

  Example: EMPLOYEE.LNAME, DEPARTMENT.DNAME
- Some queries need to refer to the same relation twice. In this case, aliases are given to the relation name

Example

Query 3: For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.

Q3: SELECT E.FNAME, E.LNAME, S.FNAME, S.LNAME FROM EMPLOYEE E S WHERE E.SUPERSSN=S.SSN

In Q3, the alternate relation names E and S are called aliases or tuple variables for the EMPLOYEE relation We can think of E and S as two different copies of EMPLOYEE; E represents employees in role of supervisees and S represents employees in role of supervisors

Aliasing can also be used in any SQL query for convenience. Can also use the AS keyword to specify aliases

Q3: SELECT E.FNAME, E.LNAME, S.FNAME, S.LNAME FROM EMPLOYEE AS E, EMPLOYEE AS S WHERE E.SUPERSSN=S.SSN

UNSPECIFIED WHERE-clause

A missing WHERE-clause indicates no condition; hence, all tuples of the relations in the FROM-clause are selected. This is equivalent to the condition WHERE TRUE

Example:

Query 4: Retrieve the SSN values for all employees.

Q4: SELECT SSN FROM EMPLOYEE

If more than one relation is specified in the FROM-clause and there is no join condition, then the CARTESIAN PRODUCT of tuples is selected

Example:

Q5: SELECT SSN, DNAME FROM EMPLOYEE, DEPARTMENT

Note: It is extremely important not to overlook specifying any selection and join conditions in the WHERE-clause; otherwise, incorrect and very large relations may result

USE OF *

To retrieve all the attribute values of the selected tuples, a * is used, which stands for all the attributes

Examples:

R**etrieve all the attribute values of EMPLOYEES who work in department 5.**

Q1a: SELECT * FROM EMPLOYEE WHERE DNO=5

Retrieve all the attributes of an employee and attributes of DEPARTMENT he works in for every employee of 'Research' department.

Q1b: SELECT * FROM EMPLOYEE, DEPARTMENT WHERE DNAME='Research' AND DNO=DNUMBER

USE OF DISTINCT

SQL does not treat a relation as a set; duplicate tuples can appear. To eliminate duplicate tuples in a query result, the keyword DISTINCT is used

Example: the result of **Q1c** may have duplicate SALARY values whereas **Q1d** does not have any duplicate values

Q1c: SELECT SALARY FROM EMPLOYEE Q1d: SELECT **DISTINCT** SALARY FROM EMPLOYEE

SET OPERATIONS

SQL has directly incorporated some set operations such as union operation (UNION), set difference (MINUS) and intersection (INTERSECT) operations. The resulting relations of these set operations are sets of tuples; duplicate tuples are eliminated from the result. The set operations apply only to union compatible relations; the two relations must have the same attributes and the attributes must appear in the same order

Query 5: Make a list of all project numbers for projects that involve an employee whose last name is 'Smith' as a worker or as a manager of the department that controls the project.

Q5: (SELECT PNAME FROM PROJECT, DEPARTMENT, EMPLOYEE WHERE DNUM=DNUMBER AND MGRSSN=SSN AND LNAME='Smith')

UNION

(SELECT PNAME FROM PROJECT, WORKS_ON, EMPLOYEE WHERE PNUMBER=PNO AND ESSN=SSN AND NAME='Smith')

NESTING OF QUERIES

A complete SELECT query, called a nested query, can be specified within the WHERE-clause of another query, called the outer query. Many of the previous queries can be specified in an alternative form using nesting

Query 6: Retrieve the name and address of all employees who work for the 'Research' department.

Q6: SELECT FNAME, LNAME, ADDRESS FROM EMPLOYEE WHERE DNO **IN** (SELECT DNUMBER FROM DEPARTMENT WHERE DNAME='Research')

Note: The nested query selects the number of the 'Research' department. The outer query selects an EMPLOYEE tuple if its DNO value is in the result of either nested query. The comparison operator IN compares a value v with a set (or multi-set) of values V, and evaluates to TRUE if v is one of the elements in V

In general, we can have several levels of nested queries. A reference to an unqualified attribute refers to the relation declared in the innermost nested query. In this example, the nested query is not correlated with the outer query

CORRELATED NESTED QUERIES

If a condition in the WHERE-clause of a nested query references an attribute of a relation declared in the outer query, the two queries are said to be correlated. The result of a correlated nested query is different for each tuple (or combination of tuples) of the relation(s) the outer query

Query 7: Retrieve the name of each employee who has a dependent with the same first name as the employee.

Q7: SELECT E.FNAME, E.LNAME FROM EMPLOYEE AS E WHERE E.SSN **IN** (SELECT ESSN FROM DEPENDENT WHERE ESSN=E.SSN AND E.FNAME=DEPENDENT_NAME)

In Q7, the nested query has a different result in the outer query. A query written with nested SELECT... FROM… WHERE... blocks and using the **= or IN** comparison operators can *always* be expressed as a single block query. For example, Q7 may be written as in Q7a

Q7a: SELECT E.FNAME, E.LNAME FROM EMPLOYEE E, DEPENDENT D WHERE E.SSN=D.ESSN AND E.FNAME=D.DEPENDENT_NAME

THE EXISTS FUNCTION

EXISTS is used to check whether the result of a correlated nested query is empty (contains no tuples) or not. We can formulate Query 7 in an alternative form that uses EXIST.

Q7b: SELECT FNAME, LNAME FROM EMPLOYEE
WHERE **EXISTS** (SELECT * FROM DEPENDENT WHERE SSN=ESSN
AND FNAME=DEPENDENT_NAME)

Query 8: Retrieve the names of employees who have no dependents.

Q8: SELECT FNAME, LNAME FROM EMPLOYEE
WHERE **NOT EXISTS**
(SELECT * FROM DEPENDENT WHERE SSN=ESSN)

Note: In Q8, the correlated nested query retrieves all DEPENDENT tuples related to an EMPLOYEE tuple. If none exist, the EMPLOYEE tuple is selected

EXPLICIT SETS

It is also possible to use an explicit (enumerated) set of values in the WHERE-clause rather than a nested query

Query 9: Retrieve the social security numbers of all employees who work on project number 1, 2, or 3.

Q9: SELECT DISTINCT ESSN FROM WORKS_ON WHERE PNO **IN (1, 2, 3)**

NULLS IN SQL QUERIES

SQL allows queries that check if a value is NULL (missing or undefined or not applicable). SQL uses IS or IS NOT to compare NULLs because it considers each NULL value distinct from other NULL values, so equality comparison is not appropriate.

Query 10: Retrieve the names of all employees who do not have supervisors.

Q10: SELECT FNAME, LNAME FROM EMPLOYEE
WHERE SUPERSSN IS NULL

Note: If a join condition is specified, tuples with NULL values for the join attributes are not included in the result

AGGREGATE FUNCTIONS

Include COUNT, SUM, MAX, MIN, and AVG

Query 11: Find the maximum salary, the minimum salary, and the average salary among all employees.

Q11: SELECT **MAX (SALARY), MIN(SALARY), AVG(SALARY)**
FROM EMPLOYEE

Note: Some SQL implementations may not allow more than one function in the SELECT-clause

Query 12: Find the maximum salary, the minimum salary, and the average salary among employees who work for the 'Research' department.

Q12: SELECT **MAX (SALARY), MIN(SALARY), AVG(SALARY)** FROM EMPLOYEE, DEPARTMENT WHERE DNO=DNUMBER AND DNAME='Research'

Queries 13 and 14: Retrieve the total number of employees in the company (Q13), and the number of employees in the 'Research' department (Q14).

Q13: SELECT **COUNT (*)** FROM EMPLOYEE

Q14: SELECT **COUNT (*)** FROM EMPLOYEE, DEPARTMENT

WHERE DNO=DNUMBER AND DNAME='Research'

GROUPING

- In many cases, we want to apply the aggregate functions to subgroups of tuples in a relation
- Each subgroup of tuples consists of the set of tuples that have the same value for the grouping attribute(s)
- The function is applied to each subgroup independently
- SQL has a GROUP BY-clause for specifying the grouping attributes, which must also appear in the SELECT-clause

Query 15: For each department, retrieve the department number, the number of employees in the department, and their average salary.

Q15: SELECT DNO, COUNT (*), AVG (SALARY)
FROM EMPLOYEE **GROUP BY** DNO

- In Q15, the EMPLOYEE tuples are divided into groups. Each group having the same value for the grouping attribute DNO
- The COUNT and AVG functions are applied to each such group of tuples separately
- The SELECT-clause includes only the grouping attribute and the functions to be applied on each group of tuples
- A join condition can be used in conjunction with grouping

Query 16: For each project, retrieve the project number, project name, and the number of employees who work on that project.

Q16: SELECT PNUMBER, PNAME, COUNT (*)
FROM PROJECT, WORKS_ON
WHERE PNUMBER=PNO
GROUP BY PNUMBER, PNAME

THE HAVING-CLAUSE

Sometimes we want to retrieve the values of these functions for only those groups that satisfy certain conditions. The HAVING-clause is used for specifying a selection condition on groups (rather than on individual tuples)

Query 17: For each project on which more than two employees work, retrieve the project number, project name, and the number of employees who work on that project.

```
Q17: SELECT PNUMBER, PNAME, COUNT (*)
FROM PROJECT, WORKS_ON
WHERE PNUMBER=PNO
GROUP BY PNUMBER, PNAME
HAVING COUNT (*) > 2
```

SUBSTRING COMPARISON

The LIKE comparison operator is used to compare partial strings. Two reserved characters are used: **'%'** (or '*' in some implementations) replaces an arbitrary number of characters, and **'_'** replaces a single arbitrary character.

Query 18: Retrieve all employees whose address is in Houston, Texas. Here, the value of the ADDRESS attribute must contain the substring 'Houston,TX‘ in it.

```
Q18: SELECT FNAME, LNAME
FROM EMPLOYEE WHERE ADDRESS LIKE '%Houston,TX%'
```

Query 19: Retrieve all employees who were born during the 1950s.

Here, '5' must be the 8th character of the string (according to our format for date), so the BDATE value is '_____5_', with each underscore as a place holder for a single arbitrary character.

```
Q19: SELECT FNAME, LNAME
FROM EMPLOYEE WHERE BDATE LIKE '_____5_’
```

Note: The LIKE operator allows us to get around the fact that each value is considered atomic and indivisible. Hence, in SQL, character string attribute values are not atomic

ARITHMETIC OPERATIONS

The standard arithmetic operators '+', '-'. '*', and '/' (for addition, subtraction, multiplication, and division, respectively) can be applied to numeric values in an SQL query result

Query 20: Show the effect of giving all employees who work on the 'ProductX' project a 10% raise.

```
Q20: SELECT FNAME, LNAME, 1.1*SALARY
FROM EMPLOYEE, WORKS_ON, PROJECT
WHERE SSN=ESSN
AND PNO=PNUMBER AND PNAME='ProductX'
```

ORDER BY

The ORDER BY clause is used to sort the tuples in a query result based on the values of some attribute(s)

Query 21: Retrieve a list of employees and the projects each works in, ordered by the employee's department, and within each department ordered alphabetically by employee last name.

```
Q21: SELECT DNAME, LNAME, FNAME, PNAME
FROM DEPARTMENT, EMPLOYEE, WORKS_ON, PROJECT
WHERE DNUMBER=DNO
AND SSN=ESSN
AND PNO=PNUMBER
ORDER BY DNAME, LNAME
```

The default order is in ascending order of values. We can specify the keyword DESC if we want a descending order; the keyword ASC can be used to explicitly specify ascending order, even though it is the default

Ex: ORDER BY DNAME **DESC**, LNAME **ASC**, FNAME **ASC**

MORE EXAMPLE QUERIES:

Query 22: Retrieve the names of all employees who have two or more dependents.

```
Q22: SELECT LNAME, FNAME FROM
EMPLOYEE
WHERE (SELECT COUNT (*) FROM DEPENDENT
        WHERE SSN=ESSN) ≥ 2);
```

Query 23: List the names of managers who have least one dependent.

```
Q23: SELECT FNAME, LNAME
     FROM EMPLOYEE
 WHERE EXISTS (SELECT * FROM DEPENDENT WHERE SSN=ESSN)
AND EXISTS ( SELECT * FROM DEPARTMENT WHERE SSN=MGRSSN );
```

SPECIFYING UPDATES IN SQL

There are three SQL commands to modify the database: **INSERT**, **DELETE**, and **UPDATE.**

INSERT

- In its simplest form, it is used to add one or more tuples to a relation
- Attribute values should be listed in the same order as the attributes were specified in the **CREATE TABLE** command

Example:

INSERT INTO EMPLOYEE VALUES ('Richard','K','Marini', '653298653', '30-DEC-52', '98 Oak Forest,Katy,TX', 'M', 37000,'987654321', 4)

- An alternate form of INSERT specifies explicitly the attribute names that correspond to the values in the new tuple. Attributes with NULL values can be left out

Example: Insert a tuple for a new EMPLOYEE for whom we only know the FNAME, LNAME, and SSN attributes.

INSERT INTO EMPLOYEE (FNAME, LNAME, SSN)VALUES ('Richard', 'Marini', '653298653')

Important Note: Only the constraints specified in the DDL commands are automatically enforced by the DBMS when updates are applied to the database. Another variation of INSERT allows insertion of multiple tuples resulting from a **query** into a relation

Example: Suppose we want to create a temporary table that has the name, number of employees, and total salaries for each department. A table DEPTS_INFO is created first, and is loaded with the summary information retrieved from the database by the query.

```
CREATE TABLE DEPTS_INFO
 (DEPT_NAME VARCHAR (10),
 NO_OF_EMPS INTEGER, TOTAL_SAL INTEGER);
```

```
INSERT INTO DEPTS_INFO (DEPT_NAME, NO_OF_EMPS, TOTAL_SAL)
SELECT DNAME, COUNT (*), SUM (SALARY) FROM DEPARTMENT,
EMPLOYEE WHERE DNUMBER=DNO GROUP BY DNAME ;
```

Note: The DEPTS_INFO table may not be up-to-date if we change the tuples in either the DEPARTMENT or the EMPLOYEE relations *after* issuing the above. We have to create a view (see later) to keep such a table up to date.

