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Database System Concepts and PL/SQL (20CS34P)

REPORT

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CHAPTER – 1

BASIC CONCEPTS OF PostgreSQL

1.1 Introduction to PostgreSQL

PostgreSQL is an object-relational database management system (ORDBMS) based on the INGRES (INteractive Graphics REtrieval System) package. Developed at the University of California, Berkeley. The POSTGRES (Post Ingres) project started in 1985, and version 1 was released to a small number of external users in June of 1989. PostgreSQL has become the most advanced open source database, available all over the world. PostgreSQL has become a popular Database as a Service (DBaaS) among the current clouds. PostgreSQL can be delivered as DBaaS on many clouds, such as Amazon Web Services (AWS), Google Cloud SQL, Microsoft Azure, Heroku, and EnterpriseDB Cloud. PostgreSQL supports a large part of the SQL standard and offers many modern features: complex queries, foreign keys, triggers, updatable views, transactional integrity, multiversion concurrency control. PostgreSQL can be extended by the user in many ways, for example by adding new data types, functions, operators, aggregate functions, index methods and procedural languages. It is fully ACID(Atomicity, Consistency, Isolation, Durability) compliant which makes it an ideal choice for OLTP (Online Transaction Processing). It is also capable of performing database analytics. It can be integrated with mathematical software like Matlab and R.

1.2 PostgreSQL Commands

SQL commands are instructions used to communicate with the database to perform specific task that work with data. SQL commands can be used not only for searching the database but also to perform various other functions like, for example, you can create tables, add data to tables, or modify data, drop the table, set permissions for users. SQL commands are grouped into four major categories depending on their functionality:

- **Data Definition Language (DDL)** - These SQL commands are used for creating, modifying, and dropping the structure of database objects. The commands are CREATE, ALTER, DROP, RENAME, and TRUNCATE.
- **Data Manipulation Language (DML)** - These SQL commands are used for storing, retrieving, modifying and deleting data. These commands are SELECT, INSERT, UPDATE, and DELETE.
- **Transaction Control Language (TCL)** - These SQL commands are used for managing

changes affecting the data. These commands are COMMIT, ROLLBACK, and SAVEPOINT.

- **Data Control Language (DCL)** - These SQL commands are used for providing security to database objects. These commands are GRANT and REVOKE.

1.2.1 Data Definition Language (DDL)

1.2.1.1 CREATE TABLE Statement

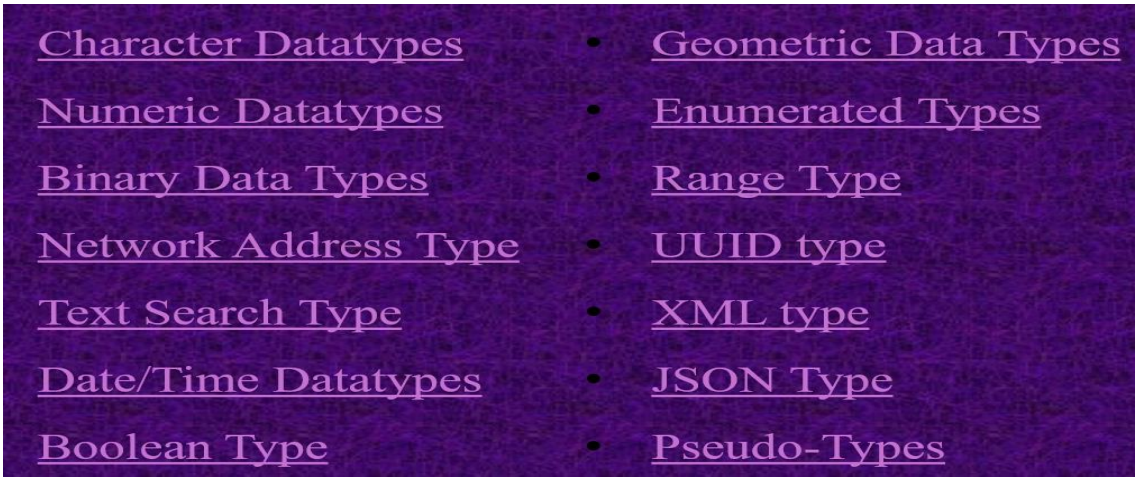
The CREATE TABLE Statement is used to create tables to store data. Integrity Constraints like primary key, unique key and foreign key can be defined for the columns while creating the table. The integrity constraints can be defined at column level or table level. The implementation and the syntax of the CREATE Statements differs for different RDBMS.

The Syntax for the CREATE TABLE Statement is:

```
CREATE TABLE table_name
(column_name1 datatype constraint,
column_name2  datatype, ...
column_nameN datatype);
```

- ***table_name*** - is the name of the table.
- ***column_name1, column_name2....*** - is the name of the columns
- ***datatype*** - is the datatype for the column like char, date, number etc.

PostgreSQL Data Types:



Character Datatypes

PostgreSQL supports character data types for storing text values. PostgreSQL builds character data types off of the same internal structures. PostgreSQL offers three character data types: CHAR(n), VARCHAR(n), and TEXT.

Name	Description
varchar(n)	Allows you to declare variable-length with a limit
Char(n)	Fixed-length, blank padded
Text	Use can use this data type to declare a variable with unlimited length

Numeric Datatypes

PostgreSQL supports two distinct types of numbers:

- Integers
- Floating-point numbers

Name	Store size	Range
smallint	2 bytes	-32768 to +32767
integer	4 bytes	-2147483648 to +2147483647
bigint	8 bytes	-9223372036854775808 to 9223372036854775807
decimal	variable	If you declared it as decimal datatype ranges from 131072 digits before the decimal point to 16383 digits after the decimal point
numeric	variable	If you declare it as the number, you can include number up to 131072 digits before the decimal point to 16383 digits after the decimal point
real	4 bytes	6 decimal digits precision
double	8 bytes	15 decimal digits precision

Binary Data Types

A binary string is a sequence of octets or bytes. Binary Postgres Data Types are divided in two ways.

- Binary strings allow storing odds of value zero
- Non- printable octets

Character strings not allow zero octets and also disallows any other octet values and sequences which are invalid as per the database's character set encoding rules.

Name	Storage size	Description
Byte	1 to 4 bytes plus the size of the binary string	Variable-length binary string

Network Address Type

Many applications store network information like IP addresses of users or sensors. PostgreSQL has three native types which help you to optimize the network data.

Name	Size	Description
cider	7 or 19 bytes	IPV4 and IPv6 networks
Inet	7 or 19 bytes	IPV4 and IPV5 host and networks
macaddr	6 bytes	MAC addresses

PostgreSQL Integrity Constraints:

Integrity Constraints are used to apply business rules for the database tables.The constraints available in SQL are **Foreign Key, Primary key, Not Null, Unique, Check.**

Constraints can be defined in two ways:

1. The constraints can be specified immediately after the column definition. This is called column-level definition.
2. The constraints can be specified after all the columns are defined. This is called table-level definition.

1) Primary key:

This constraint defines a column or combination of columns which uniquelyidentifies each row in the table.

Syntax to define a Primary key at column level:

```
Column_name datatype [CONSTRAINT constraint_name] PRIMARY KEY
```

Syntax to define a Primary key at table level:

```
[CONSTRAINT constraint_name] PRIMARY KEY(column_name1,
column_name2,..)
```

- **column_name1, column_name2** are the names of the columns which define the primary key.
- The syntax within the bracket i.e. [CONSTRAINT constraint_name] is optional.

2) Foreign key or Referential Integrity:

This constraint identifies any column referencing the PRIMARY KEY in another table. It establishes a relationship between two columns in the same table or between different tables. For a column to be defined as a Foreign Key, it should be a defined as a Primary Key in the table which it is referring. One or more columns can be defined as Foreign key.

Syntax to define a Foreign key at column level:

```
[CONSTRAINT constraint_name] REFERENCES
```

```
referenced_table_name(column_name)
```

Syntax to define a Foreign key at table level:

```
[CONSTRAINT constraint_name] FOREIGN KEY(column_name) REFERENCES
```

```
referenced_table_name(column_name);
```

3) Not Null Constraint:

This constraint ensures all rows in the table contain a definite value for the column which is specified as not null. Which means a null value is not allowed.

Syntax to define a Not Null constraint:

```
[CONSTRAINT constraint name] NOT NULL
```

4) Unique Key:

This constraint ensures that a column or a group of columns in each row have adistinct value. A column(s) can have a null value but the values cannot be duplicated.

Syntax to define a Unique key at column level:

```
[CONSTRAINT constraint_name] UNIQUE
```

Syntax to define a Unique key at table level:

```
[CONSTRAINT constraint_name] UNIQUE(column_name)
```

5) Check Constraint:

This constraint defines a business rule on a column. All the rows must satisfy thisrule. The constraint can be applied for a single column or a group of columns.

Syntax to define a Check constraint:

```
[CONSTRAINT constraint_name] CHECK (condition)
```

1.2.1.2 ALTER TABLE Statement

The SQL ALTER TABLE command is used to modify the definition structure) of a table by modifying the definition of its columns. The ALTER command is used to perform the following functions.

1) Add, drop, modify table columns

2) Add and drop constraints

3) Enable and Disable constraints

Syntax to add a column

```
ALTER TABLE table_name ADD column_name datatype;
```

For Example: To add a column "experience" to the employee table, the query would be like

```
ALTER TABLE employee ADD experience number(3);
```

Syntax to drop a column

```
ALTER TABLE table_name DROP column_name;
```

For Example: To drop the column "location" from the employee table, the query would be like

```
ALTER TABLE employee DROP location;
```

Syntax to modify a column

```
ALTER TABLE table_name MODIFY column_name datatype;
```

For Example: To modify the column salary in the employee table, the query would be like

```
ALTER TABLE employee MODIFY salary number(15,2);
```

Syntax to add PRIMARY KEY constraint

```
ALTER TABLE table_name ADD CONSTRAINT constraint_name PRIMARY KEY
column_name;
```

Syntax to drop PRIMARY KEY constraint

```
ALTER TABLE table_name DROP PRIMARY KEY;
```

1.2.1.3 The DROP TABLE Statement

The DROP TABLE statement is used to delete a table.

DROP TABLE table_name;

1.2.1.4 TRUNCATE TABLE Statement

What if we only want to delete the data inside the table, and not the table itself?

Then, use the TRUNCATE TABLE statement:

TRUNCATE TABLE table_name;

1.2.2 Data Manipulation Language (DML):

The SELECT Statement

The SELECT statement is used to select data from a database. The result is stored in a result table, called the result-set.

