

ATME COLLEGE OF ENGINEERING

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A T M E

College of Engineering

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(ACADEMIC YEAR 2023-24)**

LABORATORY MANUAL

SUBJECT: DBMS LABORATORY WITH MINI PROJECT

SUBJECT CODE: 21CSL58

SEMESTER: V

2021 CBCS Scheme

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INSTITUTIONAL MISSION AND VISION

Objectives

- To provide quality education and groom top-notch professionals, entrepreneurs and leaders for different fields of engineering, technology and management.
- To open a Training-R & D-Design-Consultancy cell in each department, gradually introduce doctoral and postdoctoral programs, encourage basic & applied research in areas of social relevance, and develop the institute as a center of excellence.
- To develop academic, professional and financial alliances with the industry as well as the academia at national and transnational levels.
- To develop academic, professional and financial alliances with the industry as well as the academia at national and transnational levels.
- To cultivate strong community relationships and involve the students and the staff in local community service.
- To constantly enhance the value of the educational inputs with the participation of students, faculty, parents and industry.

Vision

- Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

Mission

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torch bearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

Department of Computer Science & Engineering

Vision of the Department

- To develop highly talented individuals in Computer Science and Engineering to deal with real world challenges in industry, education, research and society.

Mission of the Department

- To inculcate professional behavior, strong ethical values, innovative research capabilities and leadership abilities in the young minds & to provide a teaching environment that emphasizes depth, originality and critical thinking.
- Motivate students to put their thoughts and ideas adoptable by industry or to pursue higher studies leading to research.

Program outcomes (POs)

Engineering Graduates will be able to:

- **PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
- **PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. **PSO1:** Ability to apply skills in the field of algorithms, database design, web design, cloud computing and data analytics.
2. **PSO2:** Apply knowledge in the field of computer networks for building network and internet based applications.

Program Educational Objectives (PEOs):

1. Empower students with a strong basis in the mathematical, scientific and engineering fundamentals to solve computational problems and to prepare them for employment, higher learning and R&D.
2. Gain technical knowledge, skills and awareness of current technologies of computer science engineering and to develop an ability to design and provide novel engineering solutions for software/hardware problems through entrepreneurial skills.
3. Exposure to emerging technologies and work in teams on interdisciplinary projects with effective communication skills and leadership qualities.
4. Ability to function ethically and responsibly in a rapidly changing environment by applying innovative ideas in the latest technology, to become effective professionals in Computer Science to bear a life-long career in related areas.

DBMS LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2023 -2024)
SEMESTER – V

Subject Code:21CSL58

Number of Contact Hours/Week:0:2:2

Total Number of Lab Contact Hours:36

IA Marks :40

Exam Marks:60

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.)
- Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

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, Programme_id, No-of_Copies)

BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date)

LIBRARY_PROGRAMME (Programme_id, Programme_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 Programme, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library.

2. Consider the following schema for Order Database:

SALESMAN(Salesman_id, Name, City, Commission)

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

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

Write SQL queries to

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

3. Consider the schema for Movie Database:

ACTOR(Act_id, Act_Name, Act_Gender)

DIRECTOR(Dir_id, Dir_Name, Dir_Phone)

MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)

MOVIE_CAST(Act_id, Mov_id, Role)

RATING (Mov_id, Rev_Stars)

Write SQL queries to

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

4. Consider the schema for College Database:

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

SEMSEC(SSID, Sem, Sec)

CLASS (USN, SSID)

SUBJECT (Subcode, Title, Sem, Credits)

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

Write SQL queries to

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

5. Consider the schema for CompanyDatabase:

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.

Part B: Mini project

- For any problem selected
- Make sure that the application should have five or more tables
- Indicative areas include; health care

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:

- Experiment distribution
 - For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.
 - For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.
- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution (*Course to change in accordance with university regulations*)
 - For laboratories having only one part – Procedure + Execution + Viva-Voce:
 $15+70+15 = 100$ Marks
 - For laboratories having PART A and PART B
 - i. Part A – Procedure + Execution + Viva = $6 + 28 + 6 = 40$ Marks
 - ii. Part B – Procedure + Execution + Viva = $9 + 42 + 9 = 60$ Marks

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INTRODUCTION

INTRODUCTION TO DATABASE

What is Database?

A database is a separate application that stores a collection of data. Each database has one or more distinct APIs for creating, accessing, managing, searching, and replicating the data it holds. now a days we use relational database management systems (RDBMS) to store and manager huge volume of data.

A **Relational DataBase Management System (RDBMS)** is a software that:

- Enables you to implement a database with tables, columns, and indexes.
- Guarantees the Referential Integrity between rows of various tables.
- Interprets an SQL query and combines information from various tables.

RDBMS Terminology:

Database: A database is a collection of tables, with related data.

Table: A table is a matrix with data. A table in a database looks like a *simple spreadsheet*.

Column: One column (data element) contains data of one and the same kind, for example the column postcode. or phone numbers

Row: A row (= tuple, entry or record) is a group of related data, for example the data of one subscription.

Redundancy: Storing data twice, redundantly to make the system faster.

Primary Key: A primary key is unique. A key value can not occur twice in one table. With a key you can find at most one row.

Foreign Key: A foreign key is the linking pin between two tables.

Compound Key: A compound key (composite key) is a key that consists of multiple columns, because one column is not sufficiently unique.

Index: An index in a database resembles an index at the back of a book.

Referential Integrity: Referential Integrity makes sure that a foreign key value always points to an existing row

DDL or Data Definition Language actually consists of the SQL commands that can be used to to create and modify the structure of database objects in a database. These database objects include views, schemas, tables, indexes, etc.

Some examples:

- CREATE - to create objects in the database
- ALTER - alters the structure of the database
- DROP - delete objects from the database

DML is Data Manipulation Language statements: which are used to interact with a database by deleting, inserting, retrieving, or updating data in the database.

Some examples:

- **SELECT** - retrieve data from the a database
- **INSERT** - insert data into a table
- **UPDATE** - updates existing data within a table
- **DELETE** - deletes all records from a table, the space for the records remain

DCL is Data Control Language statements: which includes commands such as **GRANT** and **REVOKE** which mainly deals with the rights, permissions and other controls of the database system.

Some examples:

- **GRANT**-gives user's access privileges to database.
- **REVOKE**-withdraw user's access privileges given by using the **GRANT** command.

TCL is Transaction Control Language which deals with a transaction within a database.

Some examples:

- **COMMIT** - save work done
- **SAVEPOINT** - identify a point in a transaction to which you can later roll back
- **ROLLBACK** - restore database to original since the last **COMMIT**
- **SET TRANSACTION** - Change transaction options like what rollback segment to use.

SQL Data Types

Each column in a database table is required to have a name and a data type.

An SQL developer must decide what type of data that will be stored inside each column when creating a table. The data type is a guideline for SQL to understand what type of data is expected inside of each column, and it also identifies how SQL will interact with the stored data.