DELETE

- Removes tuples from a relation. Includes a WHERE-clause to select the tuples to be deleted
- Referential integrity should be enforced

- Tuples are deleted from only *one table* at a time (unless CASCADE is specified on a referential integrity constraint)
- A missing WHERE-clause specifies that *all tuples* in the relation are to be deleted; the table then becomes an empty table
- The number of tuples deleted depends on the number of tuples in the relation that satisfy the WHERE-clause

Examples:

1: DELETE FROM EMPLOYEE WHERE LNAME='Brown';

2: DELETE FROM EMPLOYEE WHERE SSN='123456789';

3: DELETE FROM EMPLOYEE WHERE DNO IN (SELECT DNUMBER FROM DEPARTMENT WHERE DNAME='Research');

4: DELETE FROM EMPLOYEE;

UPDATE

- Used to modify attribute values of one or more selected tuples
- A WHERE-clause selects the tuples to be modified
- An additional SET-clause specifies the attributes to be modified and their new values
- Each command modifies tuples *in the same relation*
- Referential integrity should be enforced

Example1: Change the location and controlling department number of project number 10 to 'Bellaire' and 5, respectively.

```
UPDATE PROJECT
SET PLOCATION = 'Bellaire', DNUM = 5 WHERE PNUMBER=10;
```

Example2: Give all employees in the 'Research' department a 10% raise in salary.

```
UPDATE EMPLOYEE
SET SALARY = SALARY *1.1
WHERE DNO IN (SELECT DNUMBER FROM DEPARTMENT

WHERE DNAME='Research');
```

SQL TRIGGERS

- Objective: to monitor a database and take initiate action when a condition occurs
- Triggers are nothing but the procedures/functions that involve actions and fired/executed automatically whenever an event occurs such as an insert, delete, or update operation or pressing a button or when mouse button is clicked

VIEWS IN SQL

- A view is a single *virtual table* that is derived from other tables. The other tables could be base tables or previously defined view.
- Allows for limited update operations Since the table may not physically be stored
- Allows full query operations
- A convenience for expressing certain operations
- A view does not necessarily exist in physical form, which limits the possible update operations that can be applied to views.

PART – A

1. Consider the following schema for a Library Database:

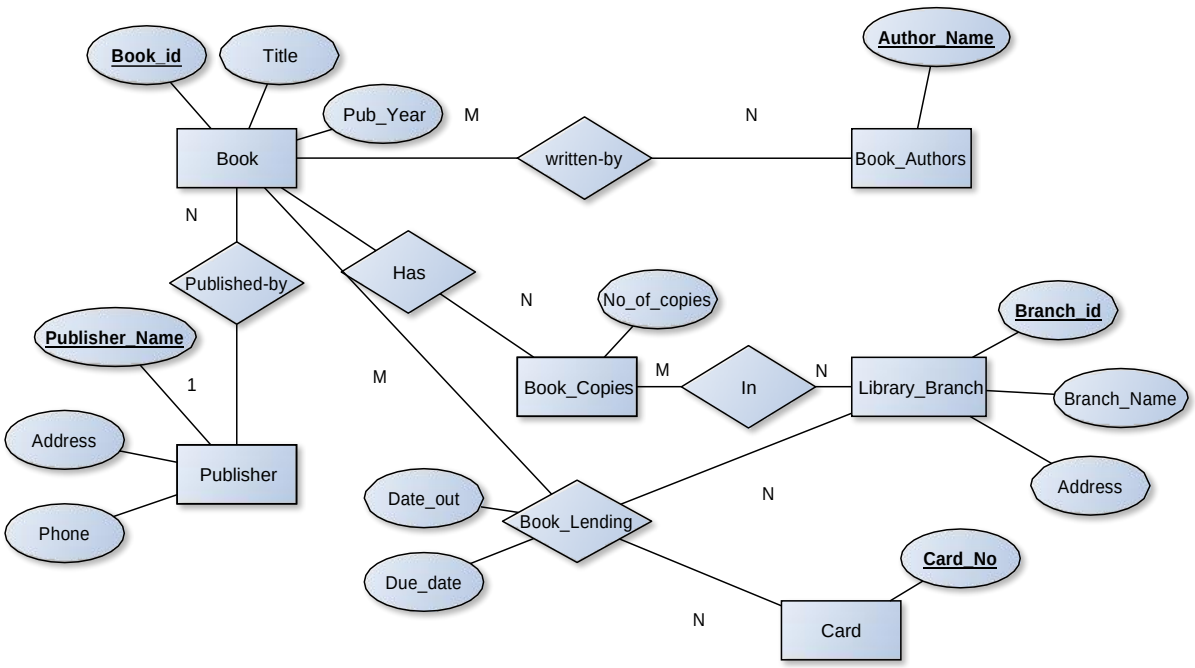
BOOK (*Book_id, Title, Publisher_Name, Pub_Year*)
BOOK_AUTHORS (Book_id, Author_*Name*)
PUBLISHER (*Name, Address, Phone*)
BOOK_COPIES (*Book_id, Branch_id, No-of_Copies*)
BOOK_LENDING (*Book_id, Branch_id, Card_No, Date_Out, Due_Date*)
LIBRARY_BRANCH (*Branch_id, Branch_Name, Address*)

Write SQL queries to

1. **Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.**
2. **Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017**
3. **Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.**
4. **Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.**
5. **Create a view of all books and its number of copies that are currently available in the Library.**

Solution:

Entity-Relationship Diagram



Schema Diagram

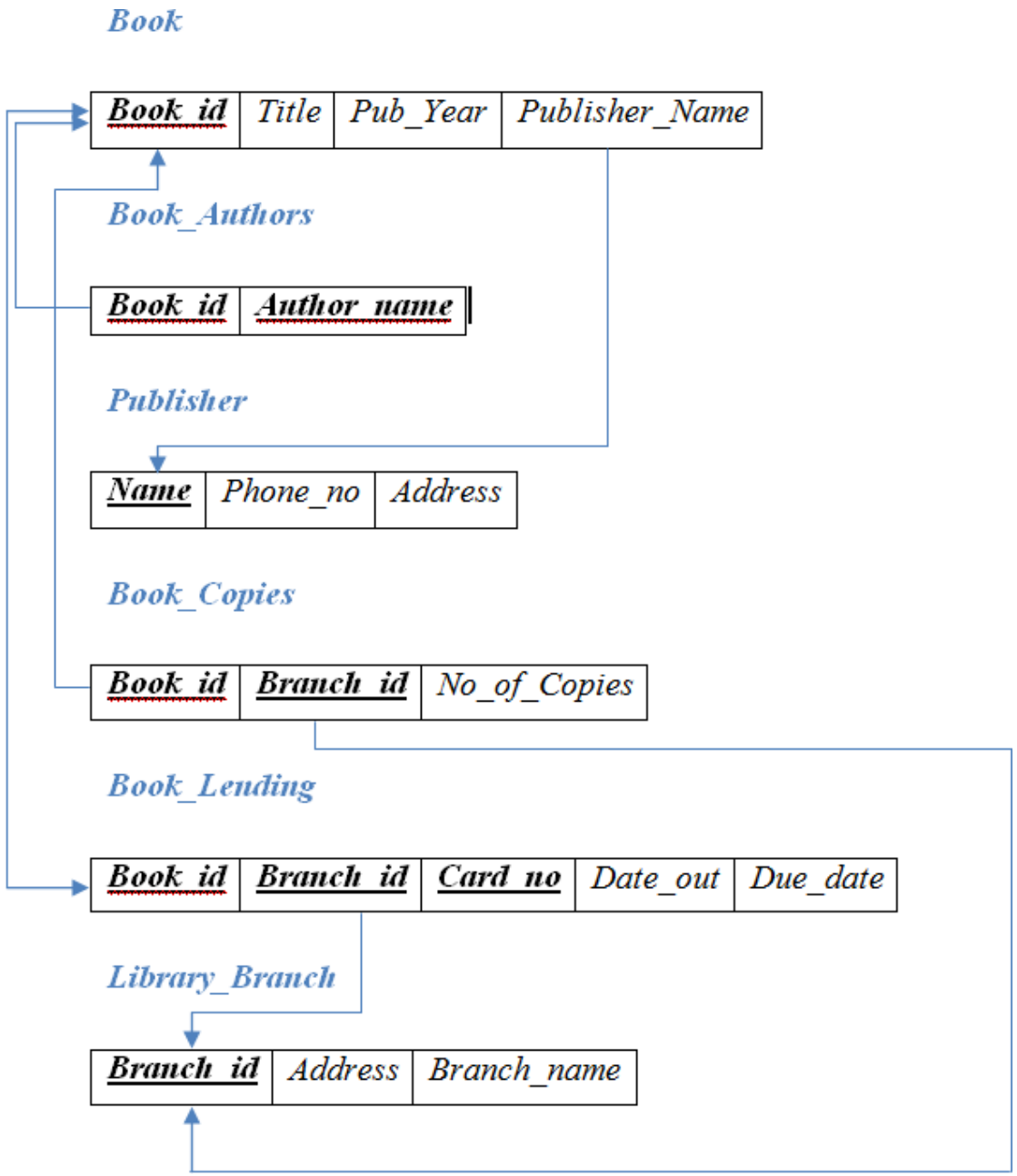


Table Creation

CREATE TABLE PUBLISHER

(NAME VARCHAR2 (20) PRIMARY KEY,

PHONE INTEGER,

ADDRESS VARCHAR2 (20));

```
CREATE TABLE BOOK

(BOOK_ID INTEGER PRIMARY KEY,

TITLE VARCHAR2 (20),

PUB_YEAR VARCHAR2 (20),

PUBLISHER_NAME REFERENCES PUBLISHER (NAME) ON DELETE CASCADE);

CREATE TABLE BOOK_AUTHORS

(AUTHOR_NAME VARCHAR2 (20),

BOOK_ID REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE,

PRIMARY KEY (BOOK_ID, AUTHOR_NAME));


CREATE TABLE LIBRARY_BRANCH

(BRANCH_ID INTEGER PRIMARY KEY,

BRANCH_NAME VARCHAR2 (50),

ADDRESS VARCHAR2 (50));


CREATE TABLE BOOK_COPIES

(NO_OF_COPIES INTEGER,

BOOK_ID REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE,

BRANCH_ID REFERENCES LIBRARY_BRANCH (BRANCH_ID) ON DELETE
CASCADE,

PRIMARY KEY (BOOK_ID, BRANCH_ID));


CREATE TABLE CARD

(CARD_NO INTEGER PRIMARY KEY);
```

CREATE TABLE BOOK_LENDING

(DATE_OUT DATE,

DUE_DATE DATE,

BOOK_ID REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE,

BRANCH_ID REFERENCES LIBRARY_BRANCH (BRANCH_ID) ON DELETE CASCADE,

CARD_NO REFERENCES CARD (CARD_NO) ON DELETE CASCADE,

PRIMARY KEY (BOOK_ID, BRANCH_ID, CARD_NO));

Table Descriptions

DESC PUBLISHER;

```
SQL> desc publisher;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 NAME                                      NOT NULL VARCHAR2(20)
 PHONE                                              NUMBER(38)
 ADDRESS                                            VARCHAR2(20)
```

DESC BOOK;

```
SQL> DESC BOOK;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 BOOK_ID                                   NOT NULL NUMBER(38)
 TITLE                                              VARCHAR2(20)
 PUB_YEAR                                           VARCHAR2(20)
 PUBLISHER_NAME                                     VARCHAR2(20)
```

DESC BOOK_AUTHORS;

```
SQL> DESC BOOK_AUTHORS;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 AUTHOR_NAME                               NOT NULL VARCHAR2(20)
 BOOK_ID                                   NOT NULL NUMBER(38)
```

DESC LIBRARY_BRANCH;

```
SQL> DESC LIBRARY_BRANCH;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 BRANCH_ID                                 NOT NULL NUMBER(38)
 BRANCH_NAME                                        VARCHAR2(50)
 ADDRESS                                            VARCHAR2(50)
```

DESC BOOK_COPIES;

```
SQL> DESC BOOK_COPIES;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 NO_OF_COPIES                                       NUMBER(38)
 BOOK_ID                                   NOT NULL NUMBER(38)
 BRANCH_ID                                 NOT NULL NUMBER(38)
```

DESC CARD;

```
SQL> DESC CARD;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 CARD_NO                                   NOT NULL NUMBER(38)
```

DESC BOOK_LENDING;

```
SQL> desc book_lending;
 Name
 ----------------------------------------------------------------------------------------------------
 DATE_OUT
 DUE_DATE
 BOOK_ID
 BRANCH_ID
 CARD_NO
```

Insertion of Values to Tables

INSERT INTO PUBLISHER VALUES (‘MCGRAW-HILL’, 9989076587, ‘BANGALORE’);

INSERT INTO PUBLISHER VALUES (‘PEARSON’, 9889076565, ‘NEWDELHI’);

INSERT INTO PUBLISHER VALUES (‘RANDOM HOUSE’, 7455679345, ‘HYDRABAD’);