SELECT Syntax:

```
SELECT * FROM table_name;
```

The SELECT DISTINCT Statement

In a table, some of the columns may contain duplicate values. This is not a problem, however, sometimes you will want to list only the different (distinct) values in a table.The DISTINCT keyword can be used to return only distinct (different) values.

SELECT DISTINCT Syntax:

```
SELECT DISTINCT column_name(s)
FROM table_name;
```

The WHERE Clause

The WHERE clause is used to extract only those records that fulfill a specified criterion.

WHERE Syntax:

```
SELECT column_name(s)
FROM table_name
WHERE column_name operator value;
```

The AND & OR Operators

- The AND operator displays a record if both the first condition and the second condition is true.
- The OR operator displays a record if either the first condition or the second condition is true.

The ORDER BY Clause

- The ORDER BY clause is used to sort the result-set by a specified column.
- The ORDER BY clausesort the records in ascending order by default.
- If you want to sort the records in a descending order, you can use the DESC keyword.

ORDER BY Syntax:

SELECT column_name(s)
FROM table_name
ORDER BY column_name(s) ASC|DESC;

The GROUP BY Clause

The GROUP BY clause can be used to create groups of rows in a table. Group functions can be applied on such groups.

GROUP BY Syntax;

SELECT column_name(s)
FROM table_name
WHERE column_name operator value
GROUP BY column_name(s);

Group functions	Meaning
AVG([DISTINCT|ALL],N])	Returns average value of n
COUNT(*|[DISTINCT|ALL]expr)	Returns the number of rows in the query. When you specify expr, this function considers rows where expr is not null. When you specify the asterisk (*), this function Returns all rows, including duplicates and nulls. You can count either all rows, or only distinct

	values of expr.
MAX([DISTINCT|ALL]expr)	Returns maximum value of expr
MIN([DISTINCT|ALL]expr)	Returns minimum value of expr
SUM([DISTINCT|ALL]n)	Returns sum of values of n

The HAVING clause

The HAVING clause can be used to restrict the display of grouped rows. The result of the grouped query is passed on to the HAVING clause for output filtration.

HAVING Syntax;

```
SELECT column_name(s)
FROM table_name
WHERE column_name operator value
GROUP BY column_name(s)
HAVING condition;
```

The INSERT INTO Statement

The INSERT INTO statement is used to insert a new row in a table.

SQL INSERT INTO Syntax:

It is possible to write the INSERT INTO statement in two forms.

- The first form doesn't specify the column names where the data will be inserted, only their values:

```
INSERT INTO table_nameVALUES (value1, value2, value3,...);
```

OR

```
INSERT INTO table_nameVALUES(&column1, &column2, &column3,...);
```

- The second form specifies both the column names and the values to be inserted:

```
INSERT INTO table_name (column1, column2, column3,...)
VALUES (value1, value2, value3,...);
```

The UPDATE Statement

The UPDATE statement is used to update existing records in a table.

SQL UPDATE Syntax:

```
UPDATE table_name
SET column1=value, column2=value2,...
WHERE some_column=some_value;
```

The DELETE Statement

The DELETE statement is used to delete rows in a table.

SQL DELETE Syntax:

```
DELETE FROM table_name
WHERE some_column=some_value;
```

1.2.3 Transaction Control language

Transaction Control Language (TCL) commands are used to manage transactions in database.These are used to manage the changes made by DML statements. It also allows statements to be grouped together into logical transactions

Commit command

Commit command is used to permanently save any transaction into database.

Following is Commit command's syntax,

commit;

Rollback command

This command restores the database to last committed state. It is also use with savepointcommand to jump to a savepoint in a transaction.

Following is Rollback command's syntax

rollback to savepoint_name;

Savepoint command

savepoint command is used to temporarily save a transaction so that you can rollback to that point whenever necessary.

Following is savepoint command's syntax,

savepoint savepoint_name;

1.2.4 Data Control Language

Data Control Language(DCL) is used to control privilege in Database. To perform any operation in the database, such as for creating tables, sequences or views we need privileges. Privileges are of two types,

- **System :** creating session, table etc are all types of system privilege.
- **Object :** any command or query to work on tables comes under object privilege.

DCL defines two commands,

- **Grant :** Gives user access privileges to database.
- **Revoke :** Take back permissions from user.

To Allow a User to create Session

```
grant create session to username;
```

To Allow a User to create Table

```
grant create table to username;
```

To provide User with some Space on Tablespace to store Table

```
alter user username quota unlimited on system;
```

To Grant all privilege to a User

```
grant sysdba to username
```

To Grant permission to Create any Table

```
grant create any table to username
```

1.3 STORED PROCEDURES in PostgreSQL:

PostgreSQL allows the users to extend the database functionality with the help of user-defined functions and stored procedures through various procedural language elements, which are often referred to as stored procedures.

The store procedures define functions for creating triggers or custom aggregate functions. In addition, stored procedures also add many procedural features e.g., control structures and complex calculation. These allow you to develop custom functions much easier and more effective.

It is possible to call a Procedural code block using the **DO** command without defining a function or stored procedure.

PostgreSQL categorizes the procedural languages into two main groups:

1. Safe languages can be used by any users. SQL and PL/pgSQL are safe languages.
2. Sand-boxed languages are only used by superusers because sand-boxed languages provide the capability to bypass security and allow access to external sources. C is an example of a sandboxed language.

By default, PostgreSQL supports three procedural languages: SQL, PL/pgSQL, and C. You can also load other procedural languages e.g., Perl, Python, and TCL into PostgreSQL using extensions.

Advantages of using PostgreSQL stored procedures:

The stored procedures bring many advantages as follows:

- Reduce the number of round trips between applications and database servers. All SQL statements are wrapped inside a function stored in the PostgreSQL database server so the application only has to issue a function call to get the result back instead of sending multiple SQL statements and wait for the result between each call.
- Increase application performance because the user-defined functions and stored procedures are pre-compiled and stored in the PostgreSQL database server.
- Reusable in many applications. Once you develop a function, you can reuse it in any applications.

Disadvantages of using PostgreSQL stored procedures:

Besides the advantages of using stored procedures, there are some caveats:

- Slowness in software development because stored procedure programming requires specialized skills that many developers do not possess.
- Difficult to manage versions and hard to debug.
- May not be portable to other database management systems e.g., MySQL or Microsoft SQL Server.

```
create or replace procedure transfer(
   sender int,
   receiver int,
   amount dec
)
language plpgsql
as $$
begin
    -- subtracting the amount from the sender's account
    update accounts
    set balance = balance - amount
    where id = sender;

    -- adding the amount to the receiver's account
    update accounts
    set balance = balance + amount
    where id = receiver;

    commit;
end;$$;
```

Calling a stored procedure

To call a stored procedure, you use the CALL statement as follows:

```
call stored_procedure_name(argument_list);
```

Example:

The below statement invokes the transfer stored procedure to transfer $1, 000 from Raju's account to Nikhil's account:

```
call transfer(1, 2, 1000);
```

1.4 VIEWS IN SQL

- Views in SQL are virtual table. A view also contains rows and columns.
- To create the view, we can select the fields from one or more tables present in the database.
- A view can either have specific rows based on certain condition or all the rows of a table.

The reasons for using Views"

- Views restrict access to the data because the view can display selective columns and rows from the table.
- Views provide groups of users with access to data according to their particular permissions.
- Views can be used to retrieve data from several tables, providing data independence for users.

Syntax:

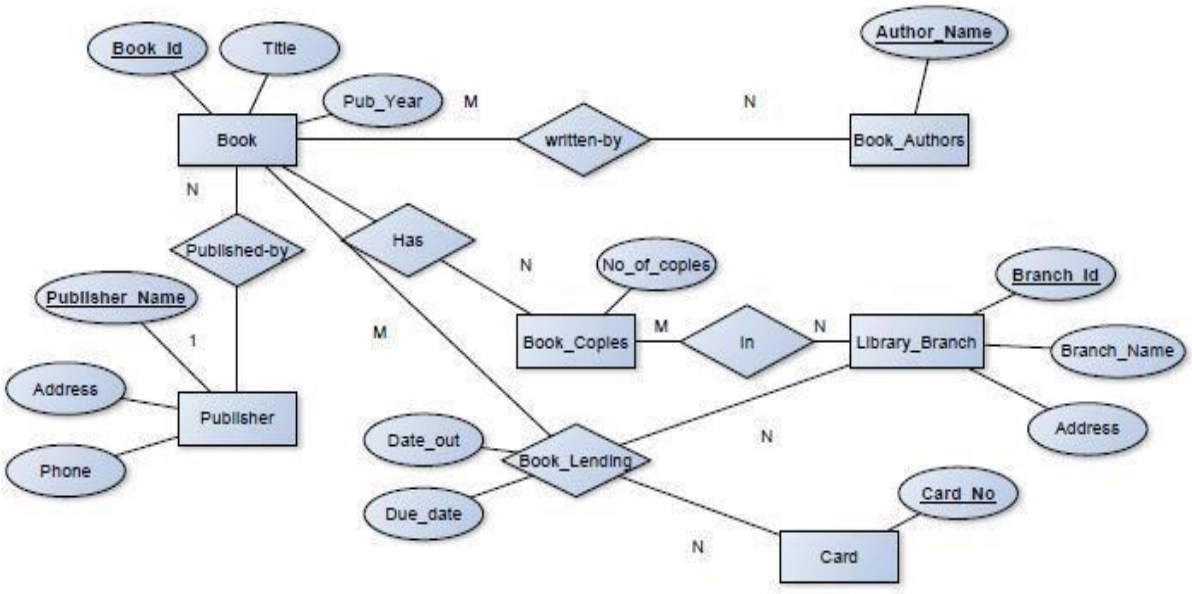
```
CREATE VIEW view_name AS
SELECT column1, column2.....
FROM table_name
WHERE condition;
```

CHAPTER – 2

LIBRARY DATABASE

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.