MySQL uses many different data types broken into three categories

- Numeric
- Date and Time
- String Type

DATA TYPES

NUMERIC:

- **INT** – A normal-sized integer that can be signed or unsigned. If signed, the allowable range is from -2147483648 to 2147483647. If unsigned, the allowable range is from 0 to 4294967295. You can specify a width of up to 11 digits.
- **TINYINT** – A very small integer that can be signed or unsigned. If signed, the allowable range is from -128 to 127. If unsigned, the allowable range is from 0 to 255. You can specify a width of up to 4 digits.
- **SMALLINT** – A small integer that can be signed or unsigned. If signed, the allowable range is from -32768 to 32767. If unsigned, the allowable range is from 0 to 65535. You can specify a width of up to 5 digits.

- **MEDIUMINT** – A medium-sized integer that can be signed or unsigned. If signed, the allowable range is from -8388608 to 8388607. If unsigned, the allowable range is from 0 to 16777215. You can specify a width of up to 9 digits.
- **BIGINT** – A large integer that can be signed or unsigned. If signed, the allowable range is from -9223372036854775808 to 9223372036854775807. If unsigned, the allowable range is from 0 to 18446744073709551615. You can specify a width of up to 20 digits.
- **FLOAT (M, D)** – A floating-point number that cannot be unsigned. You can define the display length (M) and the number of decimals (D). This is not required and will default to 10, 2, where 2 is the number of decimals and 10 is the total number of digits (including decimals). Decimal precision can go to 24 places for a FLOAT.
- **DOUBLE (M, D)** – A double precision floating-point number that cannot be unsigned. You can define the display length (M) and the number of decimals (D). This is not required and will default to 16, 4, where 4 is the number of decimals. Decimal precision can go to 53 places for a DOUBLE. REAL is a synonym for DOUBLE.
- **DECIMAL (M, D)** – an unpacked floating-point number that cannot be unsigned. In the unpacked decimals, each decimal corresponds to one byte. Defining the display length (M) and the number of decimals (D) is required. NUMERIC is a synonym for DECIMAL.

DATE AND TIME TYPES

The MySQL date and time data types are as follows –

- **DATE** – A date in YYYY-MM-DD format, between 1000-01-01 and 9999-12-31. For example, December 30th, 1973 would be stored as 1973-12-30.
- **DATETIME** – A date and time combination in YYYY-MM-DD HH:MM:SS format, between 1000-01-01 00:00:00 and 9999-12-31 23:59:59. For example, 3:30 in the afternoon on December 30th, 1973 would be stored as 1973-12-30 15:30:00.
- **TIMESTAMP** – A timestamp between midnight, January 1st, 1970 and sometime in 2037. This looks like the previous DATETIME format, only without the hyphens between numbers; 3:30 in the afternoon on December 30th, 1973 would be stored as 19731230153000 (YYYYMMDDHHMMSS).
- **TIME** – Stores the time in a HH:MM:SS format.
- **YEAR (M)** – Stores a year in a 2-digit or a 4-digit format. If the length is specified as 2 (for example YEAR (2)), YEAR can be between 1970 to 2069 (70 to 69). If the length is specified as 4, then YEAR can be 1901 to 2155. The default length is 4.

STRING TYPES

This list describes the common string data types in MySQL.

- **CHAR (M)** – A fixed-length string between 1 and 255 characters in length (for example CHAR (5)), right-padded with spaces to the specified length when stored. Defining a length is not required, but the default is 1.

- **VARCHAR (M)** – A variable-length string between 1 and 255 characters in length. For example, VARCHAR (25). You must define a length when creating a VARCHAR field.
- **BLOB or TEXT** – A field with a maximum length of 65535 characters. BLOBs are "Binary Large Objects" and are used to store large amounts of binary data, such as images or other types of files. Fields defined as TEXT also hold large amounts of data. The difference between the two is that the sorts and comparisons on the stored data are **case sensitive** on BLOBs and are **not case sensitive** in TEXT fields. You do not specify a length with BLOB or TEXT.
- **TINYBLOB or TINYTEXT** – A BLOB or TEXT column with a maximum length of 255 characters. You do not specify a length with TINYBLOB or TINYTEXT.
- **MEDIUMBLOB or MEDIUMTEXT** – A BLOB or TEXT column with a maximum length of 16777215 characters. You do not specify a length with MEDIUMBLOB or MEDIUMTEXT.
- **LONGBLOB or LONGTEXT** – A BLOB or TEXT column with a maximum length of 4294967295 characters. You do not specify a length with LONGBLOB or LONGTEXT.

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 A1><Data Type D1> [<Constraints>],

<Attribute A2><Data Type D2> [<Constraints>],

.....

<Attribute An><Data Type Dn> [<Constraints>],

[<integrity-constraint 1>, <integrity-constraint k>]);

Specifying the unique, primary key attributes, secondary keys, and referential integrity constraints

EXAMPLE OF CREATING TABLE

CREATE TABLE ORDERS

(

ORDER_ID INT (6) PRIMARY KEY,

ORDER_DATE DATE

);

ALTER TABLE STATEMENT

Once a table is created in the database, there are many occasions where one may wish to change the structure of the table. Typical cases include the following:

- Add a column
- Drop a column
- Change a column name
- Change the data type for a column
- add and drop various constraints on an existing table.including primarykey and foreignkey

The SQL syntax for **ALTER TABLE** is

ALTER TABLE "table_name" [alter specification]

[alter specification] is dependent on the type of alteration we wish to perform. alter specification is already mentioned above

ADDING COLUMN IN TABLE

To add a column in a table, use the following syntax:

```
ALTER TABLE TABLENAME ADD COLUMN_NAME DATATYPE;
```

Example: ALTER TABLE ORDERS ADD JOB VARCHAR (20);

MODIFYING DATATYPE FOR COLUMN IN TABLE

To modify a column data type in a table, use the following syntax:

```
ALTER TABLE ORDERS MODIFY COLUMN_NAME VARCHAR (50);
```

Example: ALTER TABLE ORDERS MODIFY JOB VARCHAR (50);

RENAMING COLUMN IN TABLE

You can rename a column in MySQL using the ALTER TABLE and CHANGE commands together to change an existing column.

For example,say the column is currently named JOB, but you decide that DESIGNATION is a more appropriate title. The column is located on the table entitled ORDERS.

Here is an example of how to change it:

```
ALTER TABLE TABLENAME CHANGE OLDNAME NEWNAME VARCHAR (20);
```

Example: ALTER TABLE ORDERS CHANGE JOB DESIGNATION VARCHAR (20);

DELETING COLUMN

To delete a column in a table, use the following syntax:

```
ALTER TABLE TABLENAME DROP COLUMN COLUMN_NAME
```

Example: ALTER TABLE ORDERS DROP COLUMN DESIGNATION;

RENAMING A TABLE

To rename a table, use the following syntax:

```
RENAME TABLE OLDTABLENAME TO NEWTABLENAME;
```

Example: RENAME TABLE ORDERS TO ORDERS_TBL

DROP TABLE

It is very easy to drop an existing MySQL table, but you need to be very careful while deleting any existing table because the data lost will not be recovered after deleting a table.