INSERT INTO PUBLISHER VALUES (‘HACHETTE LIVRE’, 8970862340, ‘CHENAI’);

```
INSERT INTO PUBLISHER VALUES (‘GRUPO PLANETA’, 7756120238, ‘BANGALORE’);


INSERT INTO BOOK VALUES (1,’DBMS’,’JAN-2017’, ‘MCGRAW-HILL’);

INSERT INTO BOOK VALUES (2,’ADBMS’,’JUN-2016’, ‘MCGRAW-HILL’);

INSERT INTO BOOK VALUES (3,’CN’,’SEP-2016’, ‘PEARSON’);

INSERT INTO BOOK VALUES (4,’CG’,’SEP-2015’, ‘GRUPO PLANETA’);

INSERT INTO BOOK VALUES (5,’OS’,’MAY-2016’, ‘PEARSON’);


INSERT INTO BOOK_AUTHORS VALUES (’NAVATHE’, 1);

INSERT INTO BOOK_AUTHORS VALUES (’NAVATHE’, 2);

INSERT INTO BOOK_AUTHORS VALUES (’TANENBAUM’, 3);

INSERT INTO BOOK_AUTHORS VALUES (’EDWARD ANGEL’, 4);

INSERT INTO BOOK_AUTHORS VALUES (’GALVIN’, 5);


INSERT INTO LIBRARY_BRANCH VALUES (10,’RR NAGAR’,’BANGALORE’);

INSERT INTO LIBRARY_BRANCH VALUES (11,’RNSIT’,’BANGALORE’);

INSERT INTO LIBRARY_BRANCH VALUES (12,’RAJAJI NAGAR’, ’BANGALORE’);

INSERT INTO LIBRARY_BRANCH VALUES (13,’NITTE’,’MANGALORE’);

INSERT INTO LIBRARY_BRANCH VALUES (14,’MANIPAL’,’UDUPI’);


INSERT INTO BOOK_COPIES VALUES (10, 1, 10);

INSERT INTO BOOK_COPIES VALUES (5, 1, 11);

INSERT INTO BOOK_COPIES VALUES (2, 2, 12);

INSERT INTO BOOK_COPIES VALUES (5, 2, 13);
```

INSERT INTO BOOK_COPIES VALUES (7, 3, 14);

INSERT INTO BOOK_COPIES VALUES (1, 5, 10);

INSERT INTO BOOK_COPIES VALUES (3, 4, 11);

INSERT INTO CARD VALUES (100);

INSERT INTO CARD VALUES (101);

INSERT INTO CARD VALUES (102);

INSERT INTO CARD VALUES (103);

INSERT INTO CARD VALUES (104);

INSERT INTO BOOK_LENDING VALUES ('01-JAN-17','01-JUN-17', 1, 10, 101);

INSERT INTO BOOK_LENDING VALUES ('11-JAN-17','11-MAR-17', 3, 14, 101);

INSERT INTO BOOK_LENDING VALUES ('21-FEB-17','21-APR-17', 2, 13, 101);

INSERT INTO BOOK_LENDING VALUES ('15-MAR-17','15-JUL-17', 4, 11, 101);

INSERT INTO BOOK_LENDING VALUES ('12-APR-17','12-MAY-17', 1, 11, 104);

SELECT * FROM PUBLISHER;

```
SQL> select * from publisher;

NAME                      PHONE ADDRESS
-------------------- ---------- --------------------
MCGRAW-HILL          9989076587 BANGALORE
PEARSON              9889076565 NEWDELHI
RANDOM HOUSE         7455679345 HYDRABAD
HACHETTE LIVRE       8970862340 CHENAI
GRUPO PLANETA        7756120238 BANGALORE
```

SELECT * FROM BOOK;

```
SQL> SELECT * FROM BOOK;

   BOOK_ID TITLE                PUB_YEAR             PUBLISHER_NAME
---------- -------------------- -------------------- --------------------
         1 DBMS                 JAN-2017             MCGRAW-HILL
         2 ADBMS                JUN-2016             MCGRAW-HILL
         3 CN                   SEP-2016             PEARSON
         4 CG                   SEP-2015             GRUPO PLANETA
         5 OS                   MAY-2016             PEARSON
```

SELECT * FROM BOOK_AUTHORS;

```
SQL> SELECT * FROM BOOK_AUTHORS;

AUTHOR_NAME             BOOK_ID
-------------------- ----------
NAVATHE                      1
NAVATHE                      2
TANENBAUM                    3
EDWARD ANGEL                 4
GALVIN                       5
```

SELECT * FROM LIBRARY_BRANCH;

```
SQL> SELECT * FROM LIBRARY_BRANCH;

 BRANCH_ID BRANCH_NAME                                        ADDRESS
---------- -------------------------------------------------- ------------------------------------
        10 RR NAGAR                                          BANGALORE
        11 RNSIT                                             BANGALORE
        12 RAJAJI NAGAR                                      BANGALORE
        13 NITTE                                             MANGALORE
        14 MANIPAL                                           UDUPI
```

SELECT * FROM BOOK_COPIES;

```
SQL> SELECT * FROM BOOK_COPIES;

NO_OF_COPIES    BOOK_ID  BRANCH_ID
------------ ---------- ----------
          10          1         10
           5          1         11
           2          2         12
           5          2         13
           7          3         14
           1          5         10
           3          4         11
```

SELECT * FROM CARD;

```
SQL> SELECT * FROM CARD;

   CARD_NO
----------
       100
       101
       102
       103
       104
```

SELECT * FROM BOOK_LENDING;

```
SQL> select * from book_lending;

DATE_OUT  DUE_DATE     BOOK_ID  BRANCH_ID    CARD_NO
--------- --------- ---------- ---------- ----------
01-JAN-17 01-JUN-17          1         10        101
11-JAN-17 11-MAR-17          3         14        101
21-FEB-17 21-APR-17          2         13        101
15-MAR-17 15-JUL-17          4         11        101
12-APR-17 12-MAY-17          1         11        104
```

Queries:

1. **Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.**

   SELECT B.BOOK_ID, B.TITLE, B.PUBLISHER_NAME, A.AUTHOR_NAME, C.NO_OF_COPIES, L.BRANCH_ID
   FROM BOOK B, BOOK_AUTHORS A, BOOK_COPIES C, LIBRARY_BRANCH L
   WHERE B.BOOK_ID=A.BOOK_ID
   AND B.BOOK_ID=C.BOOK_ID
   AND L.BRANCH_ID=C.BRANCH_ID;

BOOK_ID	TITLE	PUBLISHER_NAME	AUTHOR_NAME	NO_OF_COPIES	BRANCH_ID
1	DBMS	MCGRAW-HILL	NAVATHE	10	10
1	DBMS	MCGRAW-HILL	NAVATHE	5	11
2	ADBMS	MCGRAW-HILL	NAVATHE	2	12
2	ADBMS	MCGRAW-HILL	NAVATHE	5	13
3	CN	PEARSON	TANENBAUM	7	14
5	OS	PEARSON	GALVIN	1	10
4	CG	GRUPO PLANETA	EDWARD ANGEL	3	11

1. **Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.**

   SELECT CARD_NO
   FROM BOOK_LENDING
   WHERE DATE_OUT BETWEEN ’01-JAN-2017’ AND ’01-JUL-2017’

```
GROUP BY CARD_NO
HAVING COUNT (*)>3;
```

```
   CARD_NO
----------
       101
```

2. **Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.**

```
DELETE FROM BOOK
WHERE BOOK_ID=3;
```

```
SQL> DELETE FROM BOOK
  2  WHERE BOOK_ID=3;

1 row deleted.

SQL> SELECT * FROM BOOK;

   BOOK_ID TITLE                PUB_YEAR             PUBLISHER_NAME
---------- -------------------- -------------------- --------------------
         1 DBMS                 JAN-2017             MCGRAW-HILL
         2 ADBMS                JUN-2016             MCGRAW-HILL
         4 CG                   SEP-2015             GRUPO PLANETA
         5 OS                   MAY-2016             PEARSON
     .
```

3. **Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.**

```
CREATE VIEW V_PUBLICATION AS
SELECT PUB_YEAR
FROM BOOK;
```

```
PUB_YEAR
-------------
JAN-2017
JUN-2016
SEP-2016
SEP-2015
MAY-2016
```

4. **Create a view of all books and its number of copies that are currently available in the Library.**

```
CREATE VIEW V_BOOKS AS
SELECT B.BOOK_ID, B.TITLE, C.NO_OF_COPIES
FROM BOOK B, BOOK_COPIES C, LIBRARY_BRANCH L
WHERE B.BOOK_ID=C.BOOK_ID
AND C.BRANCH_ID=L.BRANCH_ID;
```

BOOK_ID	TITLE	NO_OF_COPIES
1	DBMS	10
1	DBMS	5
2	ADBMS	2
2	ADBMS	5
3	CN	7
5	OS	1
4	CG	3

2. Consider the following schema for Order Database:

SALESMAN (*Salesman_id, Name, City, Commission*)

CUSTOMER (*Customer_id, Cust_Name, City, Grade, Salesman_id*)

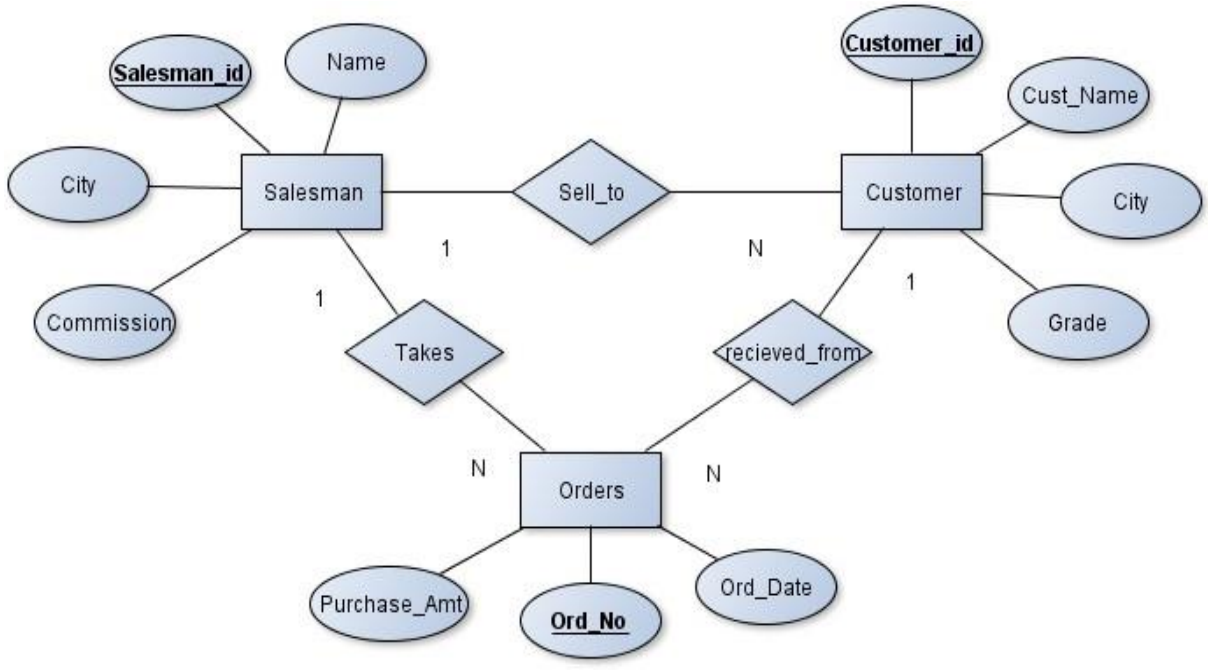
ORDERS (*Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id*)

Write SQL queries to

1. **Count the customers with grades above Bangalore's average.**
2. **Find the name and numbers of all salesmen who had more than one customer.**
3. **List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)**
4. **Create a view that finds the salesman who has the customer with the highest order of a day.**
5. **Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.**

Solution:

Entity-Relationship Diagram



Schema Diagram

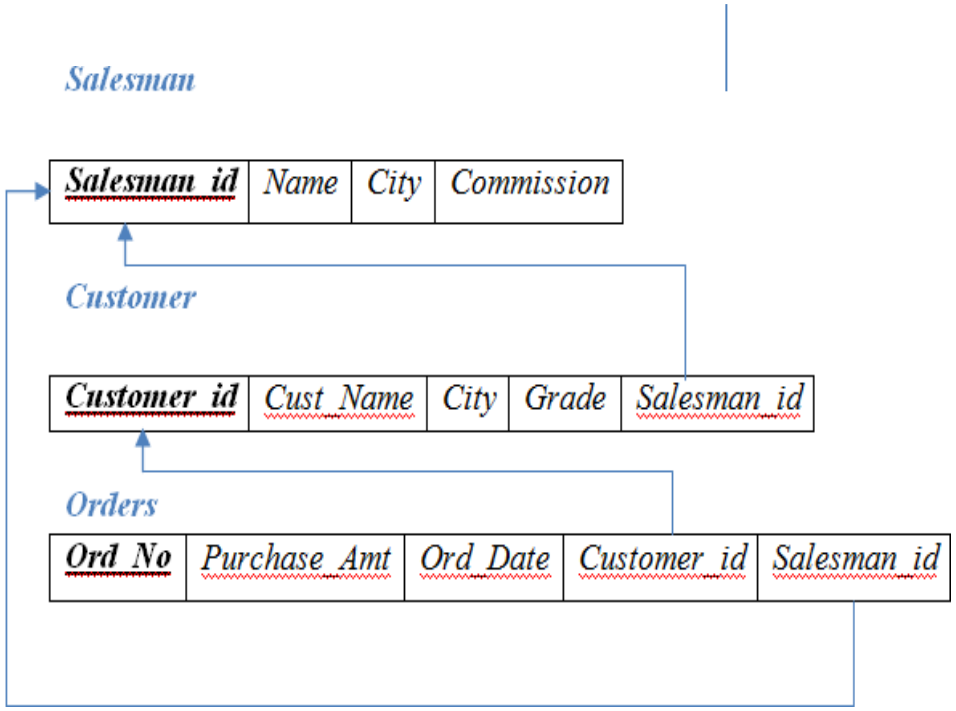


Table Creation

```
CREATE TABLE SALESMAN
(SALESMAN_ID NUMBER (4),
NAME VARCHAR2 (20),
CITY VARCHAR2 (20),
COMMISSION VARCHAR2 (20),
PRIMARY KEY        (SALESMAN_ID));

CREATE TABLE CUSTOMER1
(CUSTOMER_ID NUMBER (4),
CUST_NAME VARCHAR2 (20),
CITY VARCHAR2 (20),
GRADE NUMBER (3),
PRIMARY KEY (CUSTOMER_ID),
SALESMAN_ID REFERENCES SALESMAN (SALESMAN_ID) ON DELETE SET NULL);
```

```
CREATE TABLE ORDERS

(ORD_NO NUMBER (5),

 PURCHASE_AMT NUMBER (10, 2),

 ORD_DATE DATE,

 PRIMARY KEY (ORD_NO),

 CUSTOMER_ID REFERENCES CUSTOMER1 (CUSTOMER_ID) ON DELETE CASCADE,

 SALESMAN_ID REFERENCES SALESMAN (SALESMAN_ID) ON DELETE CASCADE);
```