ER-Diagram:



SCHEMA:

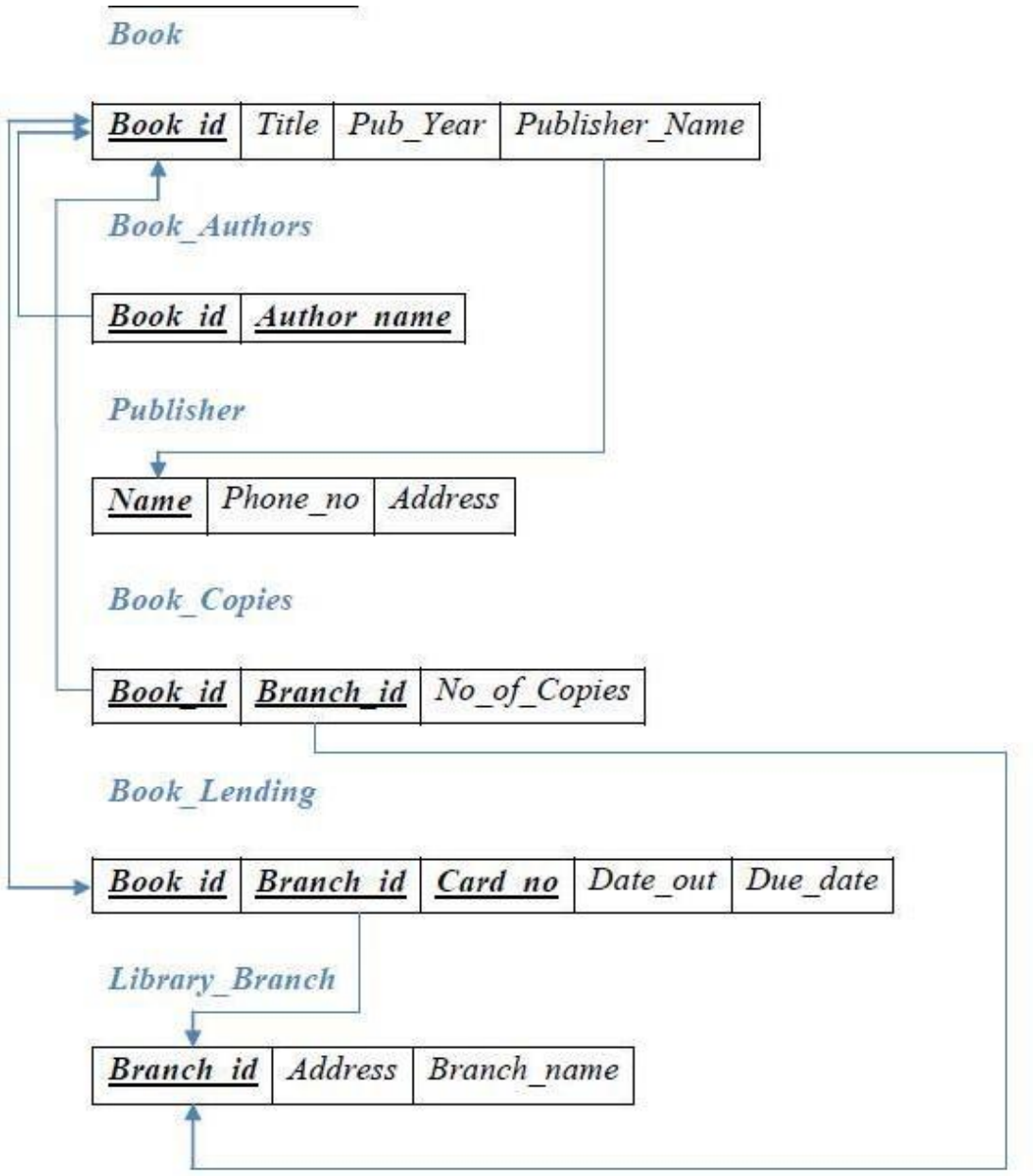

Book
Book_id
Title
Pub_Year
Publisher_Name
Book_Authors
Book_id
Author_name
Publisher
Name
Phone_no
Address
Book_Copies
Book_id
Branch_id
No_of_Copies
Book_Lending
Book_id
Branch_id
Card_no
Date_out
Due_date
Library_Branch
Branch_id
Address
Branch_name

Table Creation:

PUBLISHER

```
SQL> CREATE TABLE PUBLISHER(
     NAME VARCHAR(18) PRIMARY KEY,
     ADDRESS VARCHAR(10),
     PHONE VARCHAR(10));

Table created.
```

BOOK

```
SQL> CREATE TABLE BOOK(
     BOOK_ID INTEGER PRIMARY KEY,
     TITLE VARCHAR(20),
     PUBLISHER_NAME VARCHAR(20)REFERENCES PUBLISHER(NAME)ON DELETE
                                                          CASADE,
     PUB_YEAR NUMBER(4));

Table created.
```

BOOK_AUTHORS

```
SQL> CREATE TABLE BOOK_AUTHORS(
     BOOK_ID INTEGER REFERENCES BOOK(BOOK_ID) ON DELETE CASCADE,
     AUTHOR_NAME VARCHAR(20),
     PRIMARY KEY(BOOK_ID));

Table created.
```

LIBRARY_BRANCH

```
SQL> CREATE TABLE LIBRARY_BRANCH(
     BRANCH_ID INTEGER PRIMARY KEY,
     BRANCH_NAME VARCHAR(18),
     ADDRESS VARCHAR(15));

Table created.
```

BOOK_COPIES

```
SQL> CREATE TABLE BOOK_COPIES(
     BOOK_ID INTEGER REFERENCES BOOK(BOOK_ID) ON DELETE CASCADE,
     BRANCH_ID INTEGER REFERENCES LIBRARY_BRANCH(BRANCH_ID) ON DELETE
                                                          CASCADE,
     NO_OF_COPIES INTEGER,
     PRIMARY KEY(BOOK_ID,BRANCH_ID));

Table created.
```

BOOK_LENDING

```
SQL> CREATE TABLE BOOK_LENDING(
     BOOK_ID INTEGER REFERENCES BOOK(BOOK_ID) ON DELETE CASCADE,
     BRANCH_ID INTEGER REFERENCES LIBRARY_BRANCH(BRANCH_ID) ON DELETE
                                                            CASCADE,
     CARD_NO INTEGER,
     DATE_OUT DATE,
     DUE_DATE DATE,
     PRIMARY KEY(BOOK_ID,BRANCH_ID,CARD_NO));

Table created.
```

Values for tables:

PUBLISHER

```
SQL>INSERT INTO PUBLISHER VALUES('PEARSON','BANGALORE','9875462530');

SQL> INSERT INTO PUBLISHER VALUES('MCGRAW','NEWDELHI','7845691234');

SQL> INSERT INTO PUBLISHER VALUES('SAPNA','BANGALORE','7845963210');
```

BOOK

```
SQL> INSERT INTO BOOK VALUES(1111,'SE','PEARSON',2005);

SQL> INSERT INTO BOOK VALUES(2222,'DBMS','MCGRAW',2004);

SQL> INSERT INTO BOOK VALUES(3333,'ANOTOMY','PEARSON',2010);

SQL> INSERT INTO BOOK VALUES(4444,'ENCYCLOPEDIA','SAPNA',2010);
```

BOOK_AUTHORS

```
SQL> INSERT INTO BOOK_AUTHORS VALUES(1111,'SOMMERVILLE');

SQL> INSERT INTO BOOK_AUTHORS VALUES(2222,'NAVATHE');

SQL> INSERT INTO BOOK_AUTHORS VALUES(3333,'HENRY GRAY');

SQL> INSERT INTO BOOK_AUTHORS VALUES(4444,'THOMAS');
```

LIBRARY_BRANCH

```
SQL> INSERT INTO LIBRARY_BRANCH VALUES(11,'CENTRAL TECHNICAL','MG ROAD');

SQL> INSERT INTO LIBRARY_BRANCH VALUES(22,'MEDICAL','BH ROAD');

SQL> INSERT INTO LIBRARY_BRANCH VALUES(33,'CHILDREN','SS PURAM');

SQL> INSERT INTO LIBRARY_BRANCH VALUES(44,'SECRETARIAT','SIRAGATE');

SQL> INSERT INTO LIBRARY_BRANCH VALUES(55,'GENERAL','JAYANAGAR');
```

BOOK_COPIES

```
SQL> INSERT INTO BOOK_COPIES VALUES(1111,11,5);

SQL> INSERT INTO BOOK_COPIES VALUES(3333,22,6);

SQL> INSERT INTO BOOK_COPIES VALUES(4444,33,10);

SQL> INSERT INTO BOOK_COPIES VALUES(2222,11,12);

SQL> INSERT INTO BOOK_COPIES VALUES(4444,55,3);
```

BOOK_LENDING

```
SQL> INSERT INTO BOOK_LENDING VALUES(2222,11,1,'10-JAN-2017','20-AUG-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(3333,22,2,'09-JUL-2017','12-AUG-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(4444,55,1,'11-APR-2017','09-AUG-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(2222,11,5,'09-AUG-2017','19-AUG-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(4444,33,1,'10-JUN-2017','15-AUG-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(1111,11,1,'12-MAY-2017','10-JUN-2017');

SQL> INSERT INTO BOOK_LENDING VALUES(3333,22,1,'10-JUL-2017','15-JUL-2017');


SQL> SELECT * FROM BOOK;

  BOOK_ID    TITLE                PUBLISHER_NAME   PUB_YEAR
  ---------- -------------------- ---------------- ----------
        1111 SE                   PEARSON              2005
        2222 DBMS                 MCGRAW               2004
        3333 ANOTOMY              PEARSON              2010
        4444 ENCYCLOPEDIA         SAPNA                2010

  4 rows selected.
```

```
SQL> SELECT * FROM BOOK_AUTHORS;

  BOOK_ID AUTHOR_NAME
  ---------- -----------------
     1111 SOMMERVILLE
     2222 NAVATHE
     3333 HENRY GRAY
     4444 THOMAS

4 rows selected.

SQL> SELECT * FROM PUBLISHER;

NAME             ADDRESS          PHONE
---------------------------------------------------------- ----------
PEARSON          BANGALORE        9875462530
MCGRAW           NEWDELHI         7845691234
SAPNA            BANGALORE        7845963210

3 rows selected.

SQL> SELECT * FROM BOOK_COPIES;

BOOK_ID BRANCH_ID NO_OF_COPIES
---------- ---------- ----------
   1111         11             5
   3333         22             6
   4444         33            10
   2222         11            12
   4444         55             3

5 rows selected.

SQL> SELECT * FROM BOOK_LENDING;

  BOOK_ID BRANCH_ID CARD_NO  DATE_OUT  DUE_DATE
  ---------- ---------- ---------- --------- ---------
     2222         11         1 10-JAN-17 20-AUG-17
     3333         22         2 09-JUL-17 12-AUG-17
     4444         55         1 11-APR-17 09-AUG-17
     2222         11         5 09-AUG-17 19-AUG-17
     4444         33         1 10-JUL-17 15-AUG-17
     1111         11         1 12-MAY-17 10-JUN-17
     3333         22         1 10-JUL-17 15-JUL-17

7 rows selected.
```

```
SQL> SELECT * FROM LIBRARY_BRANCH;

      BRANCH_ID BRANCH_NAME           ADDRESS
      ---------- ------------------------- --------------
              11 CENTRAL TECHNICAL    MG ROAD
              22 MEDICAL              BH ROAD
              33 CHILDREN             SS PURAM
              44 SECRETARIAT          SIRAGATE
              55 GENERAL              JAYANAGAR

5 rows selected.
```