The DROP TABLE statement is used to drop an existing table in a database

```
DROP TABLE TABLENAME;
```

Example: DROP TABLE ORDER

TRUNCATE TABLE STATEMENT

if we wish to simply get rid of the data but not the table itself? For this, we can use the

TRUNCATE TABLE command.

The syntax for TRUNCATE TABLE is

```
TRUNCATE "table_name"
```

So, if we wanted to truncate the table called customer that we created in MYSQL , we simply type,

Example: TRUNCATE customer

CONSTRAINTS:

Common types of constraints include the following:

Primary Key:-

- A primary key is used to uniquely identify each row in a table. It can either be part of the actual record itself, or it can be an artificial field (one that has nothing to do with the actual record).
- A primary key can consist of one or more fields on a table. When multiple fields are used as a primary key, they are called a composite key.
- Primary keys can be specified either when the table is created (using CREATE TABLE) or by changing the existing table structure (using ALTER TABLE).

Below are examples for specifying a primary key when creating a table:

Example :

```
CREATE TABLE ORDERS (ORDER_ID INT (6) PRIMARY KEY,ORDER_DATE DATE);
```

Below are examples for specifying a primary key by altering a table:

```
CREATE TABLE ORDERS (ORDER_ID INT (6), ORDER_DATE DATE);
```

Example : ALTER TABLE ORDERS ADD PRIMARY KEY (ORDER_ID);

Note: - Before using the ALTER TABLE command to add a primary key, you'll need to make sure that the field is defined as 'NOT NULL' -- in other words, NULL cannot be an accepted value for that field.and column values must be unique

```
ALTER TABLE TABLENAME DROP PRIMARY KEY CONSTRAINT
```

To drop a PRIMARY KEY constraint in Table ORDERS, use the following MYSQL:syntax

Example: ALTER TABLE ORDERS DROP PRIMARY KEY

FOREIGN KEY

- A foreign key is a field (or fields) that points to the primary key of another table.
- The purpose of the foreign key is to ensure referential integrity of the data. In other words, only values that are supposed to appear in the database are permitted
- For example, say we have two tables, a CUSTOMER table that includes all customer data, and an ORDERS table that includes all customer orders. The constraint here is that all orders must be associated with a customer that is already in the CUSTOMER table.
- In this case, we will place a foreign key on the ORDERS table and have it relate to the primary key of the CUSTOMER table. This way, we can ensure that all orders in the ORDERS table are related to a customer in the CUSTOMER table. .In other words, the ORDERS table cannot contain information on a customer that is not in the CUSTOMER table.

The structure of these two tables will be as follows:

Table CUSTOMER

column name	Characteristic
SID	Primary Key
Last_Name	varchar(50)
First_Name	varchar(50)

Table ORDERS

column name	characteristic
Order_ID	Primary Key
Order_Date	Date
Customer_SID	Foreign Key
Amount	Decimal(10,2)

```
CREATE TABLE CUSTOMER
```

```
(  
SID INT PRIMARY KEY,  
Last_Name varchar(50),  
First_Name varchar(50)  
);
```

In the below example, the Customer_SID column in the ORDERS table is a foreign key pointing to the SID column which is primary key in the CUSTOMER table.

Below we show examples of how to specify the foreign key when creating the ORDERS table:

```
CREATE TABLE ORDERS
```

```
(  
Order_ID int,  
Order_Date date,  
Customer_SID int,  
Amount double,  
Primary Key (Order_ID),  
Foreign Key (Customer_SID) references CUSTOMER(SID)  
);
```

Below are examples for specifying a foreign key by altering a table.

This assumes that the ORDERS table has been created, and the foreign key has not yet been put in

```
ALTER TABLE ORDERS ADD FOREIGN KEY (customer_sid) REFERENCES  
CUSTOMER(SID);
```

We can drop a foreign key by using below syntax

```
ALTER TABLE ORDERS DROP FOREIGN KEY FOREIGNKEY_CONSTRAINT_NAME;
```

NOT NULL Constraint:-By default, a column can hold NULL. If you don't want to allow or store NULL value in a column, you will want to place a constraint on this column specifying that NULL is now not an allowable value.

DEFAULT Constraint:- The DEFAULT constraint provides a default value to a column when the INSERT INTO statement does not provide a specific value.

UNIQUE Constraint:-The UNIQUE constraint ensures that all values in a column are distinct.

CHECK Constraint:-The CHECK constraint ensures that all values in a column satisfy certain conditions. Once defined, the database will only insert a new row or update an existing row if the new value satisfies the CHECK constraint. The CHECK constraint is used to ensure data quality

BASIC QUERIES IN SQL

- SQL has one basic statement for retrieving information from a database; the **SELECT** 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 use the **COMPANY** database as shown below:

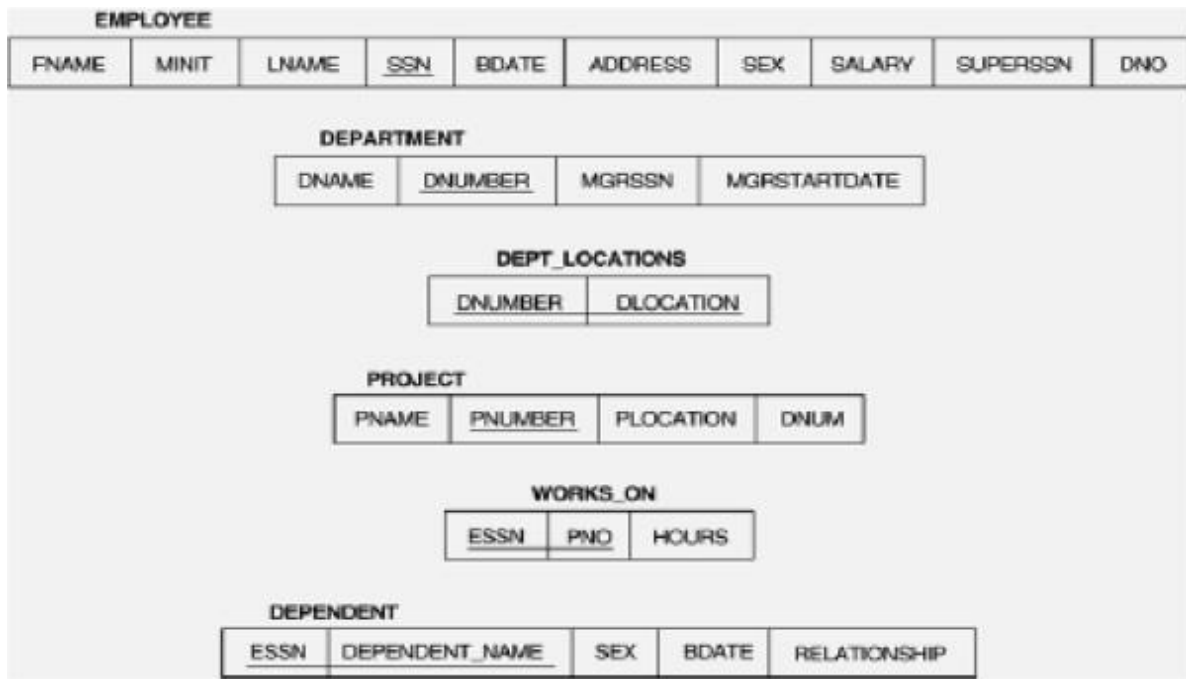
Example of a simple query on one relation

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.



