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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

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A LABORATORY MANUAL

FOR

DBMS LABORATORY WITH MINI PROJECT (18CSL58)

(V SEMESTER)

2020-21

Prepared By:

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DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2018 -2019) SEMESTER – V

Subject Code	18CSL58	CIE Marks	40
Number of contact Hours/Week	0:2:2	SEE Marks	60
Total Number of Lab contact Hours	36	Exam Hours	03

CREDITS – 02

Course objectives: This course 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.

Description (If any):

PART-A: SQL Programming (Max. Exam Mks. 50)

- Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project (Max. Exam Mks. 30)

- Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

Lab Experiments:

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, Final IA) 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 Final IA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion: If Final IA = 17 to 20 then CAT = ‘Outstanding’

If Final IA = 12 to 16 then CAT = ‘Average’ If Final IA< 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 controlled by 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. 600000.

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.

Course outcomes: The students should be able to:

- Create, Update and query on the database.
- Demonstrate the working of different concepts of DBMS
- Implement, analyze and evaluate the project developed for an application.

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks.
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
   a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
   b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

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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:

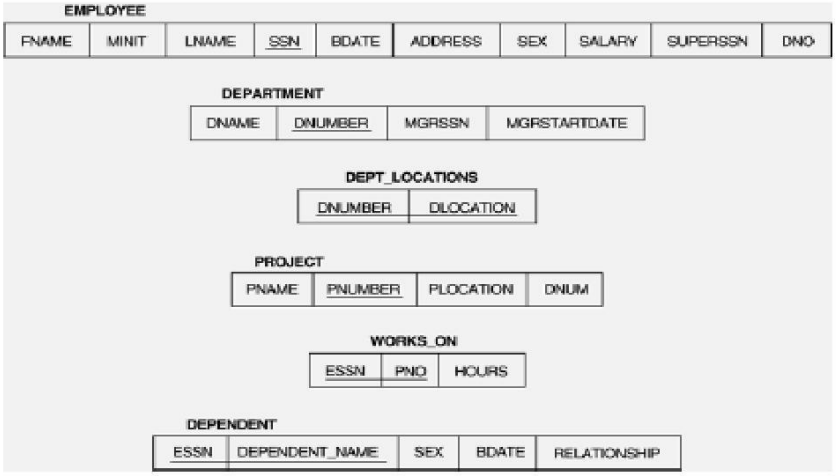
Example of a simple query on one relation

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.

LAB EXPERIMENTS

PART A: SQL PROGRAMMING

1. Consider the following schema for a Library Database:

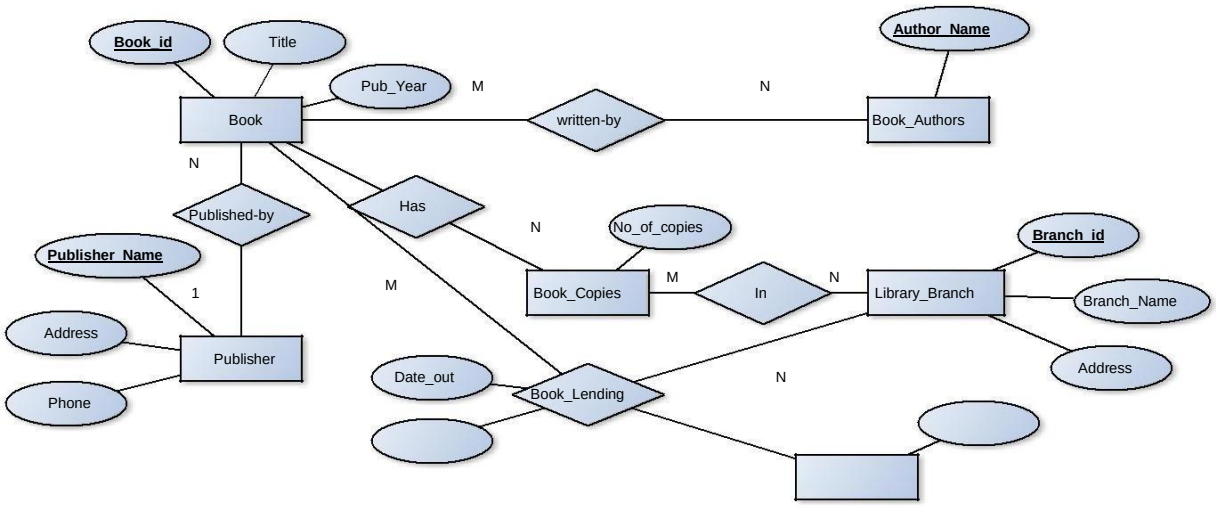
BOOK (*Book_id, Title, Publisher_Name, Pub_Year*)
BOOK_AUTHORS (Book_id, Author_*Name*)
PUBLISHER (*Name, Address, Phone*)
BOOK_COPIES (*Book_id, Branch_id, No-of_Copies*)
BOOK_LENDING (*Book_id, Branch_id, Card_No, Date_Out, Due_Date*)
LIBRARY_BRANCH (*Branch_id, Branch_Name, Address*)

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.**

Solution:

Entity-Relationship Diagram



Schema Diagram

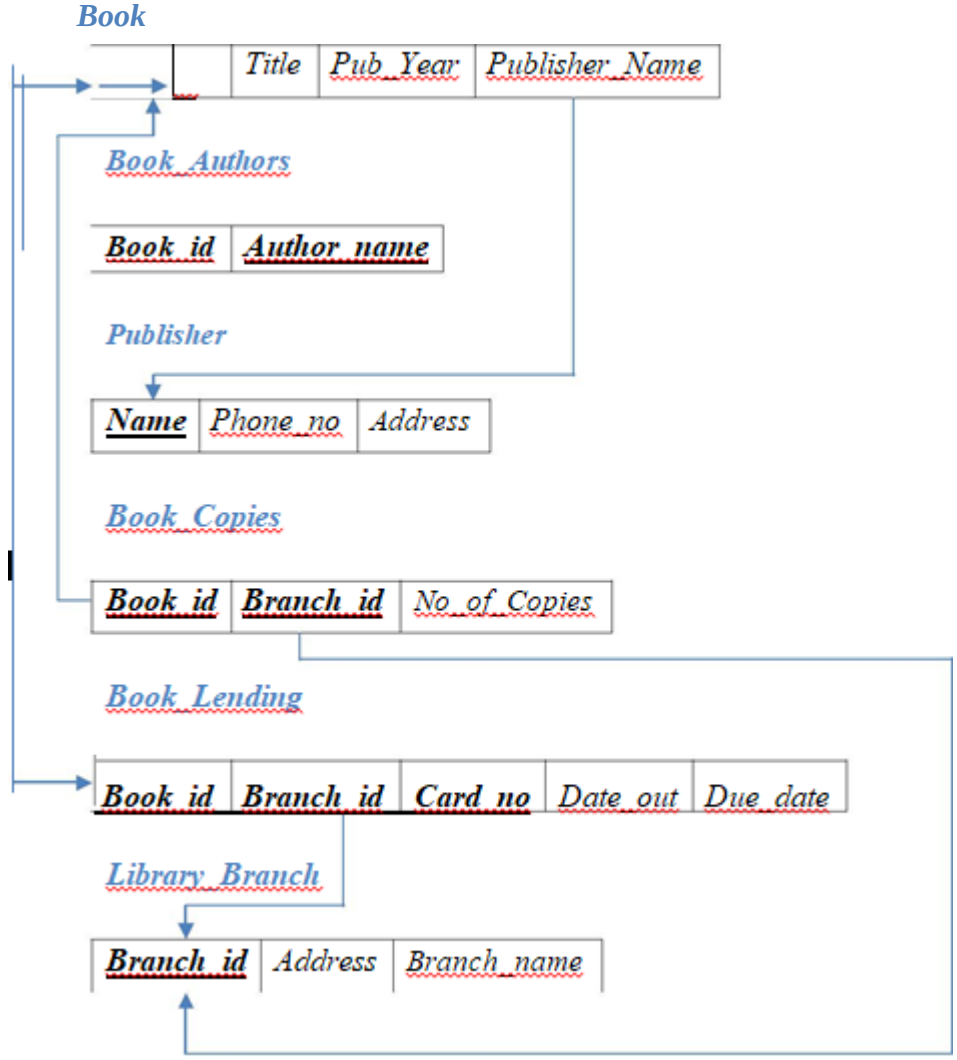


Table Creation

```
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,’SVCE’,’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
                                                     NETA
```

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

2. 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 ’30 -JUL-2017’ GROUP BY
CARD_NO HAVING
COUNT (*)>3;

CARD_NO
101

3. 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

.