Queries:

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

```
SELECT LB.BRANCH_NAME, B.BOOK_ID,TITLE, PUBLISHER_NAME,AUTHOR_NAME,
       NO_OF_COPIES
FROM BOOK B, BOOK_AUTHORS BA, BOOK_COPIES BC, LIBRARY_BRANCH LB
WHERE B.BOOK_ID = BA.BOOK_ID AND
      BA.BOOK_ID = BC.BOOK_ID AND
      BC.BRANCH_ID = LB.BRANCH_ID
GROUP BY LB.BRANCH_NAME, B.BOOK_ID, TITLE, PUBLISHER_NAME,
         AUTHOR_NAME, NO_OF_COPIES;
```

BRANCH_NAME	BOOK_ID	TITLE	PUBLISHER_NAME	AUTHOR_NAME	NO_OF_COPIES
GENERAL	4444	ENCYCLOPEDIA	SAPNA	THOMAS	3
MEDICAL	3333	ANOTOMY	PEARSON	HENRY GRAY	6
CHILDREN	4444	ENCYCLOPEDIA	SAPNA	THOMAS	10
CENTRAL TECHNICAL	1111	SE	PEARSON	SOMMERVILLE	5
CENTRAL TECHNICAL	2222	DBMS	MCGRAW	NAVATHE	12

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-JUN-2017'
GROUP BY CARD_NO
HAVING COUNT(*) > 3;

CARD_NO
----------
       1
```

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 = '3333';

1 row deleted.
```

```
SQL> SELECT * FROM BOOK;

  BOOK_ID TITLE                    PUBLISHER_NAME         PUB_YEAR
---------- ---------------------------------- ------------------------------ ----------
     1111 SE                       PEARSON                     2005
     2222 DBMS                     MCGRAW                      2004
     4444 ENCYCLOPEDIA             SAPNA                       2010


SQL> SELECT * FROM BOOK_COPIES;

  BOOK_ID BRANCH_ID NO_OF_COPIES
---------- ---------- ------------
     1111         11            5
     4444         33           10
     2222         11           12
     4444         55            3

SQL> SELECT * FROM BOOK_LENDING;

  BOOK_ID BRANCH_ID   CARD_NO DATE_OUT  DUE_DATE
---------- ---------- ---------- --------- ---------
     2222         11          1 10-JAN-17 20-AUG-17
     4444         55          1 11-APR-17 09-AUG-17
     2222         11          5 09-AUG-17 19-AUG-17
     4444         33          1 10-JUN-17 15-AUG-17
     1111         11          1 12-MAY-17 10-JUN-17
```

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

```
SELECT BOOK_ID, TITLE, PUBLISHER_NAME, PUB_YEAR
FROM BOOK
GROUP BY PUB_YEAR, BOOK_ID, TITLE, PUBLISHER_NAME;

BOOK_ID TITLE                    PUBLISHER_NAME         PUB_YEAR
---------- ---------------------------------- ------------------------------ ----------
   2222 DBMS                     MCGRAW                      2004
   1111 SE                       PEARSON                     2005
   3333 ANOTOMY                  PEARSON                     2010
   4444 ENCYCLOPEDIA             SAPNA                       2010
```

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

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

View created.

SQL> SELECT * FROM BOOKS_AVAILABLE;

BOOK_ID TITLE                NO_OF_COPIES
------- -------------------- ------------
   1111 SE                              5
   3333 ANOTOMY                         6
   4444 ENCYCLOPEDIA                   10
   2222 DBMS                           12
   4444 ENCYCLOPEDIA                    3
```

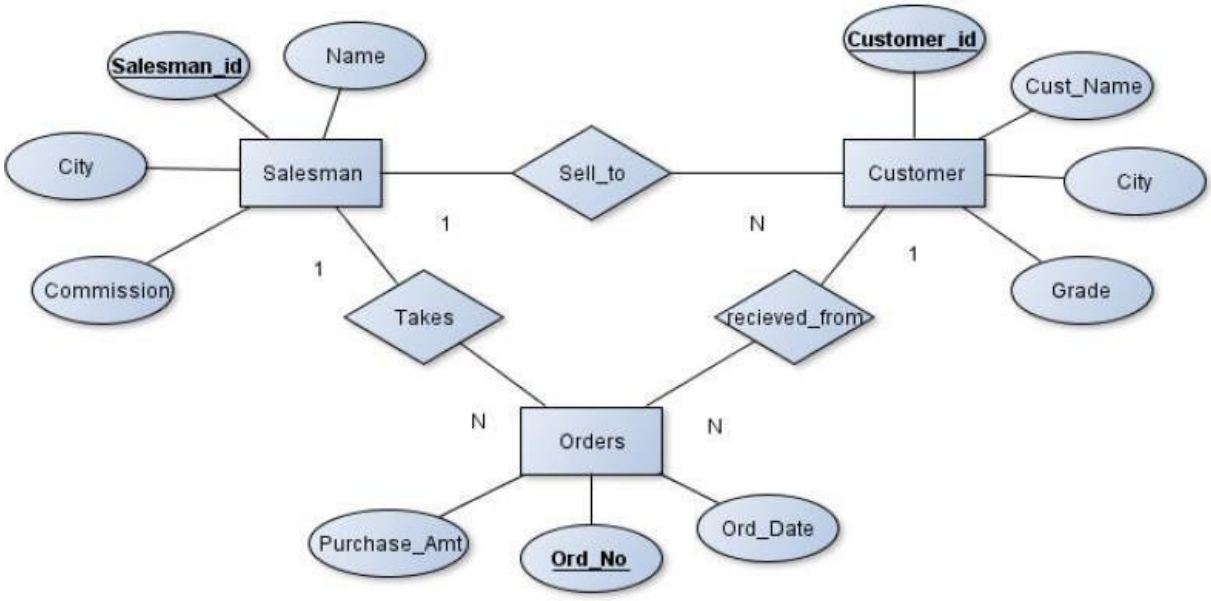
CHAPTER – 3

ORDER DATABASE

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.

ER-Diagram:



SCHEMA:

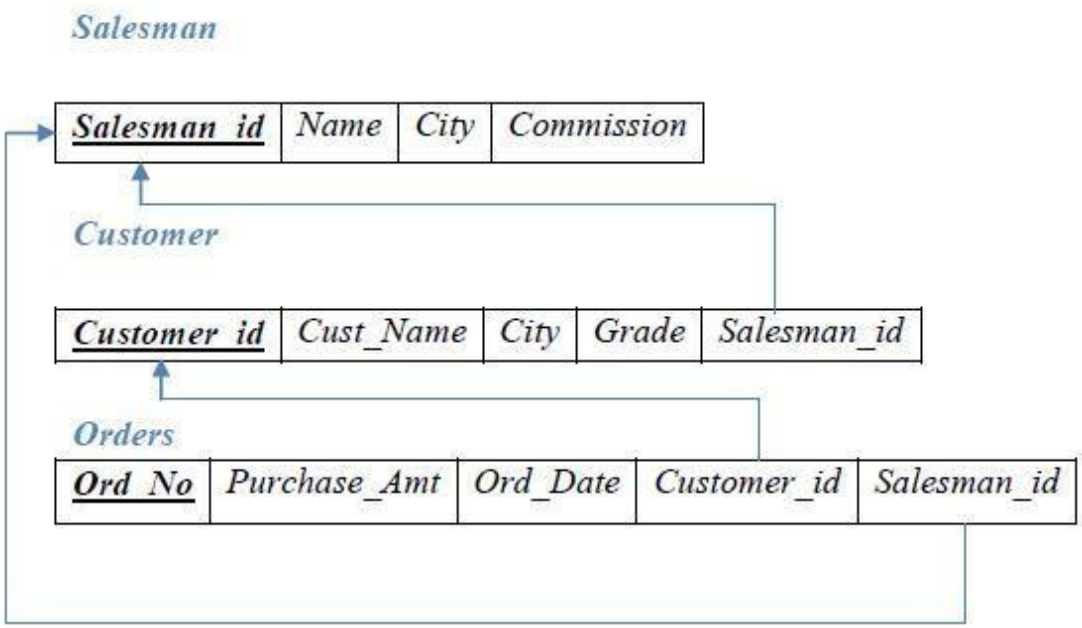

Salesman
Salesman_id
Name
City
Commission
Customer
Customer_id
Cust_Name
City
Grade
Salesman_id
Orders
Ord_No
Purchase_Amt
Ord_Date
Customer_id
Salesman_id

Table Creation:

SALESMAN

```
CREATE TABLE SALESMAN(
SALESMAN_ID NUMBER(5) CONSTRAINT SALESMAN_SALID PRIMARY KEY,
NAME VARCHAR(10) CONSTRAINT SALESMAN_NAME_NN NOT NULL,
CITY VARCHAR(15) CONSTRAINT SALESMAN_CITY_NN NOT NULL,
COMMISSION NUMBER(5));

Table created.
```

CUSTOMER

```
CREATE TABLE CUSTOMER(
CUSTOMER_ID NUMBER(5) CONSTRAINT CUSTOMER_CUSTID_PK PRIMARY KEY,
CUST_NAME VARCHAR(10) CONSTRAINT CUSTOMER_CUSTNAME_NN NOT NULL,
CITY VARCHAR(10) CONSTRAINT CUSTOMER_CITY_NN NOT NULL,
GRADE NUMBER(5) CONSTRAINT CUSTOMER_GRADE_NN NOT NULL,
SALESMAN_ID   NUMBER(5)   CONSTRAINT   CUSTOMER_SALEID_FK   REFERENCES
SALESMAN(SALESMAN_ID) ON DELETE SET NULL);

Table created.
```

ORDERS

```
CREATE TABLE ORDERS(
ORD_NO NUMBER(5) CONSTRAINT ORDERS_ODNO_PK PRIMARY KEY,
PURCHASE_AMT INTEGER CONSTRAINT ORDERS_PAMT_NN NOT NULL,
ORD_DATE DATE CONSTRAINT ORDERS_ODATE_NN NOT NULL,
CUSTOMER_ID   NUMBER(5)   CONSTRAINT   ORDERS_CUSTID_FK   REFERENCES
CUSTOMER(CUSTOMER_ID),
SALESMAN_ID   NUMBER(5)   CONSTRAINT   ORDERS_SALEID_FK   REFERENCES
SALESMAN(SALESMAN_ID) ON DELETE CASCADE);