WORKS_ON	ESSN	PNO	HOURS
	123456789	1	32.5
	123456789	2	7.5
	999884444	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
	986885555	20	null

PROJECT	PNAME	PNUMBER	PLOCATION	DNUM
	ProductX	1	Beltsville	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 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:

Retrieve 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 LNAME='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' init.

```
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 lastname.

```
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 INT,  
TOTAL_SAL INT);
```

```
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');
```

Concept of Normalization

A large database defined as a single relation may result in data duplication. This repetition of data may result in:

- Making relations very large.
- It isn't easy to maintain and update data as it would involve searching many records in relation.
- Wastage and poor utilization of disk space and resources.
- The likelihood of errors and inconsistencies increases.

So to handle these problems, we should analyze and decompose the relations with redundant data into smaller, simpler, and well-structured relations that satisfy desirable properties. Normalization is a process of decomposing the relations into relations with fewer attributes.

What is Normalization?

- Normalization is the process of organizing the data in the database.
- Normalization is used to minimize the redundancy from a relation or set of relations. It is also used to eliminate undesirable characteristics like Insertion, Update, and Deletion Anomalies.
- Normalization divides the larger table into smaller and links them using relationships.
- The normal form is used to reduce redundancy from the database table.

Why do we need Normalization?

The main reason for normalizing the relations is removing these anomalies. Failure to eliminate anomalies leads to data redundancy and can cause data integrity and other problems as the database grows. Normalization consists of a series of guidelines that help to guide you in creating a good database structure.

Data modification anomalies can be categorized into three types:

- Insertion Anomaly: Insertion Anomaly refers to when one cannot insert a new tuple into a relationship due to lack of data.
- Deletion Anomaly: The delete anomaly refers to the situation where the deletion of data results in the unintended loss of some other important data.
- Updation Anomaly: The update anomaly is when an update of a single data value requires multiple rows of data to be updated.

Advantages of Normalization

- Normalization helps to minimize data redundancy.
- Greater overall database organization.
- Data consistency within the database.
- Much more flexible database design.
- Enforces the concept of relational integrity.

Disadvantages of Normalization

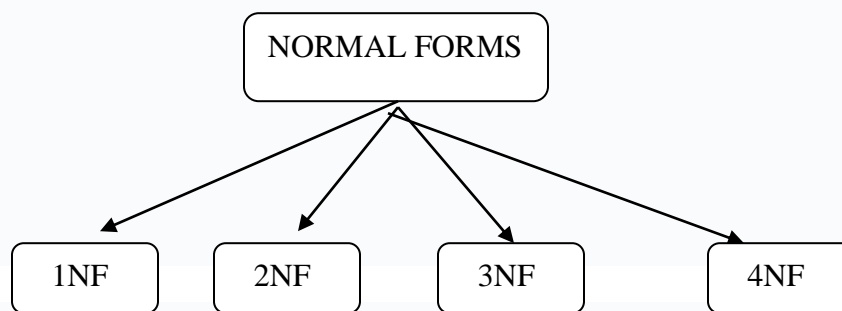
- You cannot start building the database before knowing what the user needs.
- It is very time-consuming and difficult to normalize relations of a higher degree.
- Careless decomposition may lead to a bad database design, leading to serious problems.

First Normal Form (1NF)

- A relation will be 1NF if it contains an atomic value.
- It states that an attribute of a table cannot hold multiple values. It must hold only single-valued attribute.
- First normal form disallows the multi-valued attribute, composite attribute, and their combinations.

Normal Forms

There are four types of normal forms that are usually used in relational databases as you can see in the following figure:



1. **1NF:** A relation is in 1NF if all its attributes have an atomic value.
2. **2NF:** A relation is in 2NF if it is in 1NF and all non-key attributes are fully functional dependent on the candidate key.
3. **3NF:** A relation is in 3NF if it is in 2NF and there is no transitive dependency.
4. **BCNF:** A relation is in BCNF if it is in 3NF and for every Functional Dependency, LHS is the super key.

To understand the above-mentioned normal forms, we first need to have an understanding of the functional dependencies.

Functional dependency is a relationship that exists between two sets of attributes of a relational table where one set of attributes can determine the value of the other set of attributes. It is denoted by $X \rightarrow Y$, where X is called a determinant and Y is called dependent.

There are various levels of normalizations. Let's go through them one by one:

First Normal Form (1NF)

A relation is in 1NF if every attribute is a single-valued attribute or it does not contain any multi-valued or composite attribute, i.e., every attribute is an atomic attribute. If there is a composite or multi-valued attribute, it violates the 1NF. To solve this, we can create a new row for each of the values of the multi-valued attribute to convert the table into the 1NF.

Let's take an example of a relational table <EmployeeDetail> that contains the details of the employees of the company.

<EmployeeDetail>

Employee Code	Employee Name	Employee Phone Number
101	Yogesh	98765623,998234123
101	Yogesh	89023467
102	Vinay	76213908
103	Rajiv	98132452

Here, the Employee Phone Number is a multi-valued attribute. So, this relation is not in 1NF.

To convert this table into 1NF, we make new rows with each Employee Phone Number as a new row as shown below

<EmployeeDetail>

Employee Code	Employee Name	Employee Phone Number
101	Yogesh	998234123
101	Yogesh	98765623
101	Yogesh	89023467
102	Vinay	76213908

Second Normal Form (2NF)

The normalization of 1NF relations to 2NF involves the elimination of partial dependencies. A partial dependency exists when any non-prime attributes, i.e., an attribute not a part of the candidate key, is not fully functionally dependent on one of the candidate keys.

For a relational table to be in second normal form, it must satisfy the following rules:

- The table must be in first normal form.
- It must not contain any partial dependency, i.e., all non-prime attributes are fully functionally dependent on the primary key.

If a partial dependency exists, we can divide the table to remove the partially dependent attributes and move them to some other table where they fit in well.

Let us take an example of the following <EmployeeProjectDetail> table to understand what is partial dependency and how to normalize the table to the second normal form:

<EmployeeProjectDetail>

Employee Code	Project ID	Employee Name	Project Name
101	P03	Yogesh	Project103
101	P01	Yogesh	Project101
102	P04	Vinay	Project104
103	P02	Rajiv	Project102

In the above table, the prime attributes of the table are Employee Code and Project ID. We have partial dependencies in this table because Employee Name can be determined by Employee Code and Project Name can be determined by Project ID. Thus, the above relational table violates the rule of 2NF.

The prime attributes are those which are part of one or more candidate keys.