4. 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
```

5. 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

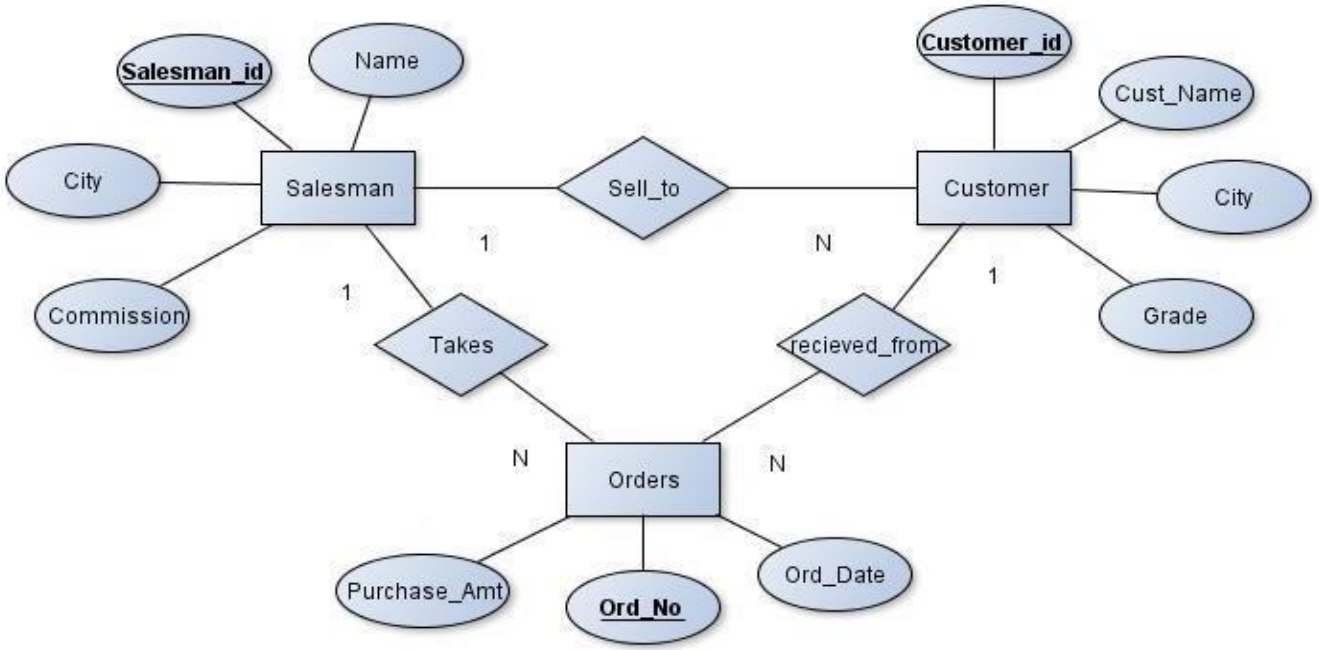
2. Consider the following schema for Order Database:

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

Salesman

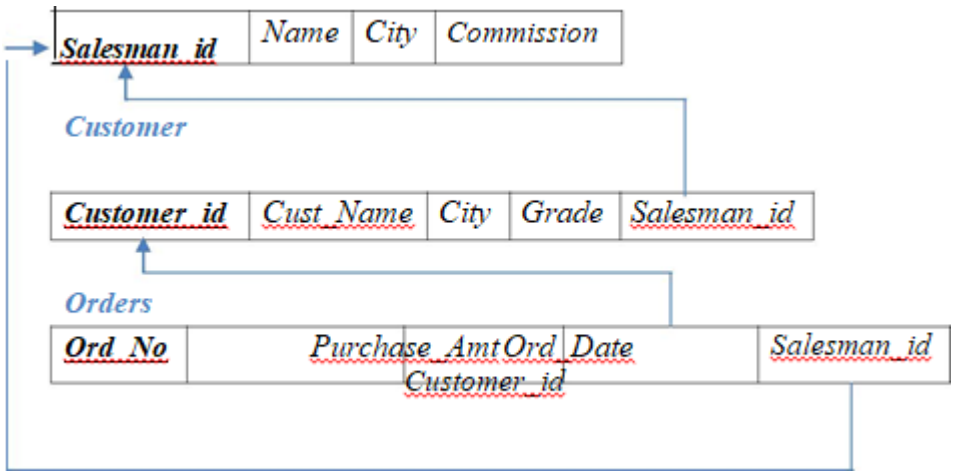


Table Creation

```
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 CUSTOMER1;

```
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 S.SALESMAN_ID, NAME, S.CITY, C.CITY FROM
SALESMAN, CUSTOMER1 C
WHERE SALESMAN.ID=
C.SALESMAN_ID AND
S.CITY=C.CITY) UNION
(SELECT S1.SALESMAN_ID, NAME,
S1.CITY,CUST_NAME, 'NO MATCH' FROM
SALESMAN S1, CUSTOMER C1
WHERE
 S1.SALESMAN_ID=
 C1.SALESMAN_ID
 AND
 S1.CITY<>C1.CITY)
 ;
```

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 ELITSALESMAN AS
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;
```

```
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:

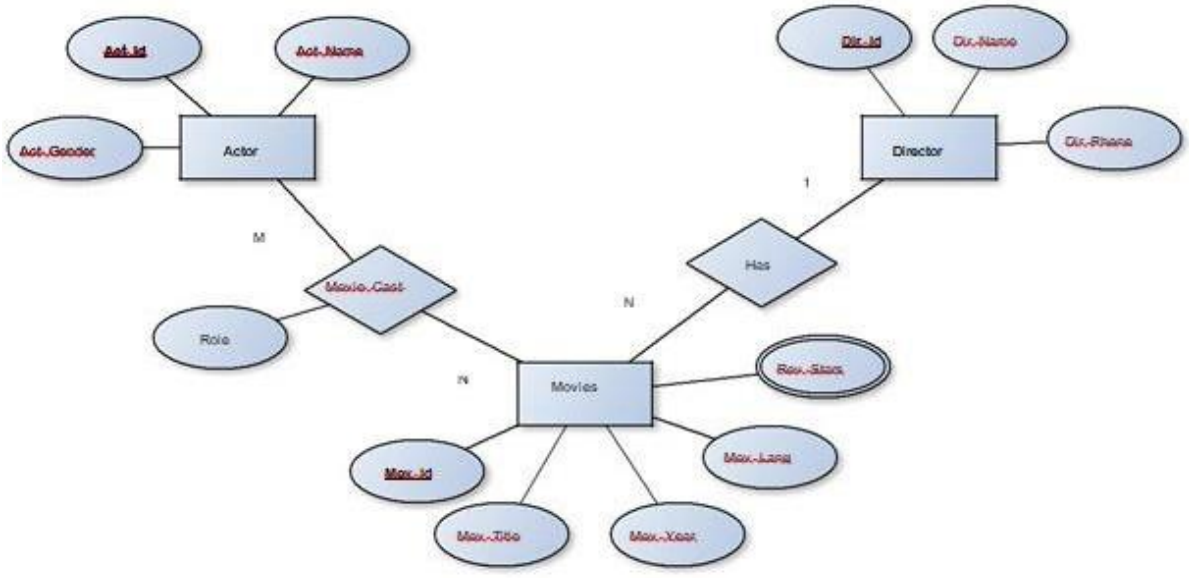
ACTOR (*Act_id, Act_Name, Act_Gender*)
DIRECTOR (*Dir_id, Dir_Name, Dir_Phone*)
MOVIES (*Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id*)
MOVIE_CAST (*Act_id, Mov_id, Role*)
RATING (*Mov_id, Rev_Stars*)