Table Descriptions

DESC SALESMAN;

```
SQL> DESC SALESMAN;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 SALESMAN_ID                               NOT NULL NUMBER(4)
 NAME                                               VARCHAR2(15)
 CITY                                               VARCHAR2(15)
 COMMISSION                                         NUMBER(3,2)
```

DESC CUSTOMER;

```
SQL> DESC CUSTOMER1;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 CUSTOMER_ID                               NOT NULL NUMBER(4)
 CUST_NAME                                          VARCHAR2(15)
 CITY                                               VARCHAR2(15)
 GRADE                                              NUMBER(3)
 SALESMAN_ID                                        NUMBER(4)
```

DESC ORDERS;

```
SQL> DESC ORDERS;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ORD_NO                                    NOT NULL NUMBER(5)
 PURCHASE_AMT                                       NUMBER(10,2)
 ORD_DATE                                           DATE
 CUSTOMER_ID                                        NUMBER(4)
 SALESMAN_ID                                        NUMBER(4)
```

Insertion of Values to Tables

INSERT INTO SALESMAN VALUES (1000, 'JOHN','BANGALORE','25 %');

INSERT INTO SALESMAN VALUES (2000, 'RAVI','BANGALORE','20 %');

INSERT INTO SALESMAN VALUES (3000, 'KUMAR','MYSORE','15 %');

INSERT INTO SALESMAN VALUES (4000, 'SMITH','DELHI','30 %');

INSERT INTO SALESMAN VALUES (5000, 'HARSHA','HYDRABAD','15 %');

INSERT INTO CUSTOMER1 VALUES (10, 'PREETHI','BANGALORE', 100, 1000);

INSERT INTO CUSTOMER1 VALUES (11, 'VIVEK','MANGALORE', 300, 1000);

INSERT INTO CUSTOMER1 VALUES (12, 'BHASKAR','CHENNAI', 400, 2000);

INSERT INTO CUSTOMER1 VALUES (13, 'CHETHAN','BANGALORE', 200, 2000);

INSERT INTO CUSTOMER1 VALUES (14, 'MAMATHA','BANGALORE', 400, 3000);

INSERT INTO ORDERS VALUES (50, 5000, '04-MAY-17', 10, 1000);

INSERT INTO ORDERS VALUES (51, 450, '20-JAN-17', 10, 2000);

INSERT INTO ORDERS VALUES (52, 1000, '24-FEB-17', 13, 2000);

INSERT INTO ORDERS VALUES (53, 3500, '13-APR-17', 14, 3000);

INSERT INTO ORDERS VALUES (54, 550, '09-MAR-17', 12, 2000);

SELECT * FROM SALESMAN;

SALESMAN_ID	NAME	CITY	COMMISSION
1000	JOHN	BANGALORE	25 %
2000	RAVI	BANGALORE	20 %
3000	KUMAR	MYSORE	15 %
4000	SMITH	DELHI	30 %
5000	HARSHA	HYDRABAD	15 %

SELECT * FROM CUSTOMER1;

CUSTOMER_ID	CUST_NAME	CITY	GRADE	SALESMAN_ID
10	PREETHI	BANGALORE	100	1000
11	VIVEK	MANGALORE	300	1000
12	BHASKAR	CHENNAI	400	2000
13	CHETHAN	BANGALORE	200	2000
14	MAMATHA	BANGALORE	400	3000

SELECT * FROM ORDERS;

ORD_NO	PURCHASE_AMT	ORD_DATE	CUSTOMER_ID	SALESMAN_ID
50	5000	04-MAY-17	10	1000
51	450	20-JAN-17	10	2000
52	1000	24-FEB-17	13	2000
53	3500	13-APR-17	14	3000
54	550	09-MAR-17	12	2000

Queries:

1. **Count the customers with grades above Bangalore's average.**

```
SELECT GRADE, COUNT (DISTINCT CUSTOMER_ID)
FROM CUSTOMER1
GROUP BY GRADE
HAVING GRADE > (SELECT AVG(GRADE)
FROM CUSTOMER1
WHERE CITY='BANGALORE');
```

GRADE	COUNT(DISTINCTCUSTOMER_ID)
300	1
400	2

2. Find the name and numbers of all salesmen who had more than one customer.

```
SELECT SALESMAN_ID, NAME

 FROM SALESMAN A

 WHERE 1 < (SELECT COUNT (*)

        FROM CUSTOMER1

 WHERE SALESMAN_ID=A.SALESMAN_ID);
```

```
SALESMAN_ID NAME
----------- --------------------
       1000 JOHN
       2000 RAVI
```

3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)

```
SELECT SALESMAN.SALESMAN_ID, NAME, CUST_NAME, COMMISSION
FROM SALESMAN, CUSTOMER1
WHERE SALESMAN.CITY = CUSTOMER1.CITY
UNION
SELECT SALESMAN_ID, NAME, 'NO MATCH', COMMISSION
FROM SALESMAN
WHERE NOT CITY = ANY
 (SELECT CITY
  FROM CUSTOMER1)
ORDER BY 2 DESC;
```

```
SALESMAN_ID NAME                 CUST_NAME            COMMISSION
----------- -------------------- -------------------- --------------------
       4000 SMITH                NO MATCH             30 %
       2000 RAVI                 CHETHAN              20 %
       2000 RAVI                 MAMATHA              20 %
       2000 RAVI                 PREETHI              20 %
       3000 KUMAR                NO MATCH             15 %
       1000 JOHN                 CHETHAN              25 %
       1000 JOHN                 MAMATHA              25 %
       1000 JOHN                 PREETHI              25 %
       5000 HARSHA               NO MATCH             15 %
```

4. Create a view that finds the salesman who has the customer with the highest order of a day.

```
CREATE VIEW ELITSALESMANAS
SELECT B.ORD_DATE, A.SALESMAN_ID, A.NAME
FROM SALESMAN A, ORDERS B
WHERE A.SALESMAN_ID = B.SALESMAN_ID
```

```
AND B.PURCHASE_AMT=(SELECT MAX (PURCHASE_AMT)
                    FROM ORDERS C
                    WHERE C.ORD_DATE =
B.ORD_DATE);
```

```
ORD_DATE  SALESMAN_ID NAME
--------- ----------- --------------------
04-MAY-17        1000 JOHN
20-JAN-17        2000 RAVI
24-FEB-17        2000 RAVI
13-APR-17        3000 KUMAR
09-MAR-17        2000 RAVI
```

5. **Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.**

Use ON DELETE CASCADE at the end of foreign key definitions while creating child table orders and then execute the following:

Use ON DELETE SET NULL at the end of foreign key definitions while creating child table customers and then executes the following:

```
DELETE FROM SALESMAN
WHERE SALESMAN_ID=1000;
```

OR

We can also write the trigger, if not ON DELETE CASCADE;

```
CREATE TRIGGER 'DEL_SALESMAN' AFTER DELETE ON 'SALESMAN'
FOR EACH ROW
BEGIN
  DELETE FROM ORDERS WHERE SALESMAN_ID = OLD.SALESMAN_ID;
UPDATE CUSTOMER1 SET SALESMAN_ID=NULL WHERE SALESMAN_ID =
OLD.SALESMAN_ID;
END
```

```
SQL> DELETE FROM SALESMAN
  2  WHERE SALESMAN_ID=1000;

1 row deleted.

SQL> SELECT * FROM SALESMAN;

SALESMAN_ID NAME                 CITY                 COMMISSION
----------- -------------------- -------------------- ----------
       2000 RAVI                 BANGALORE            20 %
       3000 KUMAR                MYSORE               15 %
       4000 SMITH                DELHI                30 %
       5000 HARSHA               HYDRABAD             15 %
```

3. Consider the schema for Movie Database:

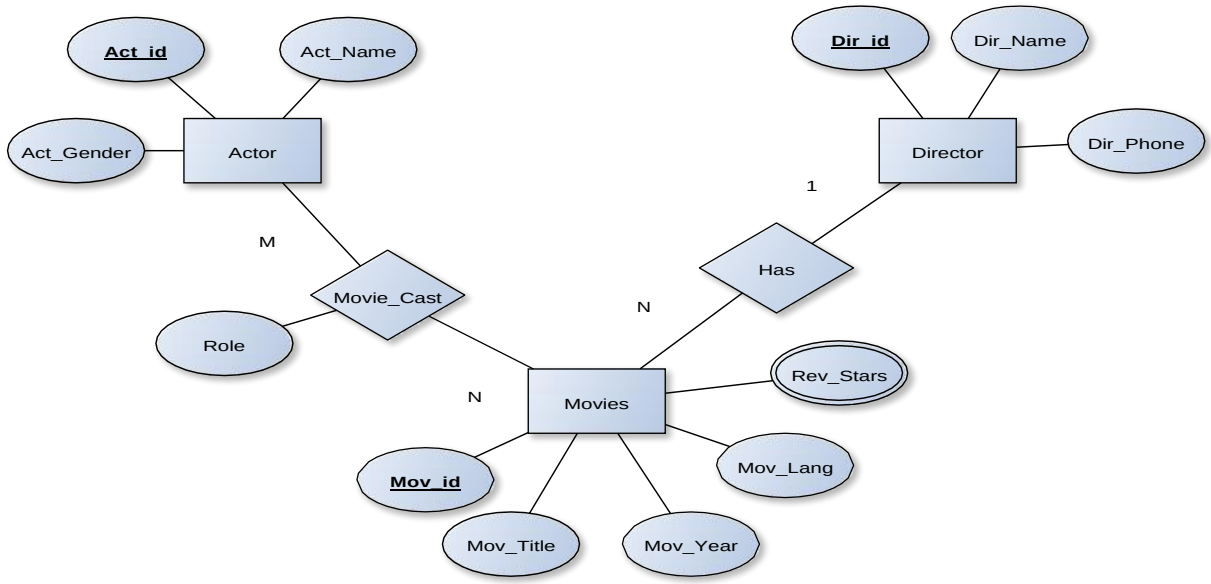
ACTOR (*Act_id, Act_Name, Act_Gender*)
DIRECTOR (*Dir_id, Dir_Name, Dir_Phone*)
MOVIES (*Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id*)
MOVIE_CAST (*Act_id, Mov_id, Role*)
RATING (*Mov_id, Rev_Stars*)

Write SQL queries to

1. **List the titles of all movies directed by 'Hitchcock'.**
2. **Find the movie names where one or more actors acted in two or more movies.**
3. **List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).**
4. **Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.**
5. **Update rating of all movies directed by 'Steven Spielberg' to 5.**

Solution:

Entity-Relationship Diagram



Schema Diagram

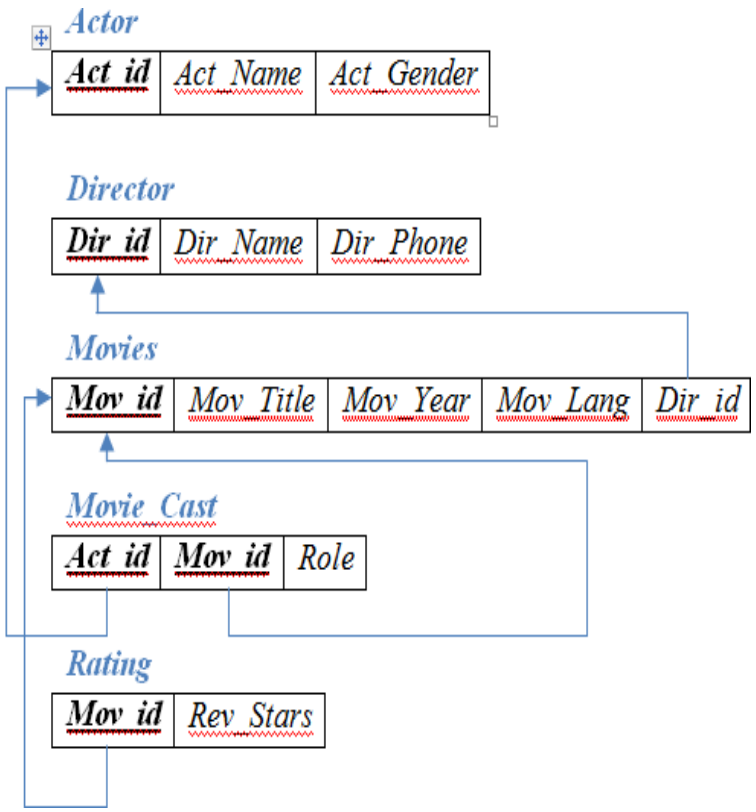


Table Creation

```
CREATE TABLE ACTOR (
ACT_ID NUMBER (3),
ACT_NAME VARCHAR (20),
ACT_GENDER CHAR (1),
PRIMARY KEY (ACT_ID));

CREATE TABLE DIRECTOR (
DIR_ID NUMBER (3),
DIR_NAME VARCHAR (20),
DIR_PHONE  NUMBER (10),
PRIMARY KEY (DIR_ID));

CREATE TABLE MOVIES (
MOV_ID NUMBER (4),
MOV_TITLE  VARCHAR (25),
MOV_YEAR  NUMBER (4),
MOV_LANG  VARCHAR (12),
DIR_ID NUMBER (3),
PRIMARY KEY (MOV_ID),
FOREIGN KEY (DIR_ID) REFERENCES DIRECTOR (DIR_ID));
CREATE TABLE MOVIE_CAST (
ACT_ID NUMBER (3),
```

MOV_ID NUMBER (4),
ROLE VARCHAR (10),
PRIMARY KEY (ACT_ID, MOV_ID),
FOREIGN KEY (ACT_ID) REFERENCES ACTOR (ACT_ID),
FOREIGN KEY (MOV_ID) REFERENCES MOVIES (MOV_ID));

CREATE TABLE RATING (
MOV_ID NUMBER (4),
REV_STARS VARCHAR (25),
PRIMARY KEY (MOV_ID),
FOREIGN KEY (MOV_ID) REFERENCES MOVIES (MOV_ID));