To remove partial dependencies from this table and normalize it into second normal form, we can decompose the <EmployeeProjectDetail> table into the following three tables:

<EmployeeDetail>

Employee Code	Employee Name
101	Yogesh
101	Yogesh
102	Vinay
103	Rajiv

<EmployeeProject>

Project ID	Project Name
P03	Project103
P01	Project101
P04	Project104
P02	Project102

Thus, we've converted the <EmployeeProjectDetail> table into 2NF by decomposing it into <EmployeeDetail>, <ProjectDetail> and <EmployeeProject> tables. As you can see, the above tables satisfy the following two rules of 2NF as they are in 1NF and every non-prime attribute is fully dependent on the primary key.

The relations in 2NF are clearly less redundant than relations in 1NF. However, the decomposed relations may still suffer from one or more anomalies due to the transitive dependency. We will remove the transitive dependencies in the Third Normal Formalization

Employee Code	Employee Name	Employee Zipcode	Employee City
101	Yogesh	575001	Mangalore
101	Yogesh	560002	Bangalore
102	Vinay	570001	Mysore
103	Sandeep	580020	Hubli

The above table is not in 3NF because it has Employee Code \rightarrow Employee City transitive dependency because: Employee Code \rightarrow Employee Zipcode

- Employee Zipcode \rightarrow Employee City
- Also, Employee Zipcode is not a super key and Employee City is not a prime attribute.
- To remove transitive dependency from this table and normalize it into the third normal form, we can decompose the <EmployeeDetail> table into the following two tables:

<EmployeeDetail>

Employee Code	Employee Name	Employee Zipcode
101	Yogesh	575001
101	Yogesh	560002
102	Vinay	570001
103	Sandeep	580020

<EmployeeLocation>

Employee Zipcode	Employee City
575001	Mangalore
560002	Bangalore
570001	Mysore
580020	Hubli

Thus, we've converted the <EmployeeDetail> table into 3NF by decomposing it into <EmployeeDetail> and <EmployeeLocation> tables as they are in 2NF and they don't have any transitive dependency.

The 2NF and 3NF impose some extra conditions on dependencies on candidate keys and remove redundancy caused by that. However, there may still exist some dependencies that cause redundancy in the database. These redundancies are removed by a more strict normal form known as BCNF.

Boyce–Codd Normal Form (BCNF)

Boyce-Codd Normal Form is an advanced version of 3NF as it contains additional constraints compared to 3NF.

For a relational table to be in Boyce-Codd normal form, it must satisfy the following rules:

1. The table must be in the third normal form.
2. For every non-trivial functional dependency $X \rightarrow Y$, X is the superkey of the table. That means X cannot be a non-prime attribute if Y is a prime attribute.

A superkey is a set of one or more attributes that can uniquely identify a row in a database table. Let us

take an example of the following <EmployeeProjectLead> table to understand how to normalize the table to the BCNF

<EmployeeProjectLead>

Employee Code	Project ID	Project Leader
101	P03	Gopalkrishna
101	P01	Chethan
102	P04	Hemanth
103	P02	Yashwanth

The above table satisfies all the normal forms till 3NF, but it violates the rules of BCNF because the candidate key of the above table is {Employee Code, Project ID}.

For the non-trivial functional dependency, Project Leader -> Project ID, Project ID is a prime attribute but Project Leader is a non-prime attribute. This is not allowed in BCNF.

To convert the given table into BCNF, we decompose it into three tables:

<EmployeeProject>

Employee Code	Project ID
101	P03
101	P01
102	P04
103	P02

<ProjectLead>

Project Leader	Project ID
Gopalkrishna	P03
Chethan	P01
Hemanth	P04
Yashwanth	P02

Thus, we've converted the <EmployeeProjectLead> table into BCNF by decomposing it into <EmployeeProject> and <ProjectLead> tables.

ACID Properties in DBMS

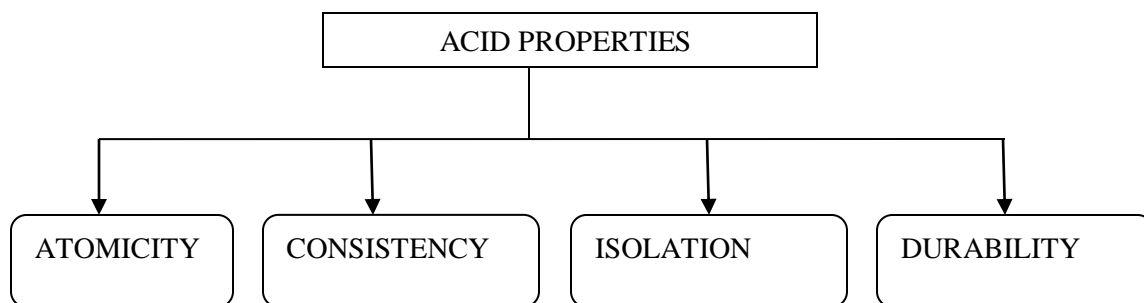
DBMS is the management of data that should remain integrated when any changes are done in it. It is because if the integrity of the data is affected, whole data will get disturbed and corrupted. Therefore, to maintain the integrity of the data, there are four properties described in the database management system, which are known as the **ACID** properties.

The ACID properties are meant for the transaction that goes through a different group of tasks, and there we come to see the role of the ACID properties.

In this section, we will learn and understand about the ACID properties. We will learn what these properties stand for and what does each property is used for. We will also understand the ACID properties with the help of some examples.

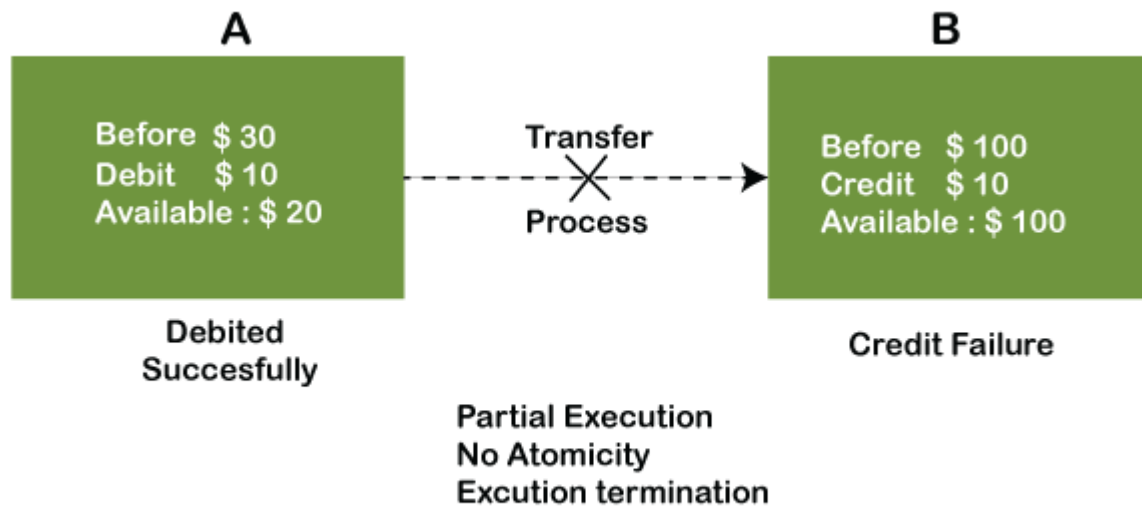
ACID Properties

The expansion of the term ACID defines for:



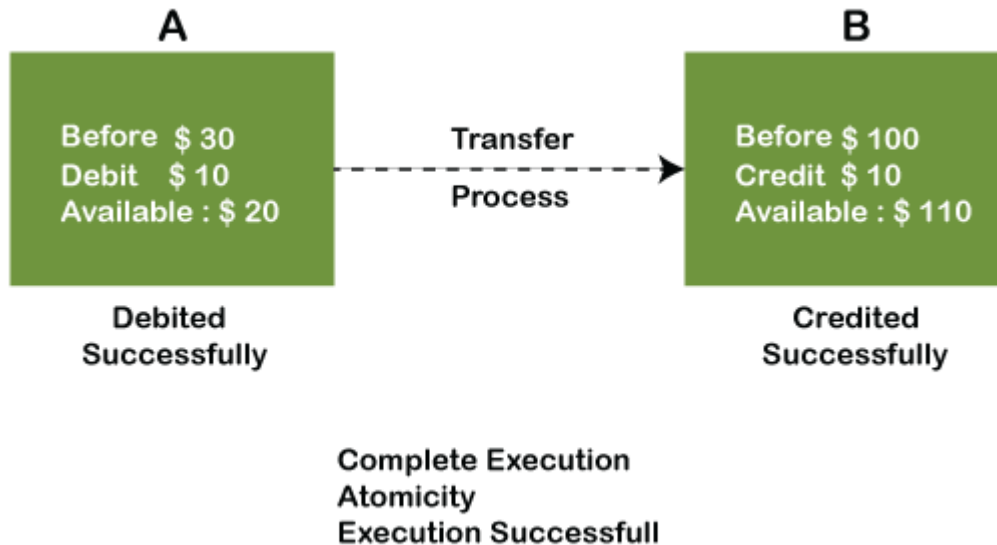
1)Atomicity: The term atomicity defines that the data remains atomic. It means if any operation is performed on the data, either it should be performed or executed completely or should not be executed at all. It further means that the operation should not break in between or execute partially. In the case of executing operations on the transaction, the operation should be completely executed and not partially.

Example: If Yogesh has account A having \$30 in his account from which he wishes to send \$10 to Vinay's account, which is B. In account B, a sum of \$ 100 is already present. When \$10 will be transferred to account B, the sum will become \$110. Now, there will be two operations that will take place. One is the amount of \$10 that Yogesh wants to transfer will be debited from his account A, and the same amount will get credited to account B, i.e., into Vinay's account. Now, what happens - the first operation of debit executes successfully, but the credit operation, however, fails. Thus, in Yogesh account A, the value becomes \$20, and to that of Vinay's account, it remains \$ 100 as it was previously present.



In the above diagram, it can be seen that after crediting \$10, the amount is still \$100 in account B. So, it is not an atomic transaction.

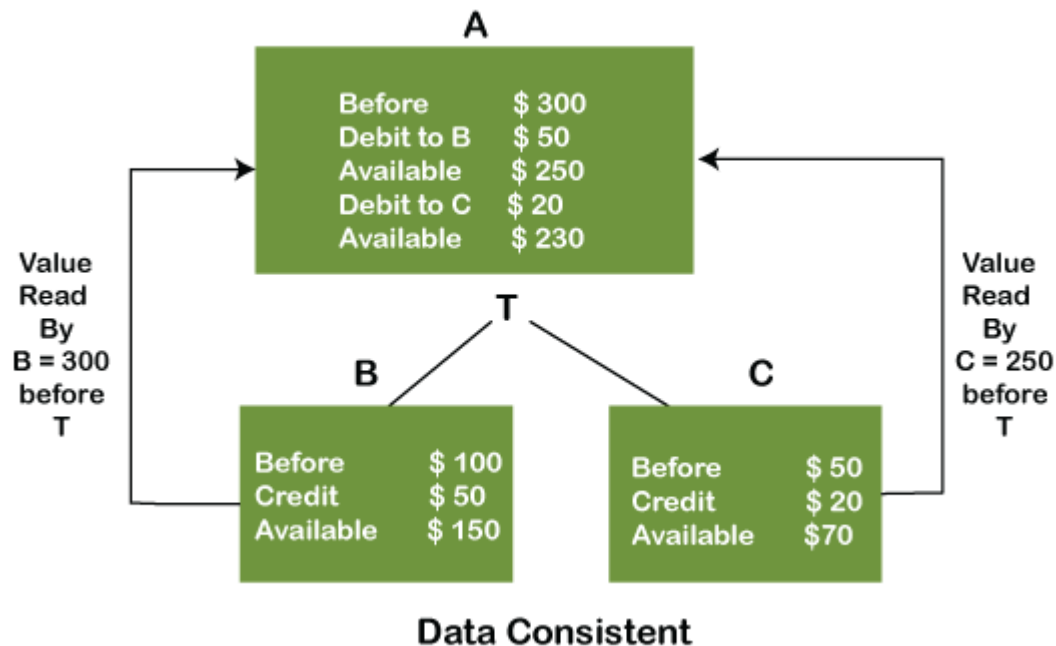
The below diagram shows that both debit and credit operations are done successfully. Thus the transaction is atomic.



Thus, when the amount loses atomicity, then in the bank systems, this becomes a huge issue, and so the atomicity is the main focus in the bank systems.

2)Consistency: The word consistency means that the value should remain preserved always. In DBMS, the integrity of the data should be maintained, which means if a change in the database is made, it should remain preserved always. In the case of transactions, the integrity of the data is very essential so that the database remains consistent before and after the transaction. The data should always be correct.

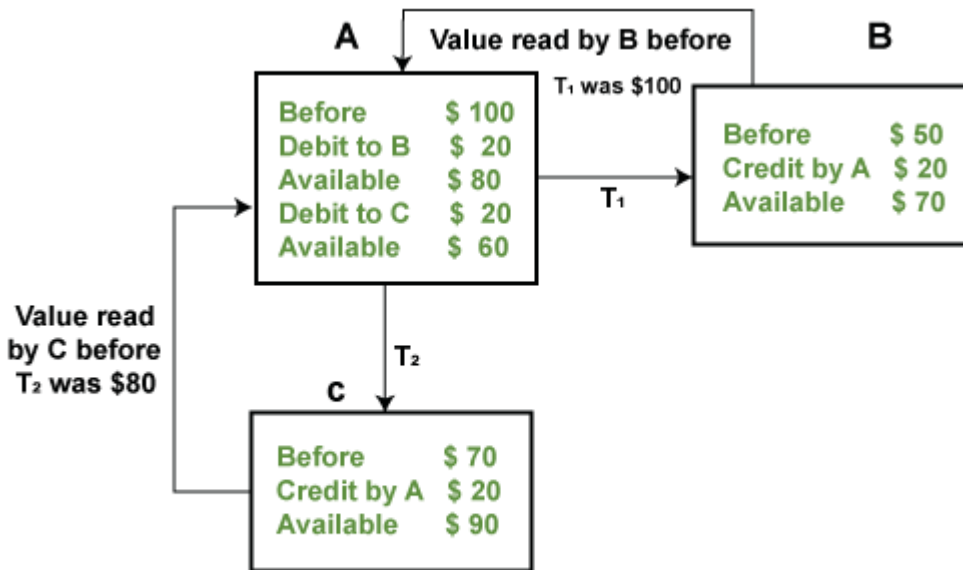
Example:



In the above figure, there are three accounts, A, B, and C, where A is making a transaction T one by one to both B & C. There are two operations that take place, i.e., Debit and Credit. Account A firstly debits \$50 to account B, and the amount in account A is read \$300 by B before the transaction. After the successful transaction T, the available amount in B becomes \$150. Now, A debits \$20 to account C, and that time, the value read by C is \$250 (that is correct as a debit of \$50 has been successfully done to B). The debit and credit operation from account A to C has been done successfully. We can see that the transaction is done successfully, and the value is also read correctly. Thus, the data is consistent. In case the value read by B and C is \$300, which means that data is inconsistent because when the debit operation executes, it will not be consistent.

4)Isolation: The term 'isolation' means separation. In DBMS, Isolation is the property of a database where no data should affect the other one and may occur concurrently. In short, the operation on one database should begin when the operation on the first database gets complete. It means if two operations are being performed on two different databases, they may not affect the value of one another. In the case of transactions, when two or more transactions occur simultaneously, the consistency should remain maintained. Any changes that occur in any particular transaction will not be seen by other transactions until the change is not committed in the memory.

Example: If two operations are concurrently running on two different accounts, then the value of both accounts should not get affected. The value should remain persistent. As you can see in the below diagram, account A is making T1 and T2 transactions to account B and C, but both are executing independently without affecting each other. It is known as Isolation.



Isolation - Independent execution of T₁ & T₂ by A

4) **Durability:** Durability ensures the permanency of something. In DBMS, the term durability ensures that the data after the successful execution of the operation becomes permanent in the database. The durability of the data should be so perfect that even if the system fails or leads to a crash, the database still survives. However, if gets lost, it becomes the responsibility of the recovery manager for ensuring the durability of the database. For committing the values, the COMMIT command must be used every time we make changes.

Therefore, the ACID property of DBMS plays a vital role in maintaining the consistency and availability of data in the database.

Thus, it was a precise introduction of ACID properties in DBMS. We have discussed these properties in the transaction section also.

INTRODUCTION TO OPERATORS IN MYSQL

An operator is a reserved word or a character used primarily in an SQL statement's WHERE clause to perform operation(s), such as comparisons and arithmetic operations. These Operators are used to specify conditions in an SQL statement and to serve as conjunctions for multiple conditions in a statement. Different type of operators are as follows

- Arithmetic operators
- Comparison operators
- Logical operators
- Operators used to negate conditions

1.Arithmetic Operators

In MySQL, arithmetic operators are used to perform the arithmetic operations as described below.

Operator	Description	Example
+	Addition of two operands	$a + b$
-	Subtraction of right operand from the left operand	$a - b$
*	Multiplication of two operands	$a * b$
/	Division of left operand by the right operand	a / b
%	Modulus – the remainder of the division of left operand by the right	$a \% b$

The following are a few examples of operations, using Arithmetic Operators.

Let us assume certain values for the below variables as

$a = 10$, $b = 5$

$a + b$ will give the result as 15.

$a - b$ will give the result as 5.

$a * b$ will give the result as 50.

a / b will give the result as 2.

$a \% b$ will give the result as 0.

Examples of Arithmetic Operators**SELECT 150 +250;****Output****400****SELECT 145 - 75;****Output****70****SELECT 17 * 5;****Output****85****SELECT 49 / 7;****Output****7.0000****SELECT 21 % 5;****Output****1****2.Comparison Operators**

The comparison operators in MySql are used to compare values between operands and return true or false according to the condition specified in the statement.

Operator	Description	Example
>	If the value of left operand is greater than that of the value of the right operand, the condition becomes true; if not then false.	a > b
<	If the value of left operand is less than that of a value of the right operand, the condition becomes true; if not then false.	a < b
=	If both the operands have equal value, the condition becomes true; if not	a == b

	then false.	
/ !=	If both the operands do not have equal value, the condition becomes true; if not then false.	a != y
>=	If the value of left operand is greater than or equal to the right operand, the condition becomes true; if not then false.	a >= b
<=	If the value of left operand is less than or equal to the right operand, the condition becomes true; if not then false.	a <= b
!<	If the value of left operand is not less than the value of right operand, the condition becomes true; if not then false.	a !< b
!>	If the value of left operand is not greater than the value of right operand, the condition becomes true; if not then false.	a !> b
<>	If the values of two operands are not equal, the condition becomes true; if not then false.	a <> b

3. Logical Operators

The logical operators used in MySQL are shown below.

Operator	Description
BETWEEN	It is used to search within a set of values, by the minimum value and maximum value provided.
EXISTS	It is used to search for the presence of a row in a table which satisfies a certain condition specified in the query.
OR	It is used to combine multiple conditions in a statement by using the WHERE clause.
AND	It allows the existence of multiple conditions in an SQL statement's WHERE clause.
NOT	It reverses the meaning of the logical operator with which it is used. (Examples: NOT EXISTS, NOT BETWEEN, NOT IN, etc.)

IN	It is used to compare a value in a list of literal values.
ALL	It compares a value to all values in another set of values.
ANY	It compares a value to any value in the list according to the condition specified.
LIKE	It uses wildcard operators to compare a value to similar values.
IS NULL	It compares a value with a NULL value.
UNIQUE	It searches for every row of a specified table for uniqueness (no duplicates).

Let us take an example of CUSTOMER table as shown below to understand how to use the comparison operators as stated above while performing MySQL queries.

Pre-Requisite Data:

CUSTOMER TABLE

ID	NAME	AGE	ADDRESS	SALARY
1	Anand	25	Bangalore	30000.00
2	Sandeep	27	Hubli	55000.00
3	Sharath	26	Bangalore	60000.00
4	Manohar	31	Mangalore	32000.00
5	Hemanth	29	Shimoga	40000.00
6	Nithin	30	Belgaum	75000.00
7	Nishant	32	Mysore	20000.00
8	Deepak	32	Mysore	25000.00
9	Bharath	39	Mysore	85000.00

Below is script for creating table CUSTOMER