Table created.
```

Values for tables

```
SQL> INSERT INTO SALESMAN VALUES(&SALESMAN_ID,'&NAME','&CITY',&COMMISSION);

SQL> INSERT INTO CUSTOMER
     VALUES(&CUSTOMER_ID,'&CUST_NAME','&CITY','&GRADE',&SALESMAN_ID);

SQL> INSERT INTO ORDERS
 VALUES(&ORD_NO,&PURCHASE_AMT,'&ORD_DATE',&CUSTOMER_ID,&SALESMAN_ID);
```

```
SELECT * FROM SALESMAN;

SALESMAN_ID NAME       CITY              COMMISSION
----------- ---------- ------------------------------ ----------
       1000 RAJ        BENGALURU                  50
       2000 ASHWIN     TUMKUR                     30
       3000 BINDU      MUMBAI                     40
       4000 LAVANYA    BENGALURU                  40
       5000 ROHIT      MYSORE                     60

SELECT * FROM CUSTOMER;

CUSTOMER_ID CUST_NAME  CITY           GRADE SALESMAN_ID
----------- ---------- ---------- ---------- -----------
         11 INFOSYS    BENGALURU           5        1000
         22 TCS        BENGALURU           4        2000
         33 WIPRO      MYSORE              7        1000
         44 TCS        MYSORE              6        2000
         55 ORACLE     TUMKUR              3        3000

SELECT * FROM ORDERS;

   ORD_NO PURCHASE_AMT ORD_DATE  CUSTOMER_ID SALESMAN_ID
---------- ---------- --------- ----------- -----------
         1     200000 12-APR-16          11        1000
         2     300000 12-APR-16          11        2000
         3     400000 15-APR-17          22        1000
```

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

```
SELECT COUNT(CUSTOMER_ID)
FROM CUSTOMER
WHERE GRADE>(SELECT AVG(GRADE)
             FROM CUSTOMER
             WHERE CITY LIKE '%BENGALURU');

COUNT(CUSTOMER_ID)
------------------
                 3
```

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

```
SELECT NAME, COUNT(CUSTOMER_ID)
FROM SALESMAN S, CUSTOMER C
WHERE S.SALESMAN_ID=C.SALESMAN_ID
GROUP BY NAME
HAVING COUNT(CUSTOMER_ID)>1;

NAME        COUNT(CUSTOMER_ID)
--------------- -------------------------
ASHWIN                          2
RAJ                             2
```

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

```
(SELECT NAME
FROM SALESMAN S, CUSTOMER C
WHERE S.SALESMAN_ID=C.SALESMAN_ID AND
      S.CITY=C.CITY)
UNION
(SELECT NAME
FROM SALESMAN
WHERE SALESMAN_ID NOT IN(SELECT S1.SALESMAN_ID
                         FROM SALESMAN S1, CUSTOMER C1
                         WHERE S1.SALESMAN_ID=C1.SALESMAN_ID AND
                               S1.CITY=C1.CITY));

NAME
--------------
ASHWIN
BINDU
LAVANYA
RAJ
ROHIT
```

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

```
CREATE VIEW SALES_HIGHERODER AS
SELECT SALESMAN_ID, PURCHASE_AMT
FROM ORDERS
WHERE PURCHASE_AMT=(SELECT MAX(O.PURCHASE_AMT)
                    FROM ORDERS O
                    WHERE O.ORD_DATE='12-APR-16');
View created.

SELECT * FROM SALES_HIGHERODER;

SALESMAN_ID PURCHASE_AMT
--------------- ----------------
       2000       300000
```

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

```
DELETE from salesman
WHERE salesman_id = 1000;

1 row deleted.
```

```
SELECT * FROM SALESMAN;

SALESMAN_ID NAME        CITY               COMMISSION
--------------- --------------  -------------------- ----------
        2000 ASHWIN     TUMKUR                     30
        3000 BINDU      MUMBAI                     40
        4000 LAVANYA    BENGALURU                  40
        5000 ROHIT      MYSORE                     60
```

```
SELECT * FROM CUSTOMER;

CUSTOMER_ID CUST_NAME  CITY            GRADE SALESMAN_ID
--------------- --------------- -------------- ---------- ---------------
          11 INFOSYS     BENGALURU             5
          22 TCS         BENGALURU             4        2000
          33 WIPRO       MYSORE                7
          44 TCS         MYSORE                6        2000
          55 ORACLE      TUMKUR                3        3000
```

```
 SELECT * FROM ORDERS;

   ORD_NO PURCHASE_AMT ORD_DATE  CUSTOMER_ID SALESMAN_ID
------------ ------------ ---------- --------------- ---------------
         2       300000 12-APR-16            11        2000
```

CHAPTER – 4

MOVIE DATABASE

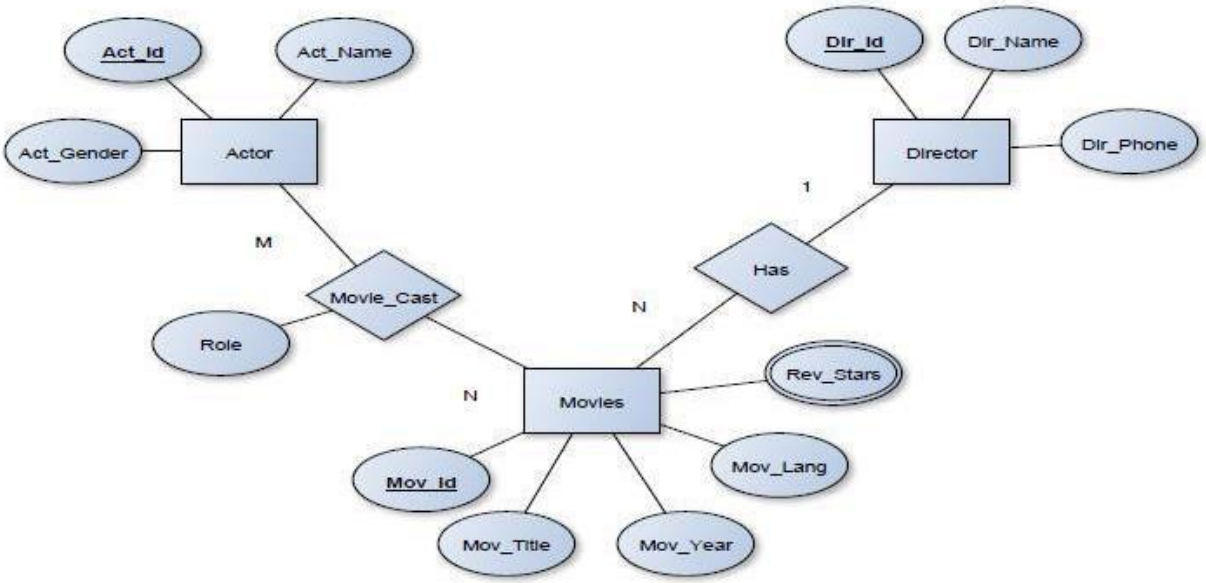
3) Consider the schema for Movie Database:

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.

ER-Diagram:



SCHEMA:

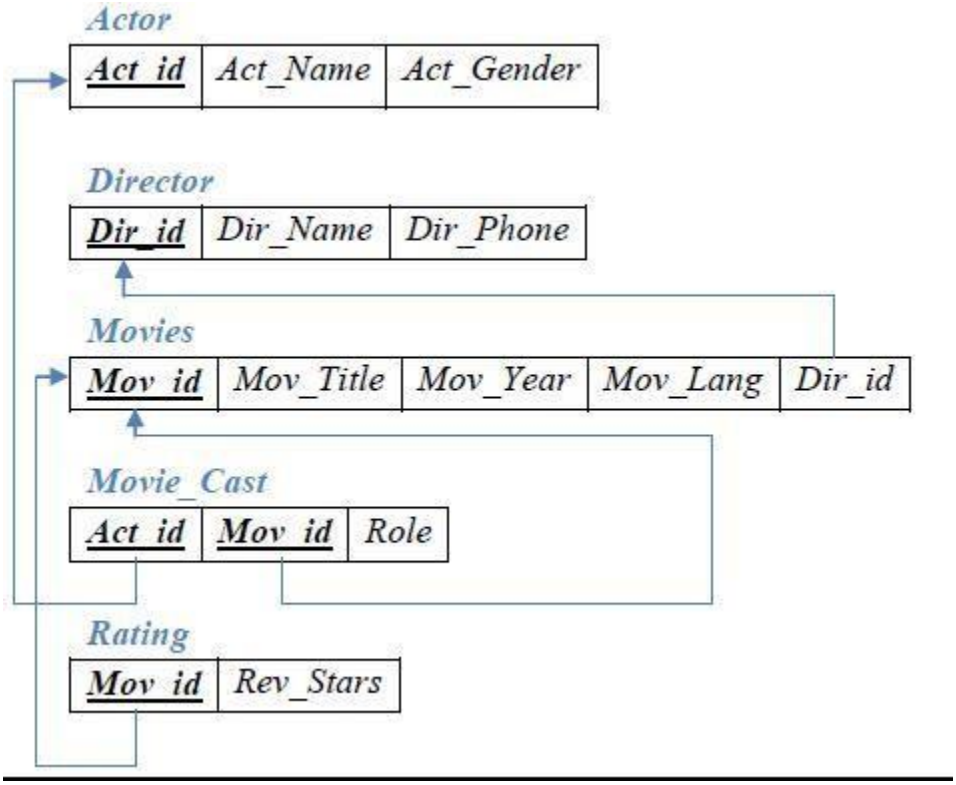

Actor
Act_id
Act_Name
Act_Gender
Director
Dir_id
Dir_Name
Dir_Phone
Movies
Mov_id
Mov_Title
Mov_Year
Mov_Lang
Dir_id
Movie_Cast
Act_id
Mov_id
Role
Rating
Mov_id
Rev_Stars

Table Creation:

ACTOR

```
CREATE TABLE ACTOR(
ACT_ID NUMBER(5) CONSTRAINT ACTOR_ACTID_PK PRIMARY KEY,
ACT_NAME VARCHAR(18) CONSTRAINT ACTOR_ACTNAME_NN NOT NULL,
ACT_GENDER VARCHAR(2) CONSTRAINT ACTOR_ACTGENDER_NN NOT NULL);
```