Table Descriptions

DESC ACTOR;

```
SQL> DESC ACTOR;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ACT_ID                                    NOT NULL NUMBER(3)
 ACT_NAME                                           VARCHAR2(20)
 ACT_GENDER                                         CHAR(1)
```

DESC DIRECTOR;

```
SQL> DESC DIRECTOR;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 DIR_ID                                    NOT NULL NUMBER(3)
 DIR_NAME                                           VARCHAR2(20)
 DIR_PHONE                                          NUMBER(10)
```

DESC MOVIES;

```
SQL> DESC MOVIES;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 MOV_ID                                    NOT NULL NUMBER(4)
 MOV_TITLE                                          VARCHAR2(25)
 MOV_YEAR                                           NUMBER(4)
 MOV_LANG                                           VARCHAR2(12)
 DIR_ID                                             NUMBER(3)
```

DESC MOVIE_CAST;

```
SQL> DESC MOVIE_CAST;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ACT_ID                                    NOT NULL NUMBER(3)
 MOV_ID                                    NOT NULL NUMBER(4)
 ROLE                                               VARCHAR2(10)
```

DESC RATING;

```
SQL> DESC RATING;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 MOV_ID                                    NOT NULL NUMBER(4)
 REV_STARS                                          VARCHAR2(25)
```

Insertion of Values to Tables

INSERT INTO ACTOR VALUES (301,'ANUSHKA','F');

INSERT INTO ACTOR VALUES (302,'PRABHAS','M');

INSERT INTO ACTOR VALUES (303,'PUNITH','M');

INSERT INTO ACTOR VALUES (304,'JERMY','M');

INSERT INTO DIRECTOR VALUES (60,'RAJAMOULI', 8751611001);

INSERT INTO DIRECTOR VALUES (61,'HITCHCOCK', 7766138911);

INSERT INTO DIRECTOR VALUES (62,'FARAN', 9986776531);

INSERT INTO DIRECTOR VALUES (63,'STEVEN SPIELBERG', 8989776530);

INSERT INTO MOVIES VALUES (1001,'BAHUBALI-2', 2017, 'TELAGU', 60);

INSERT INTO MOVIES VALUES (1002,'BAHUBALI-1', 2015, 'TELAGU', 60);

INSERT INTO MOVIES VALUES (1003,'AKASH', 2008, 'KANNADA', 61);

INSERT INTO MOVIES VALUES (1004,'WAR HORSE', 2011, 'ENGLISH', 63);

INSERT INTO MOVIE_CAST VALUES (301, 1002, 'HEROINE');

INSERT INTO MOVIE_CAST VALUES (301, 1001, 'HEROINE');

INSERT INTO MOVIE_CAST VALUES (303, 1003, 'HERO');

INSERT INTO MOVIE_CAST VALUES (303, 1002, 'GUEST');

INSERT INTO MOVIE_CAST VALUES (304, 1004, 'HERO');

INSERT INTO RATING VALUES (1001, 4);

INSERT INTO RATING VALUES (1002, 2);

INSERT INTO RATING VALUES (1003, 5);

INSERT INTO RATING VALUES (1004, 4);

SELECT * FROM ACTOR;

```
SQL> SELECT * FROM ACTOR;

    ACT_ID ACT_NAME             A
---------- -------------------- -
       301 ANUSHKA              F
       302 PRABHAS              M
       303 PUNITH               M
       304 JERMY                M
```

SELECT * FROM DIRECTOR;

```
SQL> SELECT * FROM DIRECTOR;

    DIR_ID DIR_NAME              DIR_PHONE
---------- -------------------- ----------
        60 RAJAMOULI            8751611001
        61 HITCHCOCK            7766138911
        62 FARAN                9986776531
        63 STEVEN SPIELBERG     8989776530
```

SELECT * FROM MOVIES;

```
SQL> SELECT * FROM MOVIES;

    MOV_ID MOV_TITLE                MOV_YEAR MOV_LANG         DIR_ID
---------- ------------------------ ---------- ------------ ----------
      1001 BAHUBALI-2                     2017 TELAGU               60
      1002 BAHUBALI-1                     2015 TELAGU               60
      1003 AKASH                          2008 KANNADA              61
      1004 WAR HORSE                      2011 ENGLISH              63
```

SELECT * FROM MOVIE_CAST;

```
SQL> SELECT * FROM MOVIE_CAST;

    ACT_ID     MOV_ID ROLE
---------- ---------- ----------
       301       1002 HEROINE
       301       1001 HEROINE
       303       1003 HERO
       303       1002 GUEST
       304       1004 HERO
```

SELECT * FROM RATING;

```
SQL> SELECT * FROM RATING;

    MOV_ID REV_STARS
---------- ------------------------
      1001 4
      1002 2
      1003 5
      1004 4
```

Queries:

1. **List the titles of all movies directed by 'Hitchcock'.**

```
SELECT MOV_TITLE
FROM MOVIES
WHERE DIR_ID IN (SELECT DIR_ID
                 FROM DIRECTOR
                 WHERE DIR_NAME = 'HITCHCOCK');
```

```
MOV_TITLE
------------------------
AKASH
```

2. **Find the movie names where one or more actors acted in two or more movies.**

```
SELECT MOV_TITLE
FROM MOVIES M, MOVIE_CAST MV
WHERE M.MOV_ID=MV.MOV_ID AND ACT_ID IN (SELECT ACT_ID
                                        FROM MOVIE_CAST GROUP BY ACT_ID
                                        HAVING COUNT (ACT_ID)>1)
GROUP BY MOV_TITLE
HAVING COUNT (*)>1;
```

```
MOV_TITLE
------------------------
BAHUBALI-1
```

3. **List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).**

```
SELECT ACT_NAME, MOV_TITLE, MOV_YEAR
FROM ACTOR A
JOIN MOVIE_CAST C
        ON A.ACT_ID=C.ACT_ID
JOIN MOVIES  M
        ON C.MOV_ID=M.MOV_ID
WHERE M.MOV_YEAR NOT BETWEEN 2000 AND 2015;

OR

SELECT A.ACT_NAME, A.ACT_NAME, C.MOV_TITLE, C.MOV_YEAR
FROM ACTOR A, MOVIE_CAST B, MOVIES C
WHERE A.ACT_ID=B.ACT_ID
AND B.MOV_ID=C.MOV_ID
AND C.MOV_YEAR NOT BETWEEN 2000 AND 2015;
```

ACT_NAME	MOV_TITLE	MOV_YEAR
ANUSHKA	BAHUBALI-2	2017

4. **Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.**

```
SELECT MOV_TITLE, MAX (REV_STARS)
FROM MOVIES
INNER JOIN RATING USING (MOV_ID)
GROUP BY MOV_TITLE
HAVING MAX (REV_STARS)>0
ORDER BY MOV_TITLE;
```

MOV_TITLE	MAX(REV_STARS)
AKASH	5
BAHUBALI-1	2
BAHUBALI-2	4
WAR HORSE	4

5. Update rating of all movies directed by 'Steven Spielberg' to 5

```
UPDATE RATING
SET REV_STARS=5
WHERE MOV_ID IN (SELECT MOV_ID FROM MOVIES
                 WHERE DIR_ID IN (SELECT DIR_ID
                                  FROM DIRECTOR
                                  WHERE DIR_NAME = 'STEVEN
                                  SPIELBERG'));
```

```
SQL> SELECT * FROM RATING;

    MOV_ID REV_STARS
---------- -----------
      1001 4
      1002 2
      1003 5
      1004 5
```

4. Consider the schema for College Database:

STUDENT (*USN, SName, Address, Phone, Gender*)

SEMSEC (*SSID, Sem, Sec*)

CLASS (*USN, SSID*)

SUBJECT (*Subcode, Title, Sem, Credits*)

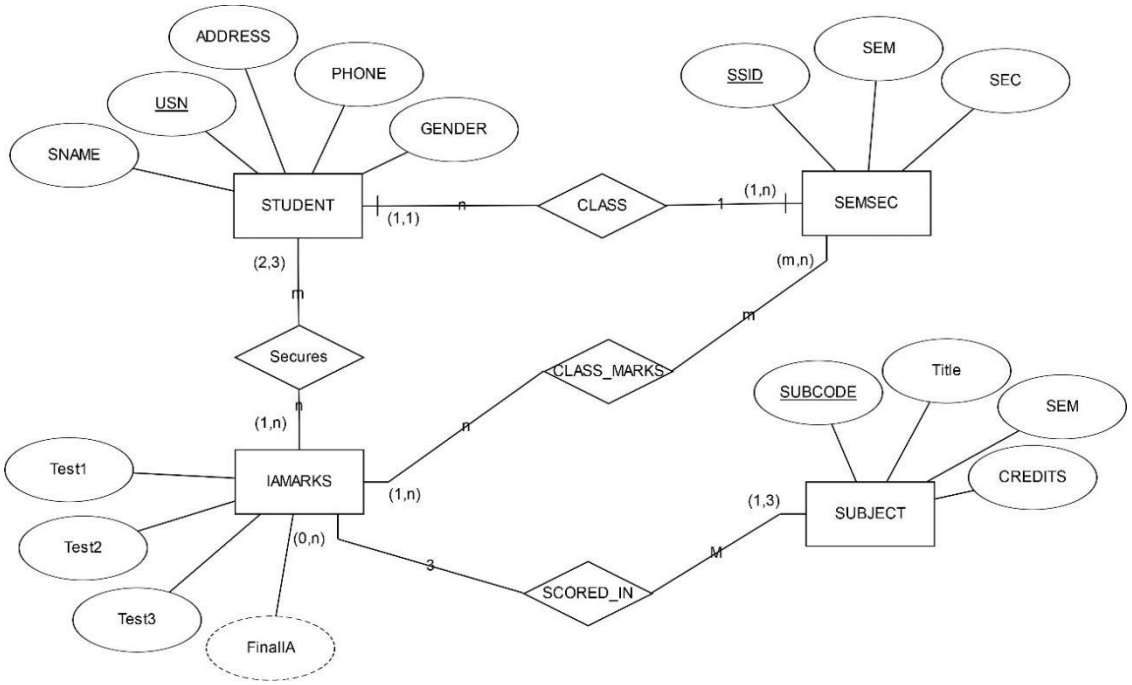
IAMARKS (*USN, Subcode, SSID, Test1, Test2, Test3, FinalIA*)

Write SQL queries to

1. **List all the student details studying in fourth semester 'C' section.**
2. **Compute the total number of male and female students in each semester and in each section.**
3. **Create a view of Test1 marks of student USN '1BI15CS101' in all subjects.**
4. **Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.**
5. **Categorize students based on the following criterion:**
   If FinalIA = 17 to 20 then CAT = 'Outstanding'
   If FinalIA = 12 to 16 then CAT = 'Average'
   If FinalIA< 12 then CAT = 'Weak'
   Give these details only for 8th semester A, B, and C section students.

Solution:

Entity - Relationship Diagram



Schema Diagram

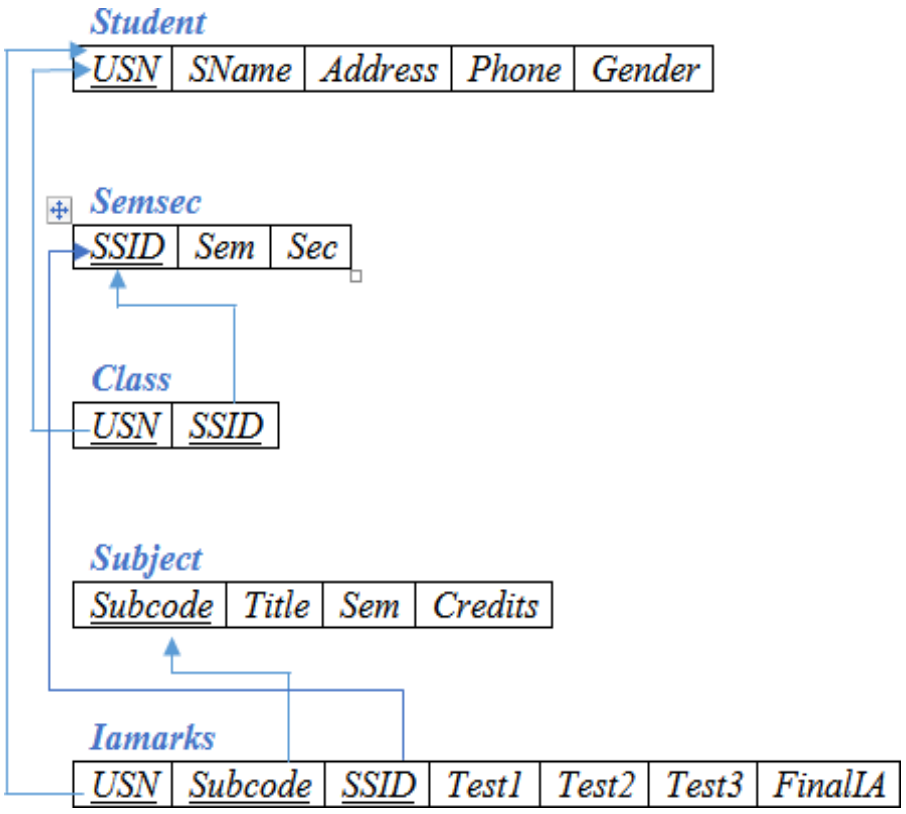


Table Creation

```
CREATE TABLE STUDENT (
 USN VARCHAR (10) PRIMARY KEY,
 SNAME VARCHAR (25),
 ADDRESS VARCHAR (25),
 PHONE NUMBER (10),
 GENDER CHAR (1));

CREATE TABLE SEMSEC (
SSID VARCHAR (5) PRIMARY KEY,
SEM NUMBER (2),
SEC CHAR (1));
```

```
CREATE TABLE CLASS (
USN VARCHAR (10),
SSID VARCHAR (5),
PRIMARY KEY (USN, SSID),
FOREIGN KEY (USN) REFERENCES STUDENT (USN),
FOREIGN KEY (SSID) REFERENCES SEMSEC (SSID));
CREATE TABLE SUBJECT (
SUBCODE VARCHAR (8),
TITLE VARCHAR (20),
SEM NUMBER (2),
CREDITS NUMBER (2),
PRIMARY KEY (SUBCODE));

 CREATE TABLE IAMARKS (
 USN VARCHAR (10),
 SUBCODE VARCHAR (8),
 SSID VARCHAR (5),
 TEST1 NUMBER (2),
 TEST2 NUMBER (2),
 TEST3 NUMBER (2),
 FINALIA NUMBER (2),
 PRIMARY KEY (USN, SUBCODE, SSID),
FOREIGN KEY (USN) REFERENCES STUDENT (USN),
```