```
CREATE TABLE CUSTOMER
(
  ID INT PRIMARY KEY,
  NAME VARCHAR(200),
  AGE INT NOT NULL,
  ADDRESS VARCHAR(200),
  SALARY DECIMAL(15,2)
);
```

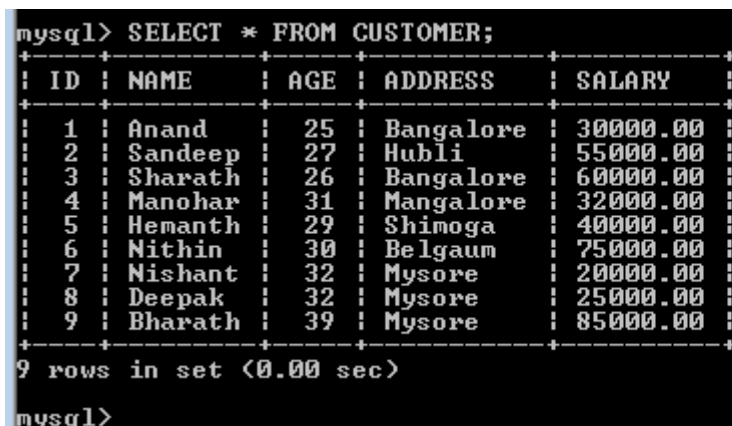
Below is script for Inserting values into CUSTOMER Table