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

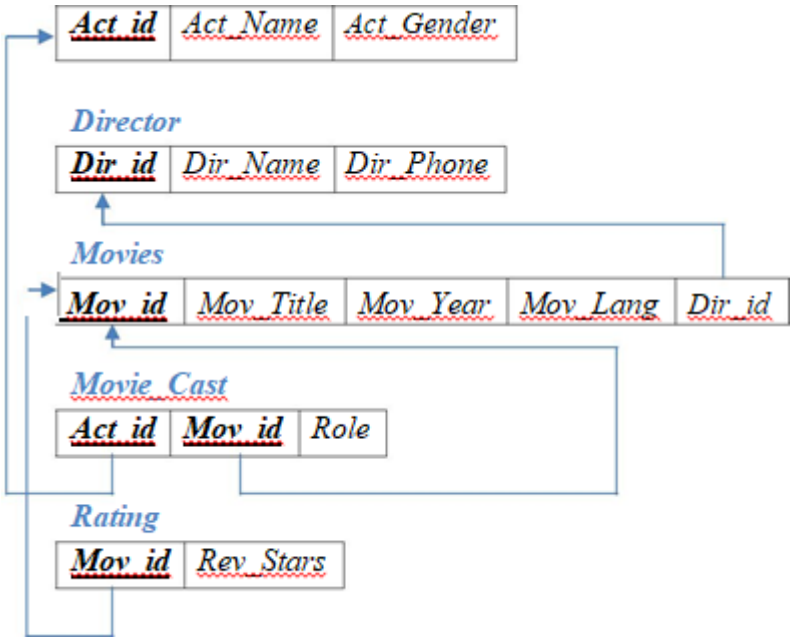


Table Creation

```
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

KL

```
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
```

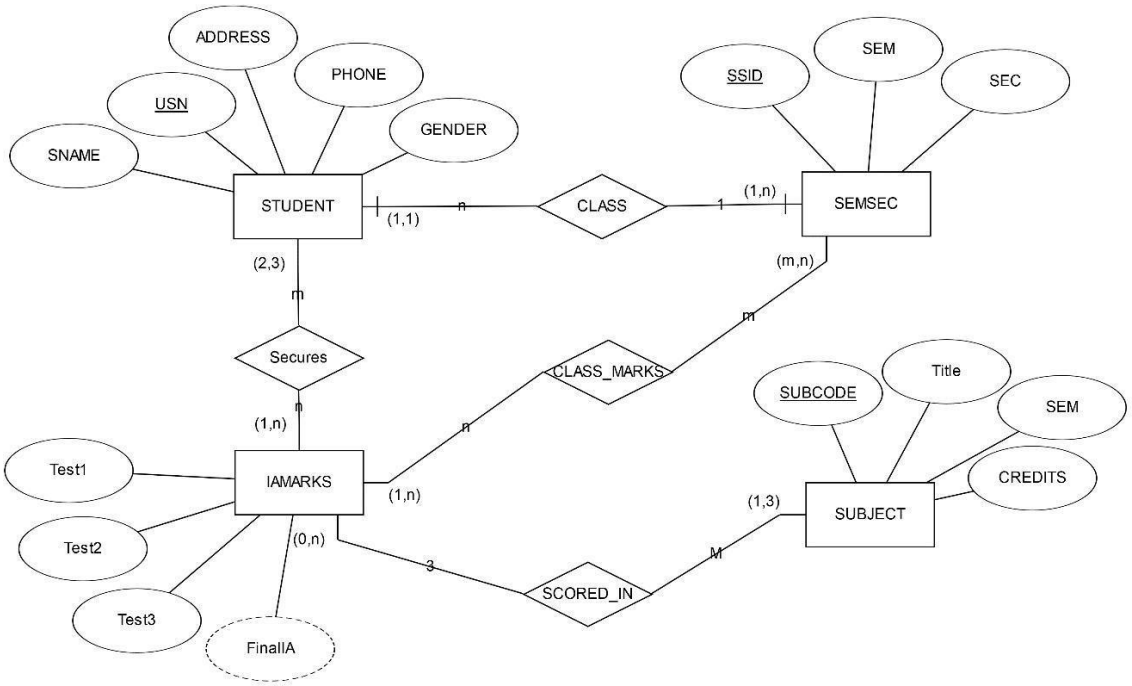
4. Consider the schema for College Database:

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

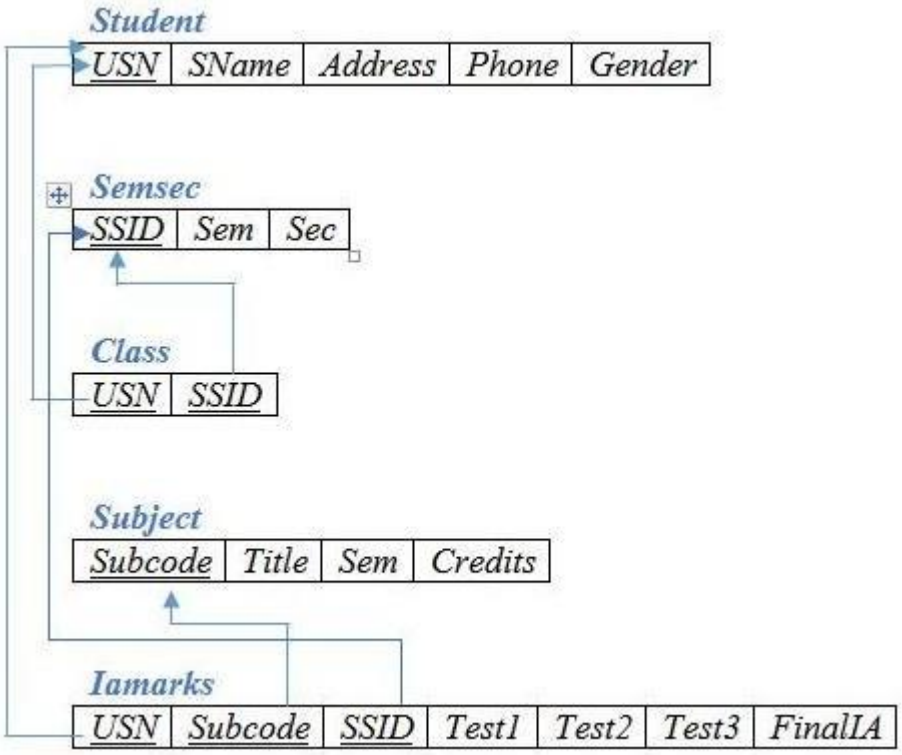


Table Creation

```
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 STUDENT 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:

OR

```
SQL> DECLARE

CURSOR C_IA_MARKS

IS

SELECT TEST1, TEST2, TEST3 FROM IAMARKS

WHERE FINAL_IA IS NULL

FOR UPDATE;

C_T1 NUMBER;

C_T2 NUMBER;

C_T3 NUMBER;

C_SUM NUMBER;

C_AVG NUMBER;

C_MIN NUMBER;

BEGIN

OPEN_IA_MARKS;

LOOP

FETCH C_IA_MARKS INTO C_T1,C_T2,C_T3;

EXIT WHEN C_IA_MARKS%NOTFOUND;

C_SUM:=C_T1+C_T2+C_T3;
```

```
DBMS_OUTPUT.PUT_LINE('SUM='||C_SUM);

IF((C_T1<=C_T2)AND(C_T1<=C_T3))

THEN

C_MIN:=C+T1;

ELSE IF ((C_T2<=C_T1)AND(C_T2<=C_T3))

THEN

C_MIN:=C_T2;

ELSE

C_MIN:=C_T3;

END IF;

END IF;

DBMS_OUTPUT.PUT_LINE('MIN='||C_MIN);

C_AVG:=(C_SUM-C_MIN)/2;

DBMS_OUTPUT.PUT_LINE('AVERAGE='||C_AVG);

UPDATE IA_MARKS SET FINAL_IA=C_AVG WHERE

CURRENT OF C_IA_MARKS;

END;



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;
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;
```

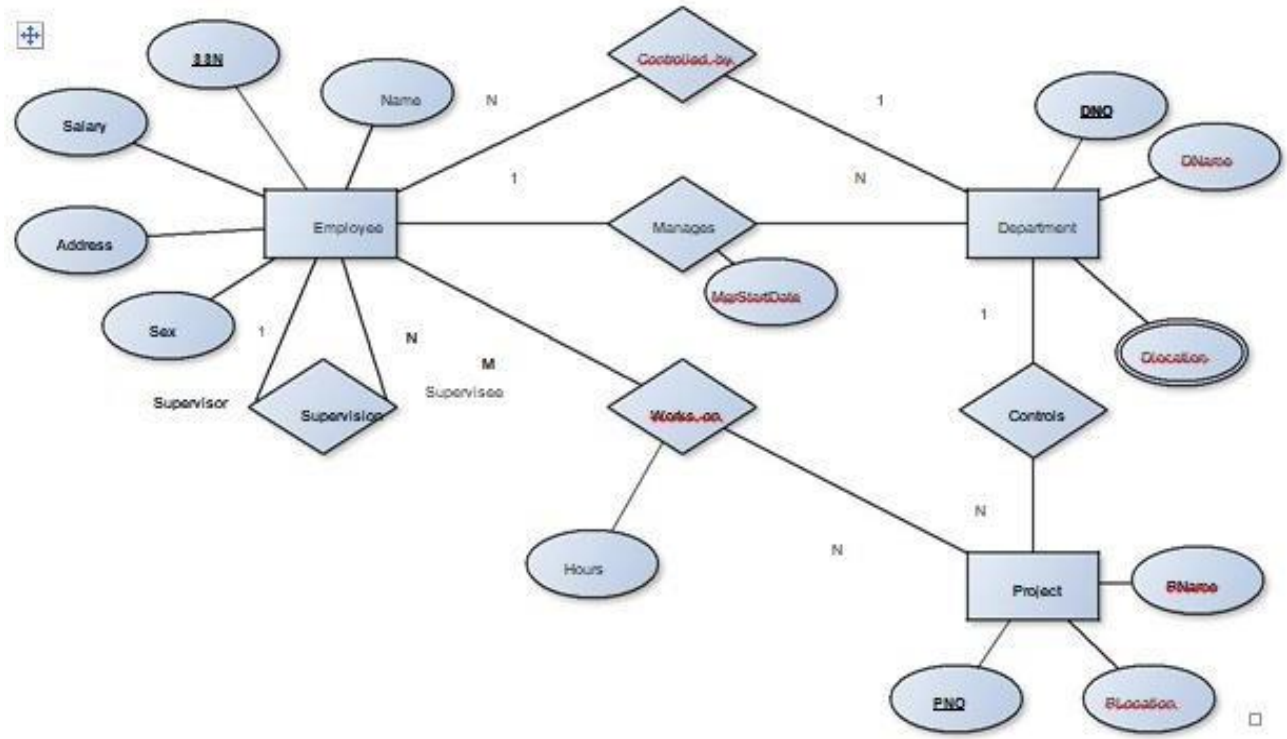
USN	SNAME	ADDRESS	PHONE	G	CAT
1RN13CS091	TEESHA	BENGALURU	7712312312	F	OutStanding
1RN13CS091	TEESHA	BENGALURU	7712312312	F	OutStanding
1RN13CS091	TEESHA	BENGALURU	7712312312	F	OutStanding
1RN13CS091	TEESHA	BENGALURU	7712312312	F	OutStanding
1RN13CS091	TEESHA	BENGALURU	7712312312	F	Average