FOREIGN KEY (SUBCODE) REFERENCES SUBJECT (SUBCODE),

FOREIGN KEY (SSID) REFERENCES SEMSEC (SSID));

Table Descriptions

DESC STUDENT;

```
Name
--------------------------------------------------------------------------------
USN
SNAME
ADDRESS
PHONE
GENDER
```

DESC SEMSEC;

```
SQL> DESC SEMSEC;
 Name
 ------------------------------------------------------------------------------
 SSID
 SEM
 SEC
```

DESC CLASS;

```
SQL> DESC CLASS;
 Name
 ----------------------------------------------
 USN
 SSID
```

DESC SUBJECT;

```
SQL> DESC SUBJECT1;
 Name
 ---------------------------------------
 SUBCODE
 TITLE
 SEM
 CREDITS
```

DESC IAMARKS;

```
SQL> DESC IAMARKS;
 Name
 ----------------------------------------------
 USN
 SUBCODE
 SSID
 TEST1
 TEST2
 TEST3
 FINALIA
```

Insertion of values to tables

INSERT INTO STUDENT VALUES ('1RN13CS020','AKSHAY','BELAGAVI', 8877881122,'M');

INSERT INTO STUDENT VALUES ('1RN13CS062','SANDHYA','BENGALURU', 7722829912,'F');

INSERT INTO STUDENT VALUES ('1RN13CS091','TEESHA','BENGALURU', 7712312312,'F');

INSERT INTO STUDENT VALUES ('1RN13CS066','SUPRIYA','MANGALURU', 8877881122,'F');

INSERT INTO STUDENTVALUES ('1RN14CS010','ABHAY','BENGALURU', 9900211201,'M');

INSERT INTO STUDENT VALUES ('1RN14CS032','BHASKAR','BENGALURU', 9923211099,'M');

INSERT INTO STUDENTVALUES ('1RN14CS025','ASMI','BENGALURU', 7894737377,'F');

INSERT INTO STUDENT VALUES ('1RN15CS011','AJAY','TUMKUR', 9845091341,'M');

INSERT INTO STUDENT VALUES ('1RN15CS029','CHITRA','DAVANGERE', 7696772121,'F');

INSERT INTO STUDENT VALUES ('1RN15CS045','JEEVA','BELLARY', 9944850121,'M');

INSERT INTO STUDENT VALUES ('1RN15CS091','SANTOSH','MANGALURU', 8812332201,'M');

INSERT INTO STUDENT VALUES ('1RN16CS045','ISMAIL','KALBURGI', 9900232201,'M');

INSERT INTO STUDENT VALUES ('1RN16CS088','SAMEERA','SHIMOGA', 9905542212,'F');

INSERT INTO STUDENT VALUES ('1RN16CS122','VINAYAKA','CHIKAMAGALUR', 8800880011,'M');

INSERT INTO SEMSEC VALUES ('CSE8A', 8,'A');

INSERT INTO SEMSEC VALUES (‘CSE8B', 8,'B');

```
INSERT INTO SEMSEC VALUES (‘CSE8C’, 8,’C’);

INSERT INTO SEMSEC VALUES ('CSE7A', 7,’A’);

INSERT INTO SEMSEC VALUES (‘CSE7B’, 7,'B’);

INSERT INTO SEMSEC VALUES ('CSE7C', 7,'C');

INSERT INTO SEMSEC VALUES (‘CSE6A', 6,'A');

INSERT INTO SEMSEC VALUES (‘CSE6B’, 6,’B’);

INSERT INTO SEMSEC VALUES ('CSE6C’, 6,’C’);

INSERT INTO SEMSEC VALUES (‘CSE5A’, 5,'A’);

INSERT INTO SEMSEC VALUES ('CSE5B', 5,'B');

INSERT INTO SEMSEC VALUES (‘CSE5C', 5,'C');

INSERT INTO SEMSEC VALUES (‘CSE4A’, 4,’A’);

INSERT INTO SEMSEC VALUES ('CSE4B', 4,’B’);

INSERT INTO SEMSEC VALUES (‘CSE4C’, 4,'C’);

INSERT INTO SEMSEC VALUES ('CSE3A', 3,'A');

INSERT INTO SEMSEC VALUES (‘CSE3B', 3,'B');

INSERT INTO SEMSEC VALUES (‘CSE3C’, 3,’C’);

INSERT INTO SEMSEC VALUES ('CSE2A', 2,’A’);

INSERT INTO SEMSEC VALUES (‘CSE2B’, 2,'B’);

INSERT INTO SEMSEC VALUES ('CSE2C', 2,'C');

INSERT INTO SEMSEC VALUES (‘CSE1A', 1,'A');

INSERT INTO SEMSEC VALUES (‘CSE1B’, 1,’B’);

INSERT INTO SEMSEC VALUES ('CSE1C', 1,’C’);


INSERT INTO CLASS VALUES (‘1RN13CS020’,’CSE8A’);
```

```
INSERT INTO CLASS VALUES (‘1RN13CS062’,’CSE8A’);

INSERT INTO CLASS VALUES (‘1RN13CS066’,’CSE8B’);

INSERT INTO CLASS VALUES (‘1RN13CS091’,’CSE8C’);

INSERT INTO CLASS VALUES (‘1RN14CS010’,’CSE7A’);

INSERT INTO CLASS VALUES (‘1RN14CS025’,’CSE7A’);

INSERT INTO CLASS VALUES (‘1RN14CS032’,’CSE7A’);

INSERT INTO CLASS VALUES (‘1RN15CS011’,’CSE4A’);

INSERT INTO CLASS VALUES (‘1RN15CS029’,’CSE4A’);

INSERT INTO CLASS VALUES (‘1RN15CS045’,’CSE4B’);

INSERT INTO CLASS VALUES (‘1RN15CS091’,’CSE4C’);

INSERT INTO CLASS VALUES (‘1RN16CS045’,’CSE3A’);

INSERT INTO CLASS VALUES (‘1RN16CS088’,’CSE3B’);

INSERT INTO CLASS VALUES (‘1RN16CS122’,’CSE3C’);


INSERT INTO SUBJECT VALUES ('10CS81','ACA', 8, 4);

INSERT INTO SUBJECT VALUES ('10CS82','SSM', 8, 4);

INSERT INTO SUBJECT VALUES ('10CS83','NM', 8, 4);

INSERT INTO SUBJECT VALUES ('10CS84','CC', 8, 4);

INSERT INTO SUBJECT VALUES ('10CS85','PW', 8, 4);

INSERT INTO SUBJECT VALUES ('10CS71','OOAD', 7, 4);

INSERT INTO SUBJECT VALUES ('10CS72','ECS', 7, 4);

INSERT INTO SUBJECT VALUES ('10CS73','PTW', 7, 4);

INSERT INTO SUBJECT VALUES ('10CS74','DWDM', 7, 4);

INSERT INTO SUBJECT VALUES (‘10CS75','JAVA', 7, 4);
```

```
INSERT INTO SUBJECT VALUES ('10CS76','SAN', 7, 4);

INSERT INTO SUBJECT VALUES ('15CS51', 'ME', 5, 4);

INSERT INTO SUBJECT VALUES ('15CS52','CN', 5, 4);

INSERT INTO SUBJECT VALUES ('15CS53','DBMS', 5, 4);

INSERT INTO SUBJECT VALUES ('15CS54','ATC', 5, 4);

INSERT INTO SUBJECT VALUES ('15CS55','JAVA', 5, 3);

INSERT INTO SUBJECT VALUES ('15CS56','AI', 5, 3);

INSERT INTO SUBJECT VALUES ('15CS41','M4', 4, 4);

INSERT INTO SUBJECT VALUES ('15CS42','SE', 4, 4);

INSERT INTO SUBJECT VALUES ('15CS43','DAA', 4, 4);

INSERT INTO SUBJECT VALUES ('15CS44','MPMC', 4, 4);

INSERT INTO SUBJECT VALUES ('15CS45','OOC', 4, 3);

INSERT INTO SUBJECT VALUES ('15CS46','DC', 4, 3);

INSERT INTO SUBJECT VALUES ('15CS31','M3', 3, 4);

INSERT INTO SUBJECT VALUES ('15CS32','ADE', 3, 4);

INSERT INTO SUBJECT VALUES ('15CS33','DSA', 3, 4);

INSERT INTO SUBJECT VALUES ('15CS34','CO', 3, 4);

INSERT INTO SUBJECT VALUES ('15CS35','USP', 3, 3);

INSERT INTO SUBJECT VALUES ('15CS36','DMS', 3, 3);


INSERT INTO IAMARKS (USN, SUBCODE, SSID, TEST1, TEST2, TEST3) VALUES
('1RN13CS091','10CS81','CSE8C', 15, 16, 18);

INSERT INTO IAMARKS (USN, SUBCODE, SSID, TEST1, TEST2, TEST3) VALUES
('1RN13CS091','10CS82','CSE8C', 12, 19, 14);

INSERT INTO IAMARKS (USN, SUBCODE, SSID, TEST1, TEST2, TEST3) VALUES
('1RN13CS091','10CS83','CSE8C', 19, 15, 20);
```

INSERT INTO IAMARKS (USN, SUBCODE, SSID, TEST1, TEST2, TEST3) VALUES ('1RN13CS091','10CS84','CSE8C', 20, 16, 19);

INSERT INTO IAMARKS (USN, SUBCODE, SSID, TEST1, TEST2, TEST3) VALUES ('1RN13CS091','10CS85','CSE8C', 15, 15, 12);

SELECT * FROM STUDENT;

```
SQL> SELECT * FROM STUDENT1;

USN        SNAME                     ADDRESS                       PHONE G
---------- ------------------------- ------------------------- ---------- -
1RN13CS020 AKSHAY                    BELAGAVI                  8877881122 M
1RN13CS062 SANDHYA                   BENGALURU                 7722829912 F
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F
1RN13CS066 SUPRIYA                   MANGALURU                 8877881122 F
1RN14CS010 ABHAY                     BENGALURU                 9900211201 M
1RN14CS032 BHASKAR                   BENGALURU                 9923211099 M
1RN15CS011 AJAY                      TUMKUR                    9845091341 M
1RN15CS029 CHITRA                    DAVANGERE                 7696772121 F
1RN15CS045 JEEVA                     BELLARY                   9944850121 M
1RN15CS091 SANTOSH                   MANGALURU                 8812332201 M
1RN16CS045 ISMAIL                    KALBURGI                  9900232201 M
1RN16CS088 SAMEERA                   SHIMOGA                   9905542212 F
1RN16CS122 VINAYAKA                  CHIKAMAGALUR              8800880011 M
1RN14CS025 ASMI                      BENGALURU                 7894737377 F
```

SELECT * FROM SEMSEC;

```
SQL> SELECT * FROM SEMSEC;

SSID          SEM S
----- ---------- -
CSE8A           8 A
CSE8B           8 B
CSE8C           8 C
CSE7A           7 A
CSE7B           7 B
CSE7C           7 C
CSE6A           6 A
CSE6B           6 B
CSE6C           6 C
CSE5A           5 A
CSE5B           5 B
CSE5C           5 C
CSE4A           4 A
CSE4B           4 B
CSE4C           4 C
CSE3A           3 A
CSE3B           3 B
CSE3C           3 C
CSE2A           2 A
CSE2C           2 C
CSE2B           2 B
CSE1A           1 A
CSE1B           1 B
CSE1C           1 C
```

SELECT * FROM CLASS;

```
SQL> SELECT * FROM CLASS;

USN        SSID
---------- -----
1RN13CS020 CSE8A
1RN13CS062 CSE8A
1RN13CS066 CSE8B
1RN13CS091 CSE8C
1RN14CS010 CSE7A
1RN14CS025 CSE7A
1RN14CS032 CSE7A
1RN15CS011 CSE4A
1RN15CS029 CSE4A
1RN15CS045 CSE4B
1RN15CS091 CSE4C
1RN16CS045 CSE3A
1RN16CS088 CSE3B
1RN16CS122 CSE3C

14 rows selected.
```

SELECT * FROM SUBJECT;

SUBCODE	TITLE	SEM	CREDITS
10CS81	ACA	8	4
10CS82	SSM	8	4
10CS83	NM	8	4
10CS84	CC	8	4
10CS85	PW	8	4
10CS71	OOAD	7	4
10CS72	ECS	7	4
10CS73	PTW	7	4
10CS74	DWDM	7	4
10CS75	JAVA	7	4
10CS76	SAN	7	4
15CS51	ME	5	4
15CS52	CN	5	4
15CS53	DBMS	5	4
15CS54	ATC	5	4
15CS55	JAVA	5	3
15CS56	AI	5	3
15CS41	M4	4	4
15CS42	SE	4	4
15CS43	DAA	4	4
15CS44	MPMC	4	4
15CS45	OOC	4	3
15CS46	DC	4	3
15CS31	M3	3	4
15CS32	ADE	3	4
15CS33	DSA	3	4
15CS34	CO	3	4
15CS35	USP	3	3
15CS36	DMS	3	3

SELECT * FROM IAMARKS;

```
SQL> SELECT * FROM IAMARKS;

USN        SUBCODE  SSID       TEST1      TEST2      TEST3    FINALIA
---------- -------- ----- ---------- ---------- ---------- ----------
1RN13CS091 10CS81   CSE8C          15         16         18
1RN13CS091 10CS82   CSE8C          12         19         14
1RN13CS091 10CS83   CSE8C          19         15         20
1RN13CS091 10CS84   CSE8C          20         16         19
1RN13CS091 10CS85   CSE8C          15         15         12
```

Queries:

1. **List all the student details studying in fourth semester 'C' section.**

SELECT S.*, SS.SEM, SS.SEC

FROM STUDENT S, SEMSEC SS, CLASS C

WHERE S.USN = C.USN AND

SS.SSID = C.SSID AND

SS.SEM = 4 AND

SS.SEc='C';

```
USN        SNAME                     ADDRESS                        PHONE G        SEM S
---------- ------------------------- ------------------------- ---------- - ---------- -
1RN15CS091 SANTOSH                   MANGALURU                  8812332201 M          4 C
```

2. **Compute the total number of male and female students in each semester and in each section.**

SELECT SS.SEM, SS.SEC, S.GENDER, COUNT (S.GENDER) AS COUNT

FROM STUDENT1 S, SEMSEC SS, CLASS C

WHERES.USN = C.USN AND

SS.SSID = C.SSID

GROUP BY SS.SEM, SS.SEC, S.GENDER

ORDER BY SEM;

SEM	S	G	COUNT
3	A	M	1
3	B	F	1
3	C	M	1
4	A	F	1
4	A	M	1
4	B	M	1
4	C	M	1
7	A	F	1
7	A	M	2
8	A	F	1
8	A	M	1
8	B	F	1
8	C	F	1

3. Create a view of Test1 marks of student USN '1BI15CS101' in all subjects.

```
CREATE VIEW STU_TEST1_MARKS_VIEW

AS

SELECT TEST1, SUBCODE

FROM IAMARKS

WHERE USN = '1RN13CS091';
```

TEST1	SUBCODE
15	10CS81
12	10CS82
19	10CS83
20	10CS84
15	10CS85

4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.

```
CREATE OR REPLACE PROCEDURE AVGMARKS

IS

CURSOR C_IAMARKS IS

SELECT GREATEST(TEST1,TEST2) AS A, GREATEST(TEST1,TEST3) AS B,
GREATEST(TEST3,TEST2) AS C
```

```
FROM IAMARKS
WHERE FINALIA IS NULL
FOR UPDATE;

  C_A NUMBER;
  C_B NUMBER;
  C_C NUMBER;
  C_SM NUMBER;
  C_AV NUMBER;

BEGIN
  OPEN C_IAMARKS;
  LOOP
  FETCH C_IAMARKS INTO C_A, C_B, C_C;
    EXIT WHEN C_IAMARKS%NOTFOUND;
    --DBMS_OUTPUT.PUT_LINE(C_A || ' ' || C_B || ' ' || C_C);
    IF (C_A != C_B) THEN
 C_SM:=C_A+C_B;
    ELSE
 C_SM:=C_A+C_C;
    END IF;

    C_AV:=C_SM/2;
    --DBMS_OUTPUT.PUT_LINE('SUM = '||C_SM);
```

```
        --DBMS_OUTPUT.PUT_LINE('AVERAGE = '||C_AV);

        UPDATE IAMARKS SET FINALIA=C_AV WHERE CURRENT OF
    C_IAMARKS;


      END LOOP;

      CLOSE C_IAMARKS;

    END;

    /
```

Note: Before execution of PL/SQL procedure, IAMARKS table contents are:

SELECT * FROM IAMARKS;

```
SQL> SELECT * FROM IAMARKS;

USN        SUBCODE  SSID       TEST1      TEST2      TEST3    FINALIA
---------- -------- ----- ---------- ---------- ---------- ----------
1RN13CS091 10CS81   CSE8C         15         16         18
1RN13CS091 10CS82   CSE8C         12         19         14
1RN13CS091 10CS83   CSE8C         19         15         20
1RN13CS091 10CS84   CSE8C         20         16         19
1RN13CS091 10CS85   CSE8C         15         15         12
```

Below SQL code is to invoke the PL/SQL stored procedure from the command line:

```
    BEGIN

    AVGMARKS; --IT INVOKES THE STORED PROCEDURE

    END;

    /
```

```
SQL> select * from IAMARks;

USN        SUBCODE  SSID       TEST1      TEST2      TEST3    FINALIA
---------- -------- ----- ---------- ---------- ---------- ----------
1RN13CS091 10CS81   CSE8C          15         16         18         17
1RN13CS091 10CS82   CSE8C          12         19         14         17
1RN13CS091 10CS83   CSE8C          19         15         20         20
1RN13CS091 10CS84   CSE8C          20         16         19         20
1RN13CS091 10CS85   CSE8C          15         15         12         15
```

5. Categorize students based on the following criterion:

If FinalIA = 17 to 20 then CAT = 'Outstanding'

If FinalIA = 12 to 16 then CAT = 'Average'

If FinalIA< 12 then CAT = 'Weak'

Give these details only for 8th semester A, B, and C section students.

```
SELECT S.USN,S.SNAME,S.ADDRESS,S.PHONE,S.GENDER,
    (CASE
      WHEN IA.FINALIA BETWEEN 17 AND 20 THEN 'OUTSTANDING'
      WHEN IA.FINALIA BETWEEN 12 AND 16 THEN 'AVERAGE'
      ELSE 'WEAK'
    END) AS CAT
FROM STUDENT S, SEMSEC SS, IAMARKS IA, SUBJECT SUB
WHERE S.USN = IA.USN AND
SS.SSID = IA.SSID AND
SUB.SUBCODE = IA.SUBCODE AND
SUB.SEM = 8;
```

```
USN        SNAME                     ADDRESS                   PHONE G CAT
---------- ------------------------- ------------------------- ---------- - -----------
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F OutStanding
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F OutStanding
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F OutStanding
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F OutStanding
1RN13CS091 TEESHA                    BENGALURU                 7712312312 F Average
```

5. Consider the schema for Company Database:

EMPLOYEE (*SSN, Name, Address, Sex, Salary, SuperSSN, DNo*)

DEPARTMENT (*DNo, DName, MgrSSN, MgrStartDate*)

DLOCATION (*DNo,DLoc*)

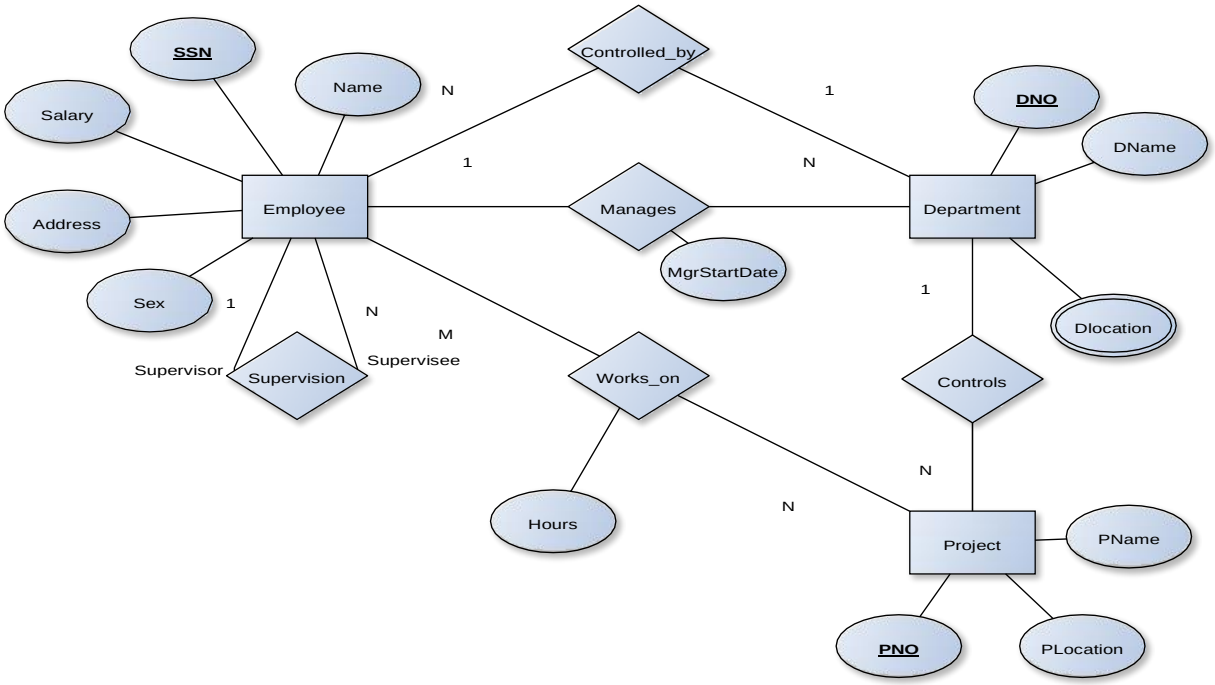
PROJECT (*PNo, PName, PLocation, DNo*)

WORKS_ON (*SSN, PNo, Hours*)

Write SQL queries to

1. **Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.**
2. **Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.**
3. **Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department**
4. **Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.**

Entity-Relationship Diagram



Schema Diagram

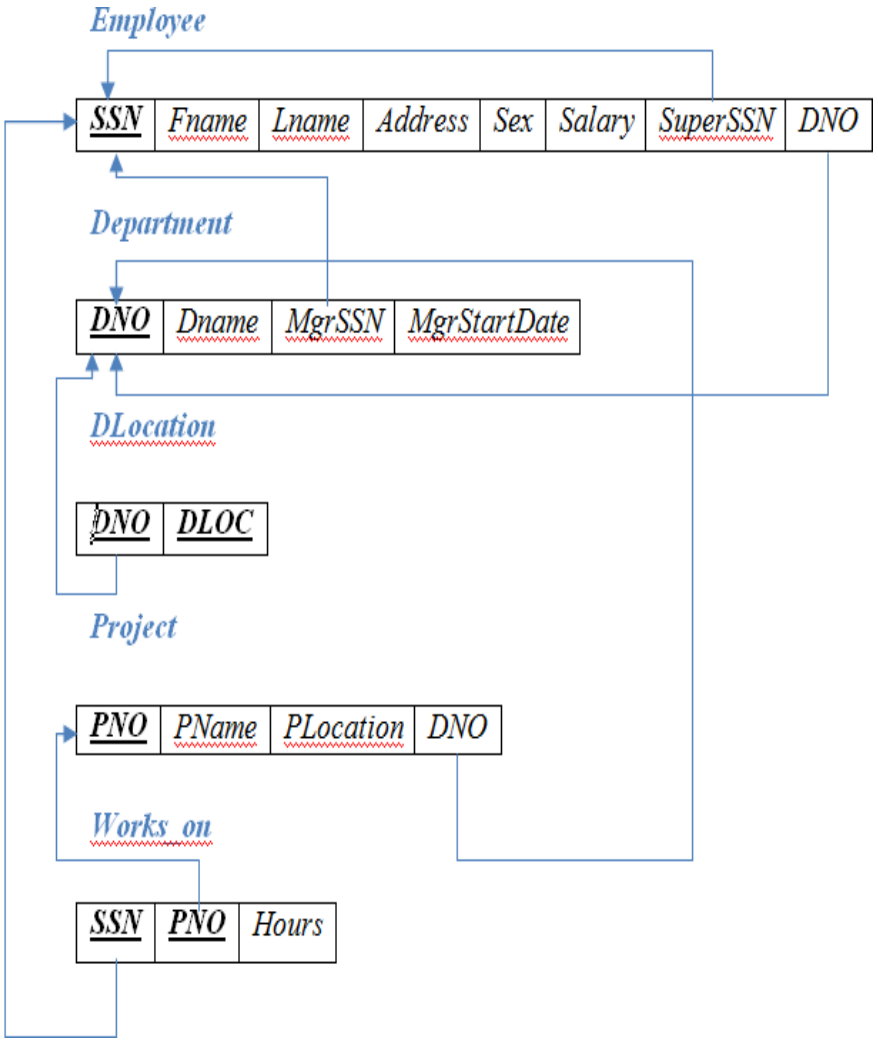


Table Creation

CREATE TABLE DEPARTMENT

(DNO VARCHAR2 (20) PRIMARY KEY,

DNAME VARCHAR2 (20),

MGRSTARTDATE DATE);

CREATE TABLE EMPLOYEE

(SSN VARCHAR2 (20) PRIMARY KEY,

FNAME VARCHAR2 (20),

LNAME VARCHAR2 (20),

ADDRESS VARCHAR2 (20),

SEX CHAR (1),

SALARY INTEGER,

SUPERSSN REFERENCES EMPLOYEE (SSN),

DNO REFERENCES DEPARTMENT (DNO));

NOTE: Once DEPARTMENT and EMPLOYEE tables are created we must alter department table to add foreign constraint MGRSSN using sql command

ALTER TABLE DEPARTMENT

ADD MGRSSN REFERENCES EMPLOYEE (SSN);

CREATE TABLE DLOCATION

(DLOC VARCHAR2 (20),

DNO REFERENCES DEPARTMENT (DNO),

PRIMARY KEY (DNO, DLOC));

CREATE TABLE PROJECT

(PNO INTEGER PRIMARY KEY,

PNAME VARCHAR2 (20),

PLOCATION VARCHAR2 (20),

DNO REFERENCES DEPARTMENT (DNO));

CREATE TABLE WORKS_ON

(HOURS NUMBER (2),

SSN REFERENCES EMPLOYEE (SSN),

PNO REFERENCES PROJECT(PNO),

PRIMARY KEY (SSN, PNO));

Table Descriptions

DESC EMPLOYEE;

```
SQL> DESC EMPLOYEE;
 Name
 -----------------------------------------------------------------
 SSN
 FNAME
 LNAME
 ADDRESS
 SEX
 SALARY
 SUPERSSN
 DNO
```

DESC DEPARTMENT;

```
SQL> DESC DEPARTMENT;
 Name
 ----------------------------------------------------
 DNO
 DNAME
 MGRSTARTDATE
 MGRSSN
```

DESC DLOCATION;

```
SQL> DESC DLOCATION;
 Name
 --------------------------
 DLOC
 DNO
```

DESC PROJECT;

```
SQL> DESC PROJECT;
 Name
 -------------------------
 PNO
 PNAME
 PLOCATION
 DNO
```

DESC WORKS_ON;

```
SQL> DESC WORKS_ON;
 Name
 -----------------------------------------------------
 HOURS
 SSN
 PNO
```