```

Insert into Customer values (1,"Anand", 25,"Bangalore", 30000.00);
Insert into Customer values(2, "Sandeep", 27,"Hubli", 55000.00);
Insert into Customer values(3, "Sharath", 26,"Bangalore", 60000.00);
Insert into Customer values(4, "Manohar", 31,"Mangalore", 32000.00);
Insert into Customer values(5, 'Hemanth', 29,'Shimoga', 40000.00);
Insert into Customer values(6, 'Nithin', 30,'Belgaum', 75000.00);
Insert into Customer values(7, "Nishant", 32,"Mysore",20000.00);
Insert into Customer values(8, "Deepak", 32,"Mysore",25000.00);
Insert into Customer values(9, "Bharath", 39,"Mysore",85000.00);

```

Below is the screen shot showing contents of customer table.



```

mysql> SELECT * FROM CUSTOMER;
+----+-----+-----+-----+-----+
| ID | NAME  | AGE  | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand | 25   | Bangalore | 30000.00 |
| 2  | Sandeep | 27   | Hubli | 55000.00 |
| 3  | Sharath | 26   | Bangalore | 60000.00 |
| 4  | Manohar | 31   | Mangalore | 32000.00 |
| 5  | Hemanth | 29   | Shimoga | 40000.00 |
| 6  | Nithin | 30   | Belgaum | 75000.00 |
| 7  | Nishant | 32   | Mysore | 20000.00 |
| 8  | Deepak | 32   | Mysore | 25000.00 |
| 9  | Bharath | 39   | Mysore | 85000.00 |
+----+-----+-----+-----+-----+
9 rows in set (0.00 sec)

mysql>

```

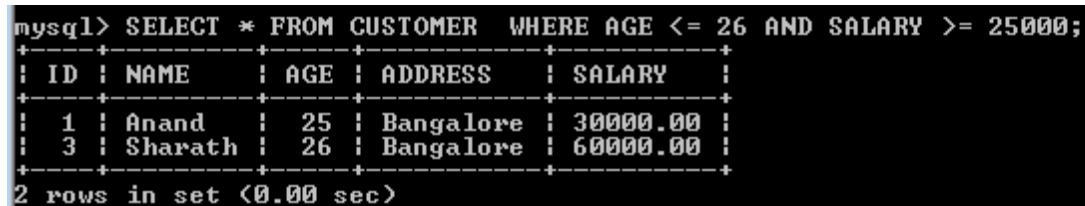
Let us use the different comparison operators to query the CUSTOMER table as shown below.

Queries:

Q1. Write a query to find the salary of a person where age is less than or equal to 26 and salary greater than or equal to 25000 from Customer table

```
SELECT * FROM CUSTOMER WHERE AGE <= 26 AND SALARY >= 25000;
```

Output:



```

mysql> SELECT * FROM CUSTOMER WHERE AGE <= 26 AND SALARY >= 25000;
+----+-----+-----+-----+-----+
| ID | NAME  | AGE  | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand | 25   | Bangalore | 30000.00 |
| 3  | Sharath | 26   | Bangalore | 60000.00 |
+----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

```

Q2. Write a query to find the salary of a person where age is less than or equal to 26 or salary greater than or equal to 33000 from customer table.

```
SELECT * FROM CUSTOMER WHERE AGE <= 26 or SALARY >= 33000;
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE AGE <=26 or SALARY >=33000;
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand  | 25  | Bangalore | 30000.00 |
| 2  | Sandeep | 27  | Hubli   | 55000.00 |
| 3  | Sharath | 26  | Bangalore | 60000.00 |
| 5  | Hemanth | 29  | Shimoga | 40000.00 |
| 6  | Nithin | 30  | Belgaum | 75000.00 |
+----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

Q3. Write a query to find the name of customer whose name start with n(using pattern matching)

```
SELECT * FROM CUSTOMER WHERE NAME LIKE 'n%';
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE NAME LIKE 'n%';
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 6  | Nithin | 30  | Belgaum | 75000.00 |
| 7  | Nishant | 32  | Mysore  | 20000.00 |
+----+-----+-----+-----+-----+
2 rows in set (0.00 sec)
```

Q4. Write a query to find the name of customer ending with th(using pattern matching)

```
SELECT * FROM CUSTOMER WHERE NAME LIKE '%th';
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE NAME LIKE '%th';
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 3  | Sharath | 26  | Bangalore | 60000.00 |
| 5  | Hemanth | 29  | Shimoga | 40000.00 |
| 9  | Bharath | 39  | Mysore  | 85000.00 |
+----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
mysql>
```

Q5. Write a query to find the customer details using “IN” operator where age can be 25 and 27.

```
SELECT * FROM CUSTOMER WHERE AGE IN (25,27);
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE AGE IN (25,27);
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand  | 25  | Bangalore | 30000.00 |
| 2  | Sandeep | 27  | Hubli   | 55000.00 |
+----+-----+-----+-----+-----+
2 rows in set (0.00 sec)
```

Q6. Write a query to find the customer details using “between ” operator where age is between 25 and 27

```
SELECT * FROM CUSTOMER WHERE AGE BETWEEN 25 AND 27;
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE AGE BETWEEN 25 AND 27;
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand  | 25  | Bangalore | 30000.00 |
| 2  | Sandeep | 27  | Hubli   | 55000.00 |
| 3  | Sharath | 26  | Bangalore | 60000.00 |
+----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

Q7. Write a query to find the customer details where age is not null

```
SELECT * FROM CUSTOMER WHERE AGE IS NOT NULL;
```

Output:

```
mysql> SELECT * FROM CUSTOMER WHERE AGE IS NOT NULL;
+----+-----+-----+-----+-----+
| ID | NAME   | AGE | ADDRESS | SALARY |
+----+-----+-----+-----+-----+
| 1  | Anand  | 25  | Bangalore | 30000.00 |
| 2  | Sandeep | 27  | Hubli   | 55000.00 |
| 3  | Sharath | 26  | Bangalore | 60000.00 |
| 4  | Manohar | 31  | Mangalore | 32000.00 |
| 5  | Hemanth | 29  | Shimoga | 40000.00 |
| 6  | Nithin | 30  | Belgaum | 75000.00 |
| 7  | Nishant | 32  | Mysore | 20000.00 |
| 8  | Deepak | 