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

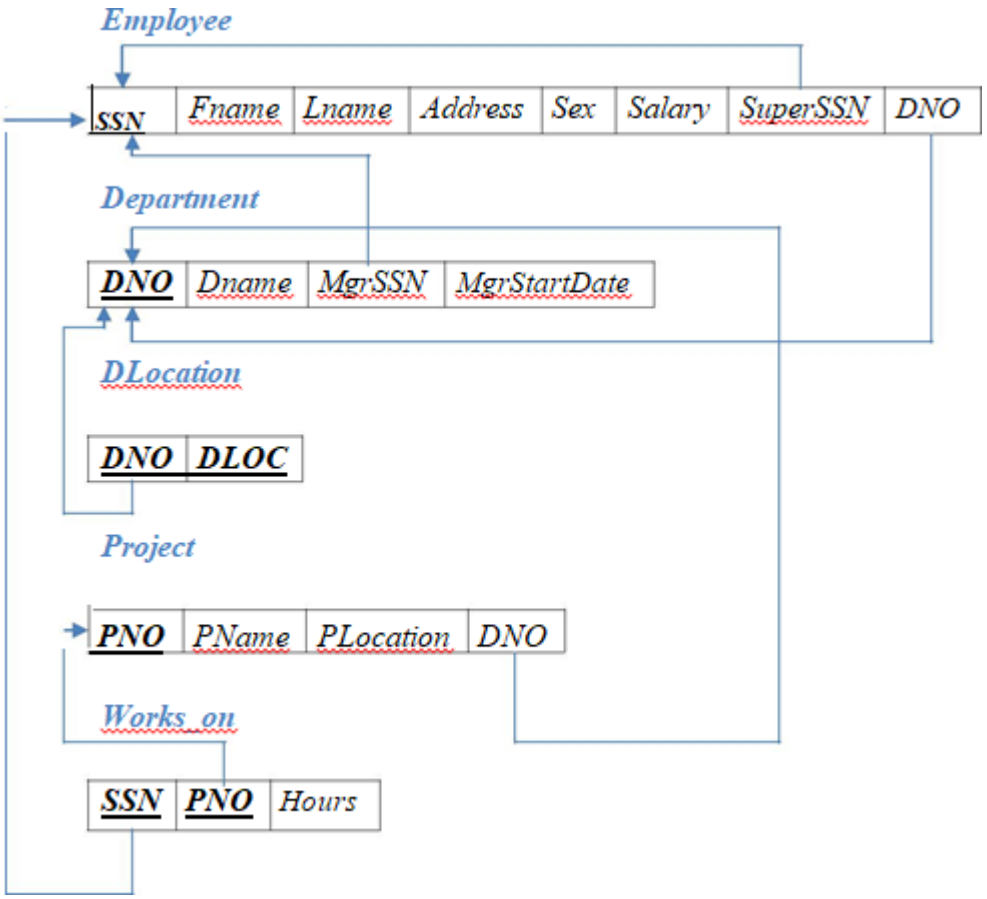


Table Creation

```
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 ('SVCE01','NAGESH','HR','BANGALORE','M', 500000);

INSERT INTO DEPARTMENT VALUES ('1','ACCOUNTS','01-JAN-01','RNSACC02');
INSERT INTO DEPARTMENT VALUES ('2','IT','01-AUG-16','SVCE01');
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=’SVCE01’;

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, 'SVCE01', 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 W.PNO
FROM DEPARTMENT D, EMPLOYEE
E , WORKS_ON W WHERE
D.MGRSSN=E.SSN
AND D.MGRSSN=W.SSN
AND E.LNAME='SCOTT')
UNION
(SELECT DISTINCT W1.PNO
FROM WORKS_ON W1, EMPLOYEE E1
WHERE E1.SSN=W.SSN AND
E1.NAME='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')
                    MINUS (SELECT PNO
                    FROM WORKS_ON
                     WHERE E.SSN=SSN));
```

FNAME	LNAME
JAMES	SMITH

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

EXTRA PROGRAMS

6. Consider the Insurance database given below. The primary keys are underlined and the data types are specified.

PERSON1 (driver – id #: String, name: string, address: strong)
CAR1 (Regno: string, model: string, year: int)
ACCIDENT1 (report-number: int, accd-date: date, location: string)
OWNS1 (driver-id #: string, Regno: string)
PARTICIPATED1 (driver-id: string, Regno: string, report-number: int, damage amount: int)

- **(i) Create the above tables by properly specifying the primary keys and the foreign keys.**
- **(ii) Enter at least five tuples for each relation.**
- **(iii) Demonstrate how you**
  - **a. Update the damage amount for the car with a specific Regno in the accident with report number 12 to 25000.**
  - **b. Add a new accident to the database.**
- **(iv) Find the total number of people who owned cars that were involved in accidents in 2008.**
- **(v) Find the number of accidents in which cars belonging to a specific model were involved.**
- **(vi) Generate suitable reports.**
- **(vii) Create suitable front end for querying and displaying the results.**

1. INSURANCE DATABASE

I. CREATE ALL THE TABLES WITH NECESSARY CONSTRAINTS

```
CREATE TABLE PERSON
    (
    DRIVER_ID VARCHAR2(10) PRIMARY KEY,
    NAME      VARCHAR2(20),
    ADDRESS   VARCHAR2(15),
    );

CREATE TABLE CAR
    (
    REGNO VARCHAR2 (10) PRIMARY KEY,
    MODEL VARCHAR2 (10),
```

```
    YEAR    NUMBER
    );

  CREATE TABLE ACCIDENT
    (
    REPORT_NO NUMBER (5) PRIMARY KEY,
    ADATE       DATE,
    LOCATION   VARCHAR2 (15)
    );



CREATE TABLE OWNS
    (
     DRIVER_ID VARCHAR2 (10),
     REGNO      VARCHAR2 (10),
     FOREIGN KEY (DRIVER_ID) REFERENCES PERSON (DRIVER_ID),
     FOREIGN KEY (REGNO) REFERENCES CAR (REGNO)
    );

   CREATE TABLE PARTICIPATED
    (
     DRIVER_ID      VARCHAR2 (10),
     REGNO          VARCHAR2 (10),
     REPORT_NO      NUMBER (5),
     DAMAGE_AMT NUMBER (7, 2),
FOREIGN KEY (DRIVER_ID) REFERENCES PERSON (DRIVER_ID) ON DELETE
CASCADE,
FOREIGN KEY (REGNO) REFERENCES CAR (REGNO) ON DELETE CASCADE,
FOREIGN KEY (REPORT_NO) REFERENCES ACCIDENT (REPORT_NO) ON DELETE
CASCADE);
```

Note:

Use the ON DELETE CASCADE option if you want rows deleted in the child table when corresponding rows are deleted in the parent table. If you do not specify cascading deletes, the default behavior of the database server prevents you from deleting data in a table if other tables reference it.