```
Table created.
```

DIRECTOR

```
CREATE TABLE DIRECTOR(
DIR_ID NUMBER(5) CONSTRAINT DIRECTOR_DIRID_PK PRIMARY KEY,
DIR_NAME VARCHAR(18) CONSTRAINT DIRECTOR_DIRNAME_NN NOT NULL,
DIR_PHONE VARCHAR(10) CONSTRAINT DIRECTOR_DIRPHONE_NN NOT NULL);
```

```
Table created.
```

MOVIES

```
CREATE TABLE MOVIES(
MOV_ID NUMBER(5) CONSTRAINT MOVIES_MOVID_PK PRIMARY KEY,
MOV_TITLE VARCHAR(10) CONSTRAINT MOVIES_MOVTITLE_NN NOT NULL,
MOV_YEAR NUMBER(5) CONSTRAINT MOVIES_MOVYEAR_NN NOT NULL,
MOV_LANG VARCHAR(10)  CONSTRAINT MOVIES_MOVLANG_NN NOT NULL,
DIR_ID NUMBER(5) CONSTRAINT MOVIES_DIRID_FK REFERENCES DIRECTOR(DIR_ID));
```

```
Table created.
```

MOVIE_CAST

```
CREATE TABLE MOVIE_CAST(
ACT_ID NUMBER(5) CONSTRAINT MOVIECAST_ACTID_FK REFERENCES ACTOR(ACT_ID),
MOV_ID NUMBER(5) CONSTRAINT MOVIECAST_MOVID_FK REFERENCES MOVIES(MOV_ID),
ROLE VARCHAR(10),
CONSTRAINT MOVIECAST_ACTID_MOVID_PK PRIMARY KEY(ACT_ID,MOV_ID));
```

```
Table created.
```

RATING

```
CREATE TABLE RATING(
MOV_ID NUMBER(5) CONSTRAINT RATING_MOVID_FK REFERENCES MOVIES(MOV_ID),
REV_STARS NUMBER(1) CONSTRAINT RATING_REVSTARS_NN NOT NULL,
CONSTRAINT RATING_MOVID_PK PRIMARY KEY(MOV_ID))
```

```
Table created.
```

Description of Schema:

```
SQL> DESC ACTOR
 Name                                      Null?    Type
 ----------------------------------------- -------- -----
 ACT_ID                                    NOT NULL NUMBER(5)
 ACT_NAME                                  NOT NULL VARCHAR2(18)
 ACT_GENDER                                NOT NULL VARCHAR2(2)


SQL> DESC DIRECTOR
 Name                                      Null?    Type
 ----------------------------------------- -------- -----
 DIR_ID                                    NOT NULL NUMBER(5)
 DIR_NAME                                  NOT NULL VARCHAR2(18)
 DIR_PHONE                                 NOT NULL VARCHAR(10)


SQL> DESC MOVIES
 Name                                      Null?    Type
 ----------------------------------------- -------- -----
 MOV_ID                                    NOT NULL NUMBER(5)
 MOV_TITLE                                 NOT NULL VARCHAR2(10)
 MOV_YEAR                                  NOT NULL NUMBER(5)
 MOV_LANG                                  NOT NULL VARCHAR2(10)
 DIR_ID                                             NUMBER(5)

SQL> DESC RATING
 Name                                      Null?    Type
 ----------------------------------------- -------- -----
 MOV_ID                                    NOT NULL NUMBER(5)
 REV_STARS                                 NOT NULL NUMBER(1)
```

Values for tables:

```
SQL> INSERT INTO ACTOR VALUES(&ACT_ID,'&ACT_NAME','&ACT_GENDER');

SQL> INSERT INTO DIRECTOR VALUES(&DIR_ID,'&DIR_NAME',&DIR_PHONE);

SQL> INSERT INTO MOVIES
     VALUES(&MOV_ID,'&MOV_TITLE','&MOV_YEAR','&MOV_LANG',&DIR_ID);

SQL> INSERT INTO MOVIE_CAST VALUES(&ACT_ID,&MOV_ID,'&ROLE');

SQL> INSERT INTO RATING VALUES(&MOV_ID,&REV_STARS);
```

```
SQL> SELECT * FROM ACTOR;

   ACT_ID ACT_NAME           AC
---------- -------------------- ---
       111 DEEPA SANNIDHI       F
       222 SUDEEP               M
       333 PUNEETH              M
       444 DHIGANTH             M
       555 ANGELA               F

SQL> SELECT * FROM DIRECTOR;

   DIR_ID DIR_NAME                       DIR_PHONE
---------- ------------------------------ ----------
       101 HITCHCOCK                      112267809
       102 RAJ MOULI                      152358709
       103 YOGARAJ                        272337808
       104 STEVEN SPIELBERG               363445678
       105 PAVAN KUMAR                    385456809

SQL> SELECT * FROM MOVIES;

   MOV_ID MOV_TITLE          MOV_YEAR MOV_LANG            DIR_ID
---------- -------------------- ---------- -------------------- ----------
      1111 LASTWORLD                  2009 ENGLISH                     104
      2222 EEGA                       2010 TELUGU                      102
      4444 PARAMATHMA                 2012 KANNADA                     103
      3333 MALE                       2006 KANNADA                     103
      5555 MANASARE                   2010 KANNADA                     103
      6666 REAR WINDOW                1954 ENGLISH                     101
      7777 NOTORIOUS                  1946 ENGLISH                     101

SQL> SELECT * FROM MOVIE_CAST;

   ACT_ID    MOV_ID ROLE
---------- ---------- ------------------------------
       222       2222 VILAN
       333       4444 HERO
       111       4444 HEROIN
       444       3333 GUEST
       444       5555 HERO
       555       7777 MOTHER

SQL> SELECT * FROM RATING;
   MOV_ID REV_STARS
---------- ----------
      1111          3
      2222          4
      3333          3
      5555          4
      4444          5
```

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

```
SELECT MOV_TITLE
FROM MOVIES M, DIRECTOR D
WHERE D.DIR_ID=M.DIR_ID AND
      DIR_NAME='HITCHCOCK';

MOV_TITLE
--------------
NOTORIOUS
REAR WINDOW
```

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

```
SELECT MOV_TITLE
FROM MOVIES M, MOVIE_CAST MC
WHERE M.MOV_ID=MC.MOV_ID AND
      MC.ACT_ID IN (SELECT ACT_ID
                    FROM MOVIE_CAST
                    GROUP BY ACT_ID
                    HAVING COUNT(MOV_ID)>=2);
MOV_TITLE
--------------
MALE
MANASARE
```

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

4.
```
(SELECT ACT_NAME
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 < 2000)
INTERSECT
(SELECT ACT_NAME
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 > 2015);

ACT_NAME
---------------
DHIGANTH
```

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,   REV_STARS
FROM MOVIES M, RATING R
WHERE        M.MOV_ID=R.MOV_ID       AND
REV_STARS>=1 ORDER BY MOV_TITLE
```

```
MOV_TITLE  REV_STARS
---------- ----------
EEGA              4
LASTWORLD         3
MALE              3
MANASARE          4
PARAMATHMA        5
```

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

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

```
1 row updated.
```

```
SELECT * FROM RATING
```

```
MOV_ID REV_STARS
------- ---------------
 1111       5
2222       4
3333       3
5555       4
4444       5
```

CHAPTER - 5

COLLEGE DATABASE

4). Consider the schema for College Database:

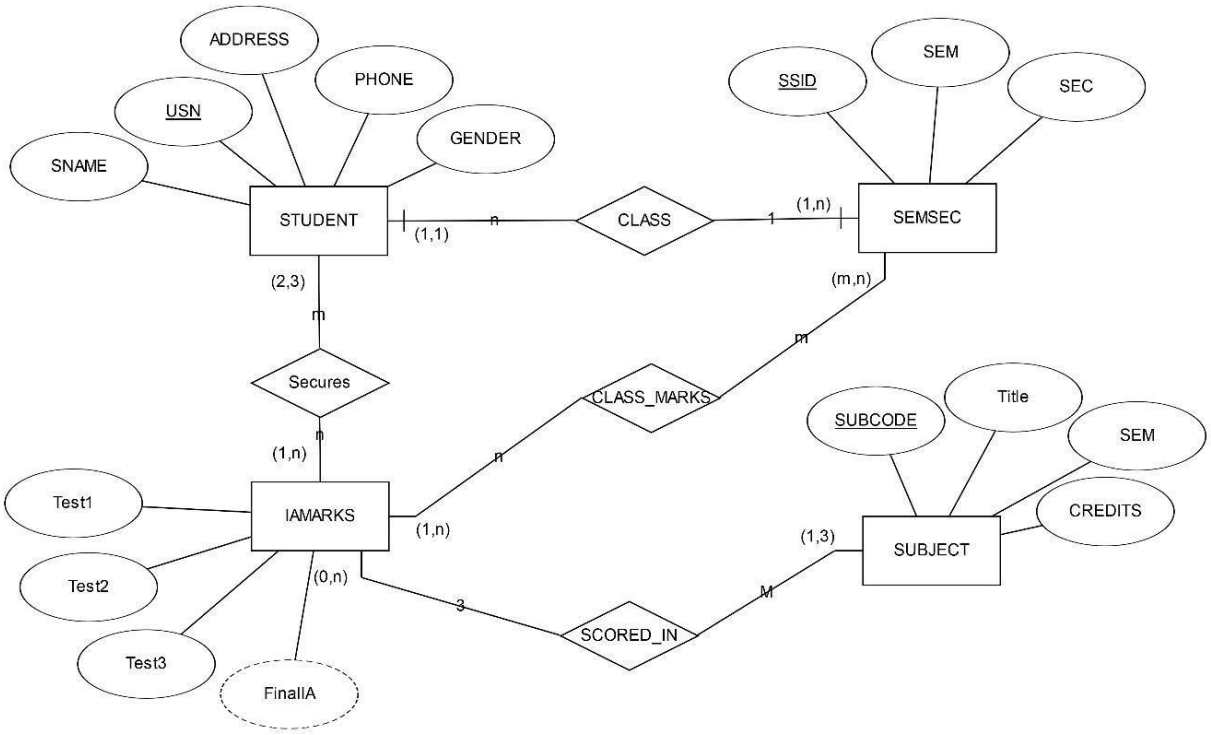
STUDENT (USN, SName, Address, Phone, Gender)
SEMSEC (SSID, Sem, Sec)
CLASS (USN, SSID)
SUBJECT (Subcode, Title, Sem, Credits)
IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

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.