Insertion of values to tables

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSECE01’,’JOHN’,’SCOTT’,’BANGALORE’,’M’, 450000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE01’,’JAMES’,’SMITH’,’BANGALORE’,’M’, 500000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE02’,’HEARN’,’BAKER’,’BANGALORE’,’M’, 700000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE03’,’EDWARD’,’SCOTT’,’MYSORE’,’M’, 500000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE04’,’PAVAN’,’HEGDE’,’MANGALORE’,’M’, 650000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE05’,’GIRISH’,’MALYA’,’MYSORE’,’M’, 450000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSCSE06’,’NEHA’,’SN’,’BANGALORE’,’F’, 800000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSACC01’,’AHANA’,’K’,’MANGALORE’,’F’, 350000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSACC02’,’SANTHOSH’,’KUMAR’,’MANGALORE’,’M’, 300000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSISE01’,’VEENA’,’M’,’MYSORE’,’M’, 600000);

INSERT INTO EMPLOYEE (SSN, FNAME, LNAME, ADDRESS, SEX, SALARY)
VALUES (‘RNSIT01’,’NAGESH’,’HR’,’BANGALORE’,’M’, 500000);

```
INSERT INTO DEPARTMENT VALUES (‘1’,’ACCOUNTS’,’01-JAN-01’,’RNSACC02’);

INSERT INTO DEPARTMENT VALUES (‘2’,’IT’,’01-AUG-16’,’RNSIT01’);

INSERT INTO DEPARTMENT VALUES (‘3’,’ECE’,’01-JUN-08’,’RNSECE01’);

INSERT INTO DEPARTMENT VALUES (‘4’,’ISE’,’01-AUG-15’,’RNSISE01’);

INSERT INTO DEPARTMENT VALUES (‘5’,’CSE’,’01-JUN-02’,’RNSCSE05’);
```

Note: update entries of employee table to fill missing fields SUPERSSN and DNO

```
UPDATE EMPLOYEE SET

SUPERSSN=NULL, DNO=’3’

WHERE SSN=’RNSECE01’;


UPDATE EMPLOYEE SET

SUPERSSN=’RNSCSE02’, DNO=’5’

WHERE SSN=’RNSCSE01’;


UPDATE EMPLOYEE SET

SUPERSSN=’RNSCSE03’, DNO=’5’

WHERE SSN=’RNSCSE02’;


UPDATE EMPLOYEE SET

SUPERSSN=’RNSCSE04’, DNO=’5’

WHERE SSN=’RNSCSE03’;
```

```
UPDATE EMPLOYEE SET
DNO='5', SUPERSSN='RNSCSE05'
WHERE SSN='RNSCSE04';

UPDATE EMPLOYEE SET
DNO='5', SUPERSSN='RNSCSE06'
WHERE SSN='RNSCSE05';

UPDATE EMPLOYEE SET
DNO='5', SUPERSSN=NULL
WHERE SSN='RNSCSE06';

UPDATE EMPLOYEE  SET
DNO='1', SUPERSSN='RNSACC02'
WHERE SSN='RNSACC01';

UPDATE EMPLOYEE SET
DNO='1', SUPERSSN=NULL
WHERE SSN='RNSACC02';

UPDATE EMPLOYEE SET
DNO='4', SUPERSSN=NULL
WHERE SSN='RNSISE01';

UPDATE EMPLOYEE SET
DNO='2', SUPERSSN=NULL
WHERE SSN='RNSIT01';
```

```
INSERT INTO DLOCATION VALUES (’BANGALORE’, ‘1’);

INSERT INTO DLOCATION VALUES (’BANGALORE’, ‘2’);

INSERT INTO DLOCATION VALUES (’BANGALORE’, ‘3’);

INSERT INTO DLOCATION VALUES (’MANGALORE’, ‘4’);

INSERT INTO DLOCATION VALUES (’MANGALORE’, ‘5’);


INSERT INTO PROJECT VALUES (100,’IOT’,’BANGALORE’,’5’);

INSERT INTO PROJECT VALUES (101,’CLOUD’,’BANGALORE’,’5’);

INSERT INTO PROJECT VALUES (102,’BIGDATA’,’BANGALORE’,’5’);

INSERT INTO PROJECT VALUES (103,’SENSORS’,’BANGALORE’,’3’);

INSERT INTO PROJECT VALUES (104,’BANK MANAGEMENT’,’BANGALORE’,’1’);

INSERT INTO PROJECT VALUES (105,’SALARY
MANAGEMENT’,’BANGALORE’,’1’);

INSERT INTO PROJECT VALUES (106,’OPENSTACK’,’BANGALORE’,’4’);

INSERT INTO PROJECT VALUES (107,’SMART CITY’,’BANGALORE’,’2’);


INSERT INTO WORKS_ON VALUES (4, ‘RNSCSE01’, 100);

INSERT INTO WORKS_ON VALUES (6, ‘RNSCSE01’, 101);

INSERT INTO WORKS_ON VALUES (8, ‘RNSCSE01’, 102);

INSERT INTO WORKS_ON VALUES (10, ‘RNSCSE02’, 100);

INSERT INTO WORKS_ON VALUES (3, ‘RNSCSE04’, 100);

INSERT INTO WORKS_ON VALUES (4, ‘RNSCSE05’, 101);
```

INSERT INTO WORKS_ON VALUES (5, ‘RNSCSE06’, 102);

INSERT INTO WORKS_ON VALUES (6, ‘RNSCSE03’, 102);

INSERT INTO WORKS_ON VALUES (7, ‘RNSECE01’, 103);

INSERT INTO WORKS_ON VALUES (5, ‘RNSACC01’, 104);

INSERT INTO WORKS_ON VALUES (6, ‘RNSACC02’, 105);

INSERT INTO WORKS_ON VALUES (4, ‘RNSISE01’, 106);

INSERT INTO WORKS_ON VALUES (10, ‘RNSIT01’, 107);

SELECT * FROM EMPLOYEE;

SSN	FNAME	LNAME	ADDRESS	S	SALARY	SUPERSSN	DNO
RNSECE01	JOHN	SCOTT	BANGALORE	M	450000		3
RNSCSE01	JAMES	SMITH	BANGALORE	M	500000	RNSCSE02	5
RNSCSE02	HEARN	BAKER	BANGALORE	M	700000	RNSCSE03	5
RNSCSE03	EDWARD	SCOTT	MYSORE	M	500000	RNSCSE04	5
RNSCSE04	PAVAN	HEGDE	MANGALORE	M	650000	RNSCSE05	5
RNSCSE05	GIRISH	MALYA	MYSORE	M	450000	RNSCSE06	5
RNSCSE06	NEHA	SN	BANGALORE	F	800000		5
RNSACC01	AHANA	K	MANGALORE	F	350000	RNSACC02	1
RNSACC02	SANTHOSH	KUMAR	MANGALORE	M	300000		1
RNSISE01	VEENA	M	MYSORE	M	600000		4
RNSIT01	NAGESH	HR	BANGALORE	M	500000		2

SELECT * FROM DEPARTMENT;

```
SQL> SELECT * FROM DEPARTMENT;
```

DNO	DNAME	MGRSTARTD	MGRSSN
1	ACCOUNTS	01-JAN-01	RNSACC02
2	IT	01-AUG-16	RNSIT01
3	ECE	01-JUN-08	RNSECE01
4	ISE	01-AUG-15	RNSISE01
5	CSE	01-JUN-02	RNSCSE05

SELECT * FROM DLOCATION;

DLOC	DNO
BANGALORE	1
BANGALORE	2
BANGALORE	3
MANGALORE	4
MANGALORE	5

SELECT * FROM PROJECT;

PNO	PNAME	PLOCATION	DNO
100	IOT	BANGALORE	5
101	CLOUD	BANGALORE	5
102	BIGDATA	BANGALORE	5
103	SENSORS	BANGALORE	3
104	BANK MANAGEMENT	BANGALORE	1
105	SALARY MANAGEMENT	BANGALORE	1
106	OPENSTACK	BANGALORE	4
107	SMART CITY	BANGALORE	2

SELECT * FROM WORKS_ON;

HOURS	SSN	PNO
4	RNSCSE01	100
6	RNSCSE01	101
8	RNSCSE01	102
10	RNSCSE02	100
3	RNSCSE04	100
4	RNSCSE05	101
5	RNSCSE06	102
6	RNSCSE03	102
7	RNSECE01	103
5	RNSACC01	104
6	RNSACC02	105
4	RNSISE01	106
10	RNSIT01	107

Queries:

1. **Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.**

```
(SELECT DISTINCT P.PNO
FROM PROJECT P, DEPARTMENT D, EMPLOYEE E
WHERE E.DNO=D.DNO
AND D.MGRSSN=E.SSN
AND E.LNAME='SCOTT')
UNION
(SELECT DISTINCT P1.PNO
FROM PROJECT P1, WORKS_ON W, EMPLOYEE E1
WHERE P1.PNO=W.PNO
AND E1.SSN=W.SSN
AND E1.LNAME='SCOTT');
```

```
     PNO
--------
     100
     101
     102
     103
     104
     105
     106
     107
```

2. **Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.**

```
SELECT E.FNAME, E.LNAME, 1.1*E.SALARY AS INCR_SAL
FROM EMPLOYEE E, WORKS_ON W, PROJECT P
WHERE E.SSN=W.SSN
AND W.PNO=P.PNO
AND P.PNAME='IOT';
```

```
FNAME                LNAME                INCR_SAL
-------------------- -------------------- ----------
JAMES                SMITH                   550000
HEARN                BAKER                   770000
PAVAN                HEGDE                   715000
```

3. **Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department**

```
SELECT SUM (E.SALARY), MAX (E.SALARY), MIN (E.SALARY), AVG
(E.SALARY)
FROM EMPLOYEE E, DEPARTMENT D
WHERE E.DNO=D.DNO
AND D.DNAME='ACCOUNTS';
```

```
SUM(E.SALARY) MAX(E.SALARY) MIN(E.SALARY) AVG(E.SALARY)
------------- ------------- ------------- -------------
       650000        350000        300000        325000
```

4. **Retrieve the name of each employee who works on all the projects Controlled by department number 5 (use NOT EXISTS operator).**

```
SELECT E.FNAME, E.LNAME
FROM EMPLOYEE E
WHERE NOT EXISTS((SELECT PNO
                  FROM PROJECT
                    WHERE DNO='5')
                    EXCEPT(SELECT PNO
                    FROM WORKS_ON
                    WHERE E.SSN=SSN));
```

```
Or
SELECT LNAME, FNAME, DNO
FROM EMPLOYEE
WHERE NOT EXISTS (SELECT *
                  FROM WORKS_ON B
                  WHERE (B.PNO IN(SELECT P.PNO
                                  FROM PROJECT P
                                  WHERE P.DNO='5')
                  AND
                  NOT EXISTS (SELECT *
                              FROM WORKS_ON C

                              WHERE C.SSN=SSN

                              AND C.PNO=B.PNO)));
```

LNAME	FNAME
SCOTT	JOHN
SMITH	JAMES
BAKER	HEARN
SCOTT	EDWARD
HEGDE	PAVAN
MALYA	GIRISH
SN	NEHA
K	AHANA
KUMAR	SANTHOSH
M	VEENA
HR	NAGESH

5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6, 00,000.

```
SELECT D.DNO, COUNT (*)
FROM DEPARTMENT D, EMPLOYEE E
WHERE D.DNO=E.DNO
AND E.SALARY>600000
AND D.DNO IN (SELECT E1.DNO
        FROM EMPLOYEE E1
        GROUP BY E1.DNO
        HAVING COUNT (*)>5)
GROUP BY D.DNO;
```

DNO	COUNT(*)
5	3

Appendix-B

This section lists the viva questions from each module.

Module 1- Introduction to Databases

1. Define database?
2. What is database management system?
3. What are the roles of Database Administrator?
4. Mention the roles of workers behind the scene.
5. What are the advantages of DBMS over traditional file system?
6. What are the different levels of Data Models?
7. Define data base schema.
8. Explain three schema architecture.
9. What is data independence? Explain with example.
10. Define entity, attributes, entity set and entity types.
11. Define relationship, Relationship type, Relationship set and Roles.
12. What are weak entity types?
13. Write and explain different Notations of ER diagram.
14. What is cardinality Ratio and Participation?

Module 2 - Relational Model

15. Define Relation?
16. Define the following terms Domain, Domain of a attribute, Tuple.
17. What is Relation, relation state and Relation schema and Relational database schema?
18. What is key? Mention different types of keys.
19. Differentiate between primary key and candidate key.
20. What are the properties of candidate key?
21. Emphasize on primary key and foreign key.
22. List and explain different data model constrain.
23. What are the different update operations?
24. Differentiate select and project operation.
25. What is join operation? List and explain working of different join operations?
26. What are different aggregate operations?

Module 3 - SQL

27. What is SQL?
28. List the different data types in SQL?
29. What are the different constrains in SQL?
30. Define Insert, Delete and update statements in SQL.
31. What are more complex queries?

32. Explain Exists and Unique functions in SQL
33. Explain Aggregate Functions in SQL?
34. What is Grouping?
35. Explain Having clause in SQl.
36. What are views in SQL.

Module 4 - Normalization: Database Design Theory

37. What are the Informal Guidelines for Relational Databases?
38. How can we reduce redundant information in tuples?
39. What are Insertion Anomalies, Deletion Anomalies?
40. How to handle null values in Tuples?
41. Disadvantages of NULL values in Tuples?
42. How to handle Generation of Spurious tuples.
43. What are Functional Dependencies?
44. What are the different Inference rules?
45. What is Functional dependency?
46. Explain the Algorithm to Find Minimal Cover.
47. Explain 1NF, 2NF, 3NFand 4NF .
48. What is BCNF?
49. What is Multivalued Dependency?
50. Explain Domain Key Normal Form.

Module 5 - Transaction Processing

51. Differentiate single user and Multi-user system.
52. Why concurrency control is needed?
53. What are different problems of Concurrency control?
54. Why recovery is needed?
55. What are different Transaction states and operations?
56. What is system log?
57. What are the AICD properties of Transactions?
58. What is serializability?
59. What are different types of locks?
60. What is two phase locking?

****