II. INSERT THE RECORDS INTO THE RELATIONS

```
INSERT INTO PERSON
VALUES ('&DRIVER_ID','&NAME','&ADDRESS');

INSERT INTO CAR
VALUES ('&REGNO','&MODEL', &YEAR);
INSERT INTO ACCIDENT
VALUES (&REPORT_NO,'&ADATE','&LOCATION');

INSERT INTO OWNS
VALUES ('&DRIVER_ID','&REGNO');

INSERT INTO PARTICIPATED
VALUES ('&DRIVER_ID','&REGNO','&REPORT_NO', &DAMAGE_AMT);
```

III. VIEW THE RECORDS

```
SELECT * FROM PERSON;
```

DRIVER_ID	NAME	ADDRESS
1111	MAHESH	K.S.LAYOUT
2222	ARUN	INDIRANAGAR
3333	JOHN	JAYANAGAR
4444	NANDU	WHITEFIELD
5555	SMITH	VIJAYANAGAR

```
SELECT * FROM CAR;
```

REGNO	MODEL	YEAR
KA04Q2301	MARUTHI-DX	2000
KA05P1000	FORDICON	2000
KA03L1234	ZEN-VXI	1999
KA03L9999	MARUTH-DX	2002
KA01P4020	INDICA-VX	2002

SELECT * FROM ACCIDENT;

REPORT_NO	ADATE	LOCATION
12	01-JUN-02	M G ROAD
200	10-DEC-02	DOUBLEROAD
300	23-JUL-99	M G ROAD
2500	11-JUN-00	RESIDENCY ROAD
2600	16-OCT-01	RICHMOND ROAD

SELECT * FROM OWNS;

DRIVER_ID	REGNO
1111	KA04Q2301
1111	KA05P1000
2222	KA03L1234
3333	KA03L9999
4444	KA01P4020

SELECT * FROM PARTICIPATED;

DRIVER_ID	REGNO	REPORT_NO	DAMAGE_AMT
1111	KA04Q2301	12	20000
2222	KA03L1234	200	500
3333	KA03L9999	300	10000
4444	KA01P4020	2500	2375
1111	KA05P1000	2600	70000

IV. a) DEMONSTRATE HOW YOU UPDATE DAMAGE AMOUNT FOR THE CAR WITH A SPECIFIC REGNO IN ACCIDENT WITH REPORTNO 12 TO 25000

```
UPDATE PARTICIPATED SET DAMAGE_AMT=25000
WHERE REPORT_NO =’12’ AND REGNO='KA04Q2301';
```

b) ADD A NEW ACCIDENT TO THE DATABASE.

```
INSERT INTO ACCIDENT
```

```
VALUES (500,'20-JAN-07','M G ROAD');
```

V. FIND THE TOTAL NO OF PEOPLE WHO OWNED CARS THAT WERE INVOLVED IN ACCIDENTS 2008.

```
SELECT COUNT (*) FROM ACCIDENT
  WHERE ADATE LIKE '--------- 08';
                    (Or)

SELECT COUNT (*) FROM ACCIDENT
  WHERE ADATE LIKE '%08';
```

VI. FIND THE NO OF ACCIDENTS IN WHICH CARS BELONGING TO A SPECIFIC MODEL WERE INVOLVED.

```
SELECT COUNT (*)
FROM CAR C, PARTICIPATED P
WHERE C.REGNO=P.REGNO AND C.MODEL='MARUTHI-DX';
```

VII FIND THE NO OF ACCIDENTS IN WHICH CARS BELONGING TO ALL MODEL WERE INVOLVED.

```
SELECT COUNT (*)
FROM CAR C, PARTICIPATED P
 WHERE C.REGNO=P.REGNO
 GROUP BY C.MODEL;
```

7. Consider The Following Database For A Banking Enterprise

Branch (Branch-Name String, Branch City: String, Assets: Real)

Account (Accno: Int, Branch-Name: String, Balance: Real)

Depositor (Customer-Name: String, Accno: Int)

Customer (Customer-Name: String, Customer-Street: String, Customercity: String) Loan (Loan-Number: Int, Branch-Name: String, Amount: Real)

Borrower (Customer-Name: String, Loan-Number: Int)

Create the above tables by properly specifying the primary keys and the foreign keys
Enter at least five tuples for each relation
Find all the customers who have at least two accounts at the *Main* branch.
Find all the customers who have an account at *all* the branches located in a specificcity.
Demonstrate how you delete all account tuples at every branch located in a specificcity.
Generate suitable reports.
Create suitable front end for querying and displaying the results.

I. CREATION OF TABLES WITH NECESSARY CONSTRAINTS

```
CREATE TABLE BRANCH
  (
        BRANCH_NAME VARCHAR2 (15) PRIMARY KEY,
        BRANCH_CITY VARCHAR2 (15),
        ASSETS NUMBER
  );
CREATE TABLE CUSTOMER
  (
        CUSTOMER_NAME      VARCHAR2 (15) PRIMARY KEY,
        CUSTOMER_ADDRESS VARCHAR2 (15),
        CUSTOMER_CITY        VARCHAR2 (15));

CREATE TABLE ACCOUNT
```

```
(
        ACCOUNT_NUMBER VARCHAR2 (15),
        BRANCH_NAME      VARCHAR2 (15),
        BALANCE              NUMBER , PRIMARY KEY (ACCOUNT_NUMBER),
        FOREIGN KEY (BRANCH_NAME) REFERENCES
         BRANCH (BRANCH_NAME) ON DELETE CASCADE
        );


        CREATE TABLE DEPOSITOR

        (

        CUSTOMER_NAME    VARCHAR2 (15),
        ACCOUNT_NUMBER VARCHAR2 (15),
        FOREIGN KEY (CUSTOMER_NAME)
        REFERENCES CUSTOMER
        (CUSTOMER_NAME) ON DELETE
        CASCADE, FOREIGN KEY
        (ACCOUNT_NUMBER) REFERENCES
        ACCOUNT (ACCOUNT_NUMBER) ON
        DELETE CASCADE);


       CREATE TABLE LOAN

        (
        LOAN_NUMBER NUMBER(6) PRIMARY KEY,
        BRANCH_NAME VARCHAR2 (15),
        AMOUNT           NUMBER (10, 4),
        FOREIGN KEY (BRANCH_NAME) REFERENCES
                BRANCH (BRANCH_NAME) ON DELETE CASCADE);

        CREATE TABLE BORROWER

        (

        CUSTOMER_NAME VARCHAR2 (15),
        LOAN_NUMBER      NUMBER (5),
        FOREIGN KEY (CUSTOMER_NAME) REFERENCES
        CUSTOMER (CUSTOMER_NAME) ON DELETE
        CASCADE, FOREIGN KEY (LOAN_NUMBER)
        REFERENCES
                LOAN (LOAN_NUMBER) ON DELETE CASCADE);
```

II. INSERTION OF TUPLES INTO THE RELATION

```
INSERT INTO BRANCH VALUES
('&BRANCH_NAME','&BRANCH_CITY',&ASSETS);
INSERT INTO CUSTOMER VALUES('&CUSTOMER_NAME','&
CUSTOMER_ADDRESS', '&CUSTOMER_CITY');
INSERT INTO ACCOUNT VALUES
('&ACCOUNT_NUMBER','&BRANCH_NAME',&BALANCE);
INSERT INTO DEPOSITOR
VALUES('&CUSTOMER_NAME','&ACCOUNT_NUMBER'); INSERT
INTO LOAN
VALUES(&LOAN_NUMBER,'&BRANCH_NAME',&AMOUNT);
INSERT INTO BORROWER
VALUES('&CUSTOMER_NAME',&LOAN_NUMBER);
```

III. VIEW THE RECORDS

```
SELECT * FROM BRANCH;
```

BRANCH_NAME	BRANCH_CITY	ASSETS
KUMBALAGODU	CHENNAI	200000
JAYANAGAR	BANGALORE	100000
VIJAYANAGAR	BANGALORE	300000
KUVEMPUNAGAR	MYSORE	100000
GOKULUM	MYSORE	100000

```
SELECT * FROM CUSTOMER;
```

CUSTOMER_NAME	CUSTOMER_ADDRES	CUSTOMER_CITY
RAVI	VIJAYANAGAR	BANGALORE
HARISH	BULLTEMPLEROAD	BANGALORE
BHAVYA	GANDHIBAZAR	BANGALORE
SRIRAM	KUMBALAGODU	BANGALORE
RANI	MGROAD	BANGALORE

```
SELECT * FROM ACCOUNT;
```

ACCOUNT_NUMBER	BRANCH_NAME	BALANCE
101	KUMBALAGODU	2000
102	KUMBALAGODU	3000
103	VIJAYANAGAR	4000
104	KUVEMPUNAGAR	5000
105	GOKULUM	5000
106	JAYANAGAR	6000
107	KUMBALAGODU	5000