ER-Diagram:



SCHEMA:

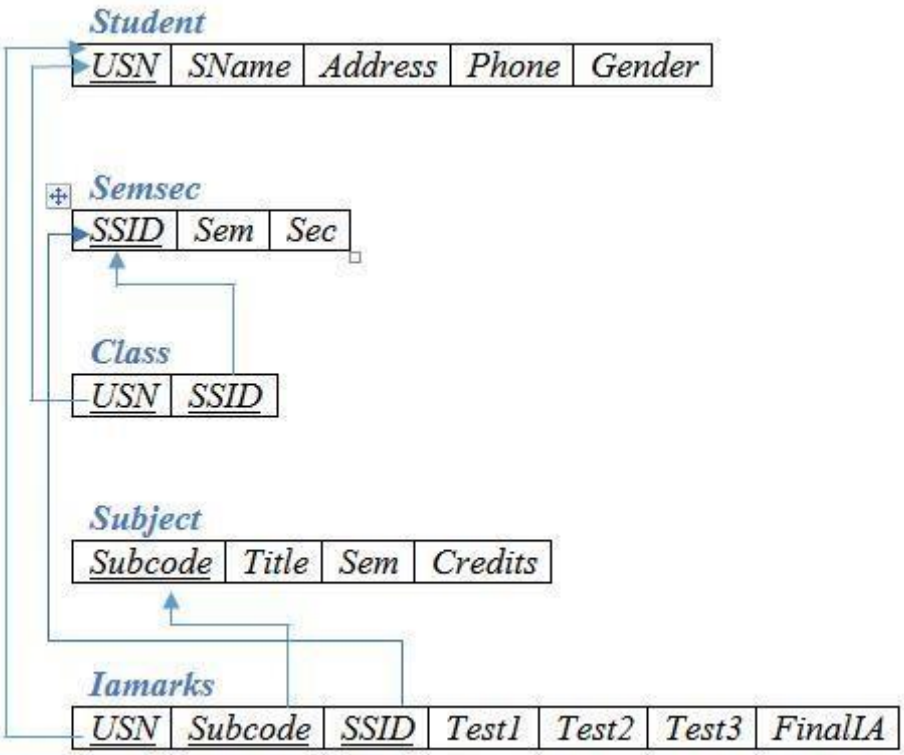

Student
USN
SName
Address
Phone
Gender
Semsec
SSID
Sem
Sec
Class
USN
SSID
Subject
Subcode
Title
Sem
Credits
Iamarks
USN
Subcode
SSID
Test1
Test2
Test3
FinalIA

Table Creation:

STUDENT

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

Table created.
```

SEMSEC

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

Table created.
```

CLASS

```
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));

Table created.
```

SUBJECT

```
CREATE TABLE SUBJECT
(SUBCODE VARCHAR(8) PRIMARY KEY,
 TITLE VARCHAR(20),
 SEM NUMBER(2), CREDITS
 NUMBER(2));

Table created.
```

IAMARKS

```
CREATE TABLE IAMARKS
(USN VARCHAR(10),
SUBCODE VARCHAR(8),
SSID VARCHAR(5), TEST1
NUMBER(2), TEST2
NUMBER(2),
```

```
 TEST3 NUMBER(2),
 FINALIA NUMBER(3),
 PRIMARY KEY(USN,SUBCODE,SSID),
 FOREIGN KEY(USN)  REFERENCES  STUDENT(USN),
 FOREIGN KEY(SUBCODE) REFERENCES SUBJECT(SUBCODE),
 FOREIGN KEY(SSID) REFERENCES SEMSEC(SSID));

Table created.
```

Values for tables:

STUDENT:

```
INSERT INTO STUDENT VALUES
('&USN','&sname','&address',’&phone’,'&gender');
```

select * from student;

USN	SNAME	ADDRESS	PHONE	G
1cg15cs001	Abhi	tumkur	9875698410	M
1cg15cs002	amulya	gubbi	8896557412	F
1cg16me063	chethan	nittur	7894759522	M
1cg14ec055	raghavi	sspuram	9485675521	F
1cg15ee065	sanjay	bangalore	9538444404	M

SEMSEC:

```
INSERT INTO SEMSEC VALUES ('&SSID', ‘&sem’,'&sec');
```

select * from semsec;

SSID	SEM	S
5A	5	A
3B	3	B
7A	7	A
2C	2	C
4B	4	B
4c	4	c

CLASS:

```
INSERT INTO CLASS VALUES (‘&USN’,’&SSID’);

select * from class;

USN         SSID
----------  ----------
1cg15cs001  5A
```

```
1cg15cs002  5A
1cg16me063     3B
1cg14ec055    7A
1cg15ee065    3B
1cg15ee065    4c
1cg15cs002 4c
```

SUBJECT:

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

```
select * from subject;
```

SUBCODE	TITLE	SEM	CREDITS
15cs53	dbms	5	4
15cs33	ds	3	4
15cs34	co	3	4
15csl58	dba	52	
10cs71	oomd	7	4

IAMARKS:

```
INSERT INTO IAMARKS VALUES
('&USN','&SUBCODE','&SSID','&TEST1','&TEST2','&TEST3');
```

```
select * from iamarks;
```

USN	SUBCODE	SSID	TEST1	TEST2	TEST3	FINALIA
1cg15cs001	15cs53	5A	18	19	15	19
1cg15cs002	15cs53	5A	15	16	14	16
1cg16me063	15cs33	3B	10	15	16	16
1cg14ec055	10cs71	7A	18	20	21	21
1cg15ee065	15cs33	3B	16	20	17	19
1cg15ee065	15cs53	4c	19	20	18	20

Queries:

1. List all the student details studying in fourth semester ‘C’ section.

```
select
s.usn,sname,address,phone,gender from
student s, class c, semsec ss where
sem=4 and
      sec='c' and
      ss.ssid=c.ssid and
      c.usn=s.usn;
```

```
USN         SNAME            ADDRESS                            PHONE          G
----------- ---------------- ---------------------------------- -------------- -
1cg15ee065 Sanjay           bangalore          9538444404    M
1cg15cs002 Amulya           gubbi              8896557412    F
```

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

```
SELECT SEM,SEC,GENDER,COUNT(*)
FROM STUDENT S, SEMSEC SS,CLASS C
WHERE S.USN=C.USN AND
      C.SSID=SS.SSID
GROUP BY SEM,SEC,GENDER
ORDER BY SEM;

 SEM S G  COUNT(*)
---- - - ----------
   3 B M          2
   4 c F          1
   4 c M          1
   5 A F          1
   5 A M          1
   7 A F          1
```

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

```
CREATE VIEW TEST1 AS
SELECT SUBCODE,TEST1
FROM IAMARKS
WHERE USN='1cg15ee065';

View created.

SQL> select * from test1;

SUBCODE      TEST1
---------- ----------
15cs33           16
15cs53           19
```

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

```
CREATE OR REPLACE PROCEDURE AVG
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 AVG;
```

Procedure created.

```
SQL> BEGIN
  2  AVG;
  3  END;
```

PL/SQL procedure successfully completed.

```
SQL> SELECT * FROM IAMARKS;
```

USN	SUBCODE	SSID	TEST1	TEST2	TEST3	FINALIA
1cg15cs001	15cs53	5A	18	19	15	19
1cg15cs002	15cs53	5A	15	16	14	16
1cg16me063	15cs33	3B	10	15	16	16
1cg14ec055	10cs71	7A	18	20	21	21
1cg15ee065	15cs33	3B	16	20	17	19
1cg15ee065	15cs53	4c	19	20	18	20

6 rows selected.