SELECT * FROM LOAN;

LOAN_NUMBER	BRANCH_NAME	AMOUNT
201	KUMBALAGODU	10000
202	JAYANAGAR	20000
203	VIJAYANAGAR	30000
204	KUVEMPUNAGAR	40000
205	GOKULUM	50000

I. FIND ALL CUSTOMERS WHO HAVe ACCOUNT AT ALL THE BRANCHES LOCATED IN A SPECIFIC CITY

```
SELECT * FROM CUSTOMER C
WHERE
NOT EXISTS (SELECT BRANCH_NAME
            FROM BRANCH
            WHERE BRANCH_CITY ='&BRANCH_CITY'
          MINUS
            SELECT A.BRANCH_NAME
            FROM ACCOUNT A, DEPOSITOR D
            WHERE D.ACCOUNT_NUMBER=A.ACCOUNT_NUMBER
            AND C.CUSTOMER_NAME=D.CUSTOMER_NAME);
```

II. FIND ALL CUSTOMERS WHO HAVE AT LEAST TWO ACCOUNTS AT THE MAIN BRANCH

```
SELECT * FROM CUSTOMER C
  WHERE
   EXISTS (SELECT CUSTOMER_NAME,COUNT(D.CUSTOMER_NAME)
        FROM    DEPOSITOR D, ACCOUNT A
        WHERE D.ACCOUNT_NUMBER=A. ACCOUNT_NUMBER
        AND
        C.CUSTOMER_NAME=D.CU
        STOMER_NAME          AND
        A.BRANCH_NAME='KUMBA
        LAGODU'      GROUP      BY
        D.CUSTOMER_NAME
        HAVING COUNT (D.CUSTOMER_NAME)>=2
       );
```

IV. DEMONSTRATE HOW YOU DELETE ALL THE TUPLES AT EVERY BRANCH LOCATED IN A PARTICULAR CITY.

```
DELETE FROM ACCOUNT
WHERE BRANCH_NAME
IN (SELECT B.BRANCH_NAME
     FROM BRANCH B
     WHERE B.BRANCH_CITY='BANGALORE'
```

Viva Questions

1. What is SQL?

Structured Query Language

2. What is database?

A database is a logically coherent collection of data with some inherent meaning, representing some aspect of real world and which is designed, built and populated with data for a specific purpose.

3. What is DBMS?

It is a collection of programs that enables user to create and maintain a database. In other words it is general-purpose software that provides the users with the processes of defining, constructing and manipulating the database for various applications.

4. What is a Database system?

The database and DBMS software together is called as Database system.

5. Advantages of DBMS?

- Redundancy is controlled.
- Unauthorized access is restricted.
- Providing multiple user interfaces.
- Enforcing integrity constraints.
- Providing backup and recovery.

6. Disadvantage in File Processing System?

- Data redundancy & inconsistency.
- Difficult in accessing data.
- Data isolation.
- Data integrity.
- Concurrent access is not possible.
- Security Problems.

7. Describe the three levels of data abstraction? There are three levels of abstraction:

- Physical level: The lowest level of abstraction describes how data are stored.

- Logical level: The next higher level of abstraction, describes what data are stored in database and what relationship among those data.
- View level: The highest level of abstraction describes only part of entire database.

8. Define the "integrity rules"

There are two Integrity rules.

- Entity Integrity: States that “Primary key cannot have NULL value”
- Referential Integrity: States that “Foreign Key can be either a NULL value or should be Primary Key value of other relation.

9. What is extension and intension?

Extension - It is the number of tuples present in a table at any instance. This is time dependent.

Intension - It is a constant value that gives the name, structure of table and the constraints laid on it.

10. What is Data Independence?

Data independence means that “the application is independent of the storage structure and access strategy of data”. In other words, The ability to modify the schema definition in one level should not affect the schema definition in the next higher level.

Two types of Data Independence:

- Physical Data Independence: Modification in physical level should not affect the logical level.
- Logical Data Independence: Modification in logical level should affect the view level.

NOTE: Logical Data Independence is more difficult to achieve

11. What is a view? How it is related to data independence?

A view may be thought of as a virtual table, that is, a table that does not really exist in its own right but is instead derived from one or more underlying base table. In other words, there is no stored file that direct represents the view instead a definition of view is stored in data dictionary.

Growth and restructuring of base tables is not reflected in views. Thus the view can insulate users from the effects of restructuring and growth in the database. Hence accounts for logical data independence.

12. What is Data Model?

A collection of conceptual tools for describing data, data relationships data semantics and constraints.

13. What is E-R model?

This data model is based on real world that consists of basic objects called entities and of relationship among these objects. Entities are described in a database by a set of attributes.

14. What is Object Oriented model?

This model is based on collection of objects. An object contains values stored in instance variables within the object. An object also contains bodies of code that operate on the object. These bodies of code are called methods. Objects that contain same types of values and the same methods are grouped together into classes.

15. What is an Entity?

It is an 'object' in the real world with an independent existence.

16. What is an Entity type?

It is a collection (set) of entities that have same attributes.

17. What is an Entity set?

It is a collection of all entities of particular entity type in the database.

18. What is an Extension of entity type?

The collections of entities of a particular entity type are grouped together intonentity set.

19. What is an attribute?

It is a particular property, which describes the entity.

20. What is a Relation Schema and a Relation?

A relation Schema denoted by R(A1, A2, …, An) is made up of the relation name R and the list of attributes A_i that it contains. A relation is defined as a set of tuples. Let r be the relation which contains set tuples (t1, t2, t3, ...,tn). Each tuple is an ordered list of n-values t=(v1,v2, ..., vn).

21. What is degree of a Relation?

It is the number of attribute of its relation schema.

22. What is Relationship?

It is an association among two or more entities.

23. What is Relationship set?

The collection (or set) of similar relationships.

24. What is Relationship type?

Relationship type defines a set of associations or a relationship set among a given set of entity types.

25. What is degree of Relationship type?

It is the number of entity type participating.

26. What is DDL (Data Definition Language)?

A data base schema is specified by a set of definitions expressed by a special language called DDL.

27. What is VDL (View Definition Language)?

It specifies user views and their mappings to the conceptual schema.

28. What is SDL (Storage Definition Language)?

This language is to specify the internal schema. This language may specify the mapping between two schemas.

29. What is Data Storage - Definition Language?

The storage structures and access methods used by database system are specified by a set of definition in a special type of DDL called data storage- definition language.

30. What is DML (Data Manipulation Language)?

This language that enable user to access or manipulate data as organized by appropriate data model.

- Procedural DML or Low level: DML requires a user to specify what data are needed and how to get those data.
- Non-Procedural DML or High level: DML requires a user to specify what data are needed without specifying how to get those data.

31. What is DML Compiler?

It translates DML statements in a query language into low-level instruction that the query evaluation engine can understand.

32. What is Relational Algebra?

It is a procedural query language. It consists of a set of operations that take one or

two relations as input and produce a new relation.

33. What is Relational Calculus?

It is an applied predicate calculus specifically tailored for relational databases proposed by E.F. Codd. E.g. of languages based on it are DSL, ALPHA, QUEL.

34. What is normalization?

It is a process of analyzing the given relation schemas based on their Functional Dependencies (FDs) and primary key to achieve the properties

- Minimizing redundancy
- Minimizing insertion, deletion and update anomalies.

35. What is Functional Dependency?

A Functional dependency is denoted by X Y between sets of attributes X and Y

that are subsets of R specifies a constraint on the possible tuple that can form a relation state r of R. The constraint is for any two tuples t1 and t2 in r if t1[X] = t2[X] then they have t1[Y] = t2[Y]. This means the value of X component of a tuple uniquely determines the value of component Y.

36. When is a functional dependency F said to be minimal?

- Every dependency in F has a single attribute for its right hand side.
- We cannot replace any dependency X A in F a dependency Y A where Y is a → proper subset of X and still have a set of dependency that is equivalent to F.
- We cannot remove any dependency from F and still have set of dependency that is equivalent to F.

37. What is Multi valued dependency?

Multivalued dependency denoted by X→Y specified on relation schema R, where X and Y are both subsets of R, specifies the following constraint on any relation r of R: if two tuples t1 and t2 exist in r such that t1[X] = t2[X] then t3 and t4 should also exist in r with the following properties

- t3[x] = t4[X] = t1[X] = t2[X]
- t3[Y] = t1[Y] and t4[Y] = t2[Y]

- t3[Z] = t2[Z] and t4[Z] =
  t1[Z] where [Z =
  (R-(X U Y))]

38. What is Lossless join property?

It guarantees that the spurious tuple generation does not occur with respect to relation schemas after decomposition.

39. What is 1 NF (Normal Form)?

The domain of attribute must include only atomic (simple, indivisible) values.

40. What is Fully Functional dependency?

It is based on concept of full functional dependency. A functional dependency X Y is fully functional dependency if removal of any attribute A from X means that the dependency does not hold any more.

41. What is 2NF?

A relation schema R is in 2NF if it is in 1NF and every non-prime attribute A in R is fully functionally dependent on primary key.

42. What is 3NF?

A relation schema R is in 3NF if it is in 2NF and for every FD X A either of the following is true

- X is a Super-key of R.
- A is a prime attribute of R.

  In other words, if every nonprime attribute is non-transitively dependent on primary key.

43. What is BCNF (Boyce- Codd Normal Form)?

A relation schema R is in BCNF if it is in 3NF and satisfies additional constraints that for every FD X A, X must be a candidate key.

44. What is 4NF?

A relation schema R is said to be in 4NF if for every Multi valued dependency X Y that holds over R, one of following is true

- X is subset or equal to (or) XY = R.
- X is a super key.

45. What is 5NF?

A Relation schema R is said to be 5NF if for every join dependency {R1, R2, ...,Rn} that holds R, one the following is true

- Ri = R for some i.
- The join dependency is implied by the set of FD, over R in which the left side is key of R.

46. What is Domain-Key Normal Form?

A relation is said to be in DKNF if all constraints and dependencies that should hold on the

constraint can be enforced by simply enforcing the domain constraint and key constraint on the relation.

47. What are partial, alternate,, artificial, compound and natural key?

Partial Key:

It is a set of attributes that can uniquely identify weak entities and that are related to same owner entity. It is sometime called as Discriminator. Alternate Key:

All Candidate Keys excluding the Primary Key are known as Alternate Keys.

Artificial Key:

If no obvious key, either stand alone or compound is available, then the last Resort is to simply create a key, by assigning a unique number to each record or occurrence. Then

This is known as developing an artificial key.

Compound Key**:**

If no single data element uniquely identifies occurrences within a construct, then

combining multiple elements to create a unique identifier for the construct is known as creating a

Compound key.

Natural Key**:**

When one of the data elements stored within a construct is utilized as the primary key, then it is called the natural key.

48. What is indexing and what are the different kinds of indexing?

Indexing is a technique for determining how quickly specific data can be found.

- Binary search style indexing

- B-Tree indexing
- Inverted list indexing
- Memory resident table
- Table indexing

49. What is system catalog or catalog relation? How is better known as?

A RDBMS maintains a description of all the data that it contains, information about every relation and index that it contains. This information is stored in a collection of relations maintained by the system called metadata. It is also called data dictionary.

50. What is meant by query optimization?

The phase that identifies an efficient execution plan for evaluating a query that has the least estimated cost is referred to as query optimization.

51. What is join dependency and inclusion dependency?

Join Dependency:

A Join dependency is generalization of Multi valued dependency. A JD {R1, R2, ...,Rn} is said to hold over a relation R if R1, R2, R3, ..., Rn is a lossless-join decomposition of R . There is no set of sound and complete inference rules for JD. Inclusion Dependency:

An Inclusion Dependency is a statement of the form that some columns of a relation are contained in other columns. A foreign key constraint is an example of inclusion dependency.

52. What is durability in DBMS?

Once the DBMS informs the user that a transaction has successfully completed, its effects should persist even if the system crashes before all its changes are reflected on disk. This property is called durability.

53. What do you mean by atomicity and aggregation?

Atomicity:

Either all actions are carried out or none are. Users should not have to worry about the effect of incomplete transactions. DBMS ensures this by undoing the actions of incomplete transactions.

Aggregation*:*

A concept which is used to model a relationship between a collection of entities and relationships. It is used when we need to express a relationship among relationships.

54. What is a Phantom Deadlock?

In distributed deadlock detection, the delay in propagating local information might cause the deadlock detection algorithms to identify deadlocks that do not really exist. Such situations are called phantom deadlocks and they lead to unnecessary aborts.

55. What is a checkpoint and when does it occur?

A Checkpoint is like a snapshot of the DBMS state. By taking checkpoints, the DBMS can reduce the amount of work to be done during restart in the event of subsequent crashes.

56. What are the different phases of transaction? Different phases are

- Analysis phase
- Redo Phase
- Undo phase

57. What do you mean by flat file database?

It is a database in which there are no programs or user access languages. It has no cross-file capabilities but is user-friendly and provides user-interface management.

58. What is "transparent DBMS"?

It is one, which keeps its Physical Structure hidden from user.

59. Brief theory of Network, Hierarchical schemas and their properties

Network schema uses a graph data structure to organize records example for such a database management system is CTCG while a hierarchical schema uses a tree data structure example for such a system is IMS.

60. What is a query?

A query with respect to DBMS relates to user commands that are used to interact with a data base. The query language can be classified into data definition language and data manipulation language.

61. What do you mean by Correlated subquery?

Sub queries, or nested queries, are used to bring back a set of rows to be used by the parent query. Depending on how the sub query is written, it can be executed once for the parent

query or it can be executed once for each row returned by the parent query. If the sub query is executed for each row of the parent, this is called a *correlated sub query*.

A correlated sub query can be easily identified if it contains any references to the parent sub query columns in its WHERE clause. Columns from the sub query cannot be referenced anywhere else in the parent query. The following example demonstrates a non-correlated sub query.

E.g. Select * From CUST Where '10/03/1990' IN (Select ODATE From ORDER Where CUST.CNUM = ORDER.CNUM)

62. What are the primitive operations common to all record management systems? Addition, deletion and modification.

63. Name the buffer in which all the commands that are typed in are stored

64. What are the unary operations in Relational Algebra? PROJECTION and SELECTION.

65. Are the resulting relations of PRODUCT and JOIN operation the same?

No.

PRODUCT: Concatenation of every row in one relation with every row in another.

JOIN: Concatenation of rows from one relation and related rows from another.

66. What is RDBMS KERNEL?

Two important pieces of RDBMS architecture are the kernel, which is the software, and the data dictionary, which consists of the system-level data structures used by the kernel to manage the database

You might think of an RDBMS as an operating system (or set of subsystems), designed specifically for controlling data access; its primary functions are storing, retrieving, and securing data. An RDBMS maintains its own list of authorized users and their associated privileges; manages memory caches and paging; controls locking for concurrent resource usage; dispatches and schedules user requests; and manages space usage within its table-space structures.

67. Name the sub-systems of a RDBMS

I/O, Security, Language Processing, Process Control, Storage Management, Logging and Recovery, Distribution Control, Transaction Control, Memory Management, Lock Management

68. Which part of the RDBMS takes care of the data dictionary? How

Data dictionary is a set of tables and database objects that is stored in a special area of the database and maintained exclusively by the kernel.

69. What is the job of the information stored in data-dictionary?

The information in the data dictionary validates the existence of the objects, provides access to them, and maps the actual physical storage location.

70. Not only RDBMS takes care of locating data it also

Determines an optimal access path to store or retrieve the data

71. How do you communicate with an RDBMS?

You communicate with an RDBMS using Structured Query Language (SQL)

72. Define SQL and state the differences between SQL and other conventional programming Languages

SQL is a nonprocedural language that is designed specifically for data access operations on normalized relational database structures. The primary difference between SQL and other conventional programming languages is that SQL statements specify what data operations should be performed rather than how to perform them.

73. Name the three major set of files on disk that compose a database in Oracle

There are three major sets of files on disk that compose a database. All the files are binary. These are

- Database files
- Control files
- Redo logs

The most important of these are the database files where the actual data resides. The control files and the redo logs support the functioning of the architecture itself.

All three sets of files must be present, open, and available to Oracle for any data on the database to be useable. Without these files, you cannot access the database, and the

database administrator might have to recover some or all of the database using a backup, if there is one.

74. What is an Oracle Instance?

The Oracle system processes, also known as Oracle background processes, provide functions for the user processes—functions that would otherwise be done by the user processes themselves

Oracle database-wide system memory is known as the SGA, the system global area or shared global area. The data and control structures in the SGA are shareable, and all the Oracle background processes and user processes can use them.

The combination of the SGA and the Oracle background processes is known as an Oracle instance

75. What are the four Oracle system processes that must always be up and running for the

database to be useable

The four Oracle system processes that must always be up and running for the database to be useable include DBWR (Database Writer), LGWR (Log Writer), SMON (System Monitor), and PMON (Process Monitor).

76. What are database files, control files and log files. How many of these files should a database have at least? Why?

Database Files

The database files hold the actual data and are typically the largest in size.

Depending on their sizes, the tables (and other objects) for all the user accounts can go in one database file—but that's not an ideal situation because it does not make the database structure very flexible for controlling access to storage for different users, putting the database on different disk drives, or backing up and restoring just part of the database.