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=7
```

USN	SNAME	ADDRESS	PHONE	G	CAT
1cg14ec055	raghavi	sspuram	9485675521	F	WEAK

CHAPTER – 6

COMPANY DATABASE

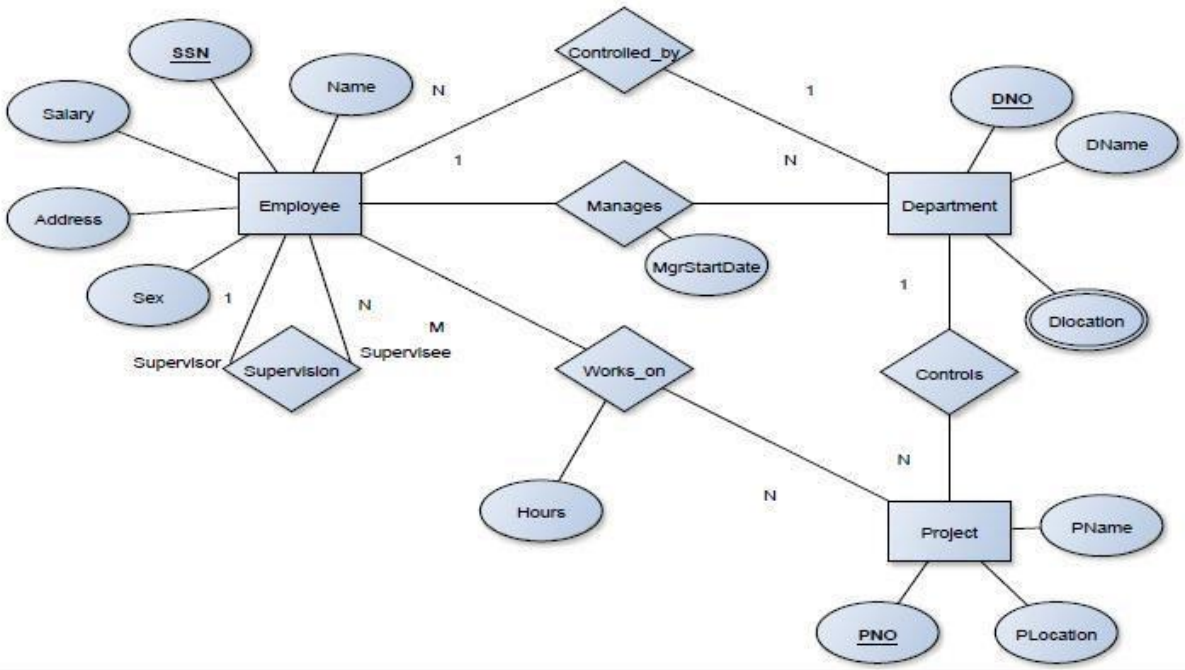
5). Consider the schema for Company Database:

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. 6,00,000.

ER-Diagram:



SCHEMA:

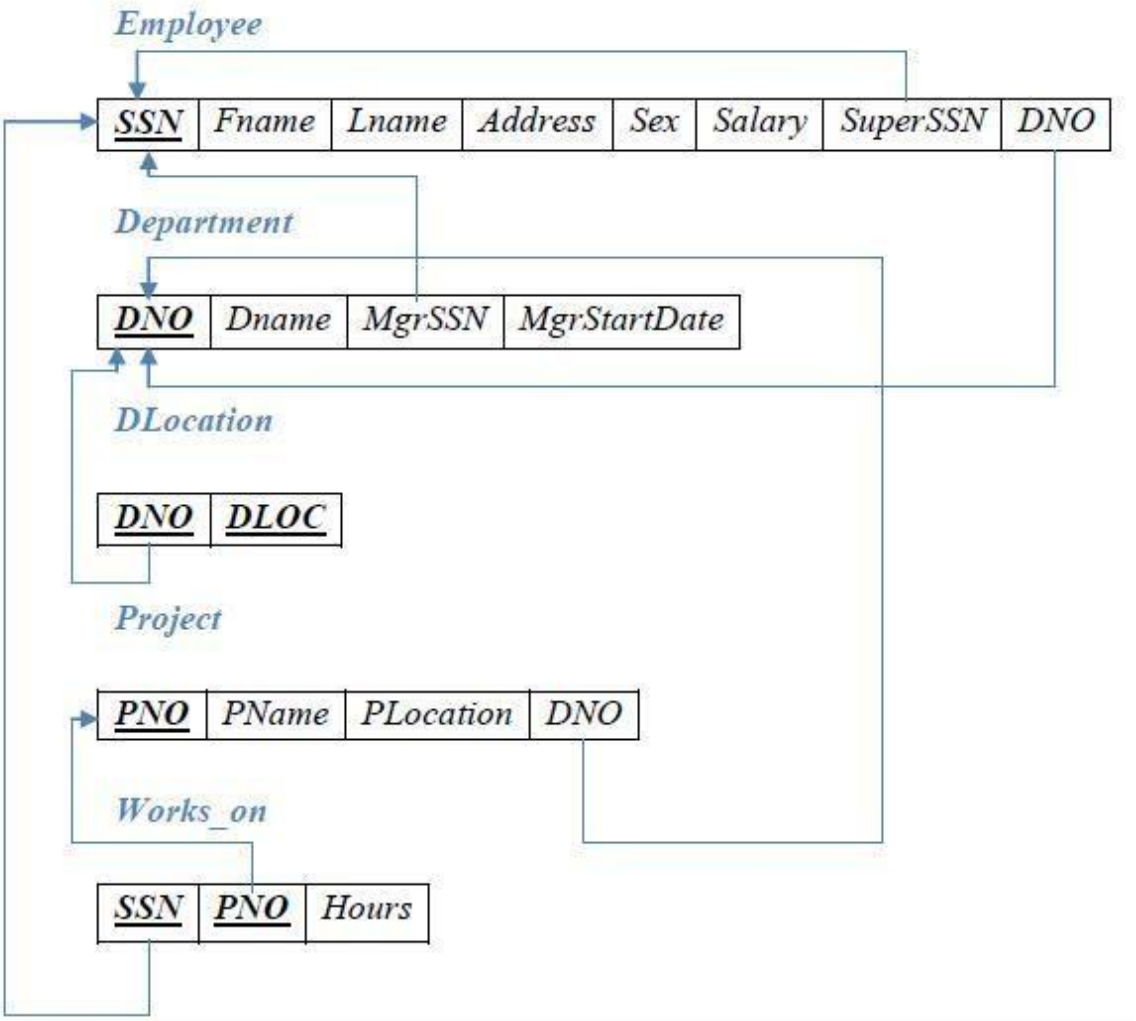

Employee
SSN
Fname
Lname
Address
Sex
Salary
SuperSSN
DNO
Department
DNO
Dname
MgrSSN
MgrStartDate
DLocation
DNO
DLOC
Project
PNO
PName
PLocation
DNO
Works_on
SSN
PNO
Hours

Table Creation:

DEPARTMENT

```
CREATE TABLE DEPARTMENT(
DNO NUMBER(3) CONSTRAINT DEPT_DNO_PK PRIMARY KEY, DNAME
VARCHAR(15) CONSTRAINT DEPT_DNAME_NN NOT NULL, MGRSSN
CHAR(10),
MGRSTARTDATE DATE);
```

EMPLOYEE

```
CREATE TABLE EMPLOYEE(
SSN CHAR(10) CONSTRAINT EMP_SSN_PK PRIMARY KEY,
NAME VARCHAR(18) CONSTRAINT EMP_NAME_NN NOT NULL,
ADDRESS VARCHAR(18),
SEX VARCHAR(3), SALARY
REAL, SUPER_SSN
CHAR(10),
DNO NUMBER(3) CONSTRAINT EMP_DNO_FK REFERENCES DEPARTMENT(DNO));

ALTER TABLE DEPARTMENT ADD CONSTRAINT DEPT_MGRSSN_FK FOREIGN
KEY(MGRSSN) REFERENCES EMPLOYEE(SSN);

Table altered.
```

DLOCATION

```
CREATE TABLE DLOCATION(
DLOC VARCHAR2 (20),
DNO REFERENCES DEPARTMENT (DNO),
PRIMARY KEY (DNO, DLOC));
```

PROJECT

```
CREATE TABLE PROJECT(
PNO INTEGER PRIMARY KEY,
PNAME VARCHAR2 (20),
PLOCATION VARCHAR2 (20),
DNO REFERENCES DEPARTMENT (DNO));
```

WORKS_ON

```
CREATE TABLE WORKS_ON(
HOURS NUMBER (2),
SSN REFERENCES EMPLOYEE (SSN),
PNO REFERENCES PROJECT(PNO),
PRIMARY KEY (SSN, PNO));
```

Values for tables:

DEPARTMENT

```
INSERT INTO DEPARTMENT VALUES(&DNO,'&DNAME',&MGRSSN,'&MGRSTARTDATE');

SELECT * FROM DEPARTMENT;

       DNO DNAME              MGRSSN     MGRSTARTD
---------- -------------------- ---------- ----------
         1 RESEARCH             111111     10-AUG-12
         2 ACCOUNTS             222222     10-AUG-10
         3 AI                   333333     15-APR-12
         4 NETWORKS             111111     18-MAY-14
         5 BIGDATA              666666     21-JAN-10

5 rows selected.
```

EMPLOYEE

```
INSERT INTO EMPLOYEE
VALUES('&SSN','&NAME','&ADDRESS','&SEX',&SALARY,'&SUPERSSN',&
DNO);

SELECT * FROM EMPLOYEE;

SSN       NAME               ADDRESS              SEX   SALARY SUPERSSN       DNO
--------- ------------------ -------------------- ----- ------ ---------- ---------
--------------------                                                       ----------
111111    RAJ                BENGALURU            M     700000                    1
222222    RASHMI             MYSORE               F     400000 111111             2
333333    RAGAVI             TUMKUR               F     800000                    3
444444    RAJESH             TUMKUR               M     650000 333333             3
555555    RAVEESH            BENGALURU            M     500000 333333             3
666666    SCOTT              ENGLAND              M     700000 444444             5
777777    NIGANTH            GUBBI                M     200000 222222             2
888888    RAMYA              GUBBI                F     400000 222222             3
999999    VIDYA              TUMKUR               F     650000 333333             3
100000    GEETHA             TUMKUR               F     800000                    3

10 rows selected.
```

DLOCATION

```
INSERT INTO DLOCATION VALUES(&DNO,'&DLOC');

 SELECT * FROM DLOCATION;

         DNO  DLOC
   ---------- --------------------
            1 MYSORE
            1 TUMKUR
            2 BENGALURU
```

```
           3 GUBBI
           4 DELHI
           5 BENGALURU

   6 rows selected.
```

PROJECT

```
INSERT INTO PROJECT VALUES(&PNO,'&PNAME','&PLOCATION','&DNO');

 SELECT * FROM PROJECT;

          PNO PNAME       PLOCATION          DNO
                         ------------------------- --------------------
          111 IOT         GUBBI                   3
 222 TEXTSPEECH  GUBBI                 3
 333 IPSECURITY  DELHI                 4
 444 TRAFICANAL  BENGALURU             5
 555 CLOUDSEC    DELHI                 1

   5 rows selected.
```

WORKS_ON

```
INSERT INTO WORKS_ON VALUES('&SSN',&PNO,&HOURS);


 SELECT * FROM WORKS_ON;

   SSN                 PNO       HOURS
 ------------------------------------------------- --------------------
   666666              333             4

   666666              111             2
   111111              222             3
   555555              222             2
   333333              111             4
   444444              111             6
   222222              111             2

8 rows selected.
```

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

```
      PNO
----------
      111
      333
      444
```

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

```
SELECT FNAME, LNAME, 1.1*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';
```

SSN	NAME	ADDRESS	SEX	SALARY	SUPERSSN	DNO
111111	RAJ	BENGALURU	M	700000		1
222222	RASHMI	MYSORE	F	440000	111111	2
333333	RAGAVI	TUMKUR	F	880000		3
444444	RAJESH	TUMKUR	M	715000	333333	3
555555	RAVEESH	BENGALURU	M	500000	333333	3
666666	SCOTT	ENGLAND	M	770000	444444	5
777777	NIGANTH	GUBBI	M	200000	222222	2
888888	RAMYA	GUBBI	F	400000	222222	3
999999	VIDYA	TUMKUR	F	650000	333333	3
100000	GEETHA	TUMKUR	F	800000		3

```
10 rows selected.
```

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(SALARY),    MAX(SALARY),    MIN(SALARY),
AVG(SALARY) FROM EMPLOYEE E, DEPARTMENT D
WHERE DNAME='ACCOUNTS' AND
      D.DNO=E.DNO;
SUM(SALARY) MAX(SALARY) MIN(SALARY) AVG(SALARY)
            ------------- ------------ -------------
                        -            -            -
             440000     200000     320000
```

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

```
SELECT NAME FROM
EMPLOYEE E
WHERE NOT EXISTS( (SELECT PNO
                  FROM ROJECT
                  WHERE
                  DNO=5)
                  MINUS
                  (SELECT PNO
                    FROM WORKS_ON W
                    WHERE E.SSN=W.SSN))
NAME
----------------------
SCOTT
```

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   DNO,COUNT(SSN)
FROM EMPLOYEE
WHERE SALARY>600000 AND DNO
      IN(SELECT DNO
             FROM   EMPLOYEE
             GROUP BY DNO
             HAVING COUNT(SSN)>5)
GROUP BY DNO ;

      DNO COUNT(SSN)
------------ --------------
         3          4
```