You must have at least one database file but usually, more than one files are used. In terms of accessing and using the data in the tables and other objects, the number (or location) of the files is immaterial.

The database files are fixed in size and never grow bigger than the size at which they were created

Control Files

The control files and redo logs support the rest of the architecture. Any database must have at least one control file, although you typically have more than one to guard against loss. The control file records the name of the database, the date and time it was created, the location of the database and redoes logs, and the synchronization information to ensure that all three sets of files are always in step. Every time you add a new database or redo log file to the database, the information is recorded in the control files.

Redo Logs

Any database must have at least two redo logs. These are the journals for the database; the redo logs record all changes to the user objects or system objects. If any type of failure occurs, the changes recorded in the redo logs can be used to bring the database to a consistent state without losing any committed transactions. In the case of non-data loss failure, Oracle can apply the information in the redo logs automatically without intervention from the DBA.

The redo log files are fixed in size and never grow dynamically from the size at which they were created.

77. What is ROWID?

The ROWID is a unique database-wide physical address for every row on every table. Once assigned (when the row is first inserted into the database), it never changes until the row is deleted or the table is dropped.

The ROWID consists of the following three components, the combination of which uniquely identifies the physical storage location of the row.

- Oracle database file number, which contains the block with the rows
- Oracle block address, which contains the row
- The row within the block (because each block can hold many rows)

The ROWID is used internally in indexes as a quick means of retrieving rows with a particular key value. Application developers also use it in SQL statements as a quick way to access a row once they know the ROWID

78. What is Oracle Block? Can two Oracle Blocks have the same address?

Oracle "formats" the database files into a number of Oracle blocks when they are first created—making it easier for the RDBMS software to manage the files and easier to read data into the memory areas.

The block size should be a multiple of the operating system block size. Regardless of the block size, the entire block is not available for holding data; Oracle takes up some space to manage the contents of the block. This block header has a minimum size, but it can grow.

These Oracle blocks are the smallest unit of storage. Increasing the Oracle block size can improve performance, but it should be done only when the database is first created.

Each Oracle block is numbered sequentially for each database file starting at 1. Two blocks can have the same block address if they are in different database files.

79. What is database Trigger?

A database trigger is a PL/SQL block that can defined to automatically execute for insert, update, and delete statements against a table. The trigger can e defined to execute once for the entire statement or once for every row that is inserted, updated, or deleted. For any one table, there are twelve events for which you can define database triggers. A database trigger can call database procedures that are also written in PL/SQL.

80. Name two utilities that Oracle provides, which are use for backup and recovery.

Along with the RDBMS software, Oracle provides two utilities that you can use to back up and restore the database. These utilities are Exportand Import.

The Export utility dumps the definitions and data for the specified part of the database to an operating system binary file. The Import utility reads the file produced by an export, recreates the definitions of objects, and inserts the data

If Export and Import are used as a means of backing up and recovering the database, all the changes made to the database cannot be recovered since the export was performed. The best you can do is recovering the database to the time when the export was last performed.

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82. What are stored-procedures? And what are the advantages of using them.

Stored procedures are database objects that perform a user defined operation. A stored procedure can have a set of compound SQL statements. A stored procedure executes the SQL commands and returns the result to the client. Stored procedures are used to reduce network traffic.

83. Tables derived from the ERD

a) Are totally unnormalised

b) Are always in 1NF

c) Can be further denormalised

d) May have multi-valued attributes

e) Are always in 1NF

84. Spurious tuples may occur due to

i. Bad normalization

ii. Theta joins

iii. Updating tables from join

a) i& ii b) ii & iii

c) i& iii d) ii & iii

(a) i& iii because theta joins are joins made on keys that are not primary keys.

85. In mapping of ERD to DFD

a) entities in ERD should correspond to an existing entity/store in DFD

b) entity in DFD is converted to attributes of an entity in ERD

c) relations in ERD has 1 to 1 correspondence to processes in DFD

d) relationships in ERD has 1 to 1 correspondence to flows in DFD

(a) entities in ERD should correspond to an existing entity/store in DFD

86. A dominant entity is the entity

a) on the N side in a 1 : N relationship

b) on the 1 side in a 1 : N relationship

c) on either side in a 1 : 1 relationship

d) nothing to do with 1 : 1 or 1 : N relationship

(b) on the 1 side in a 1 : N relationship

87. Select 'NORTH', CUSTOMER From CUST_DTLS Where REGION = 'N' Order By CUSTOMER Union Select 'EAST', CUSTOMER From CUST_DTLS Where REGION

= 'E' Order By CUSTOMER

The above is

a) Not an error

b) Error - the string in single quotes 'NORTH' and 'SOUTH'

c) Error - the string should be in double quotes

d) Error - ORDER BY clause

(d) Error - the ORDER BY clause. Since ORDER BY clause cannot be used in UNIONS

88. What is Storage Manager?

It is a program module that provides the interface between the low-level data stored in database, application programs and queries submitted to the system.

89. What is Buffer Manager?

It is a program module, which is responsible for fetching data from disk storage into main memory and deciding what data to be cache in memory.

90. What is Transaction Manager?

It is a program module, which ensures that database, remains in a consistent state despite system failures and concurrent transaction execution proceeds without conflicting.

91. What is File Manager?

It is a program module, which manages the allocation of space on disk storage and data structure used to represent information stored on a disk.

92. What is Authorization and Integrity manager?

It is the program module, which tests for the satisfaction of integrity constraint and checks the authority of user to access data.

93. What are stand-alone procedures?

Procedures that are not part of a package are known as stand-alone because they independently defined. A good example of a stand-alone procedure is one written in a SQL*Forms application. These types of procedures are not available for reference from other Oracle tools. Another limitation of stand-alone procedures is that they are compiled at run time, which slows execution.

94. What are cursors give different types of cursors.

PL/SQL uses cursors for all database information accesses statements. The language supports the use two types of cursors

- *Implicit*
- *Explicit*

95. What is cold backup and hot backup (in case of Oracle)?

- Cold Backup:

Itis copying the three sets of files (database files, redo logs, and control file) when the instance is shut down. This is a straight file copy, usually from the disk directly to tape. You must shut down the instance to guarantee a consistent copy.

If a cold backup is performed, the only option available in the event of data file loss is restoring all the files from the latest backup. All work performed on the database since the last backup is lost.

- Hot Backup:

Some sites (such as worldwide airline reservations systems) cannot shut down the database while making a backup copy of the files. The cold backup is not an available option.

So different means of backing up database must be used — the hot backup. Issue a SQL command to indicate to Oracle, on a table space-by-table space basis, that the files of the table space are to backed up. The users can continue to make full use of the files, including making changes to the data. Once the user has indicated that he/she wants to back up the table space files, he/she can use the operating system to copy those files to the desired backup destination.

The database must be running in ARCHIVELOG mode for the hot backup option. If a data loss failure does occur, the lost database files can be restored using the hot backup and the online and offline redo logs created since the backup was done. The database is restored to the most consistent state without any loss of committed transactions.

96. How can you find the minimal key of relational schema?

Minimal key is one which can identify each tuple of the given relation schema uniquely. For finding the minimal key it is required to find the closure that is the set of all attributes that are dependent on any given set of attributes under the given set of functional dependency.

Algo. I Determining X^+, closure for X, given set of FDs F

1. Set $X^+ = X$
2. Set Old $X^+ = X^+$
3. For each FD Y → Z in F and if Y belongs to X^+ then add Z to X^+
4. Repeat steps 2 and 3 until Old $X^+ = X^+$

Algo.II Determining minimal K for relation schema R, given set of FDs F 1. Set K to R that is make K a set of all attributes in R

2. For each attribute A in K
   a. Compute $(K – A)^+$ with respect to F
   b. If $(K – A)^+ = R$ then set $K = (K – A)^+$

97. What do you understand by dependency preservation?

Given a relation R and a set of FDs F, dependency preservation states that the closure of the union of the projection of F on each decomposed relation Ri is equal to the closure of F. i.e.,

$$((\Pi_{R1}(F)) \cup \ldots \cup (\Pi_{Rn}(F)))^+ = F^+$$

if decomposition is not dependency preserving, then some dependency is lost in the decomposition.

98. What is meant by Proactive, Retroactive and Simultaneous Update.

Proactive Update:

The updates that are applied to database before it becomes effective in real world.

Retroactive Update:

The updates that are applied to database after it becomes effective in real world.

Simultaneous Update:

The updates that are applied to database at the same time when it becomes effective in real world .

99. What are the different types of JOIN operations?

Equi Join: This is the most common type of join which involves only equality comparisons. The disadvantage in this type of join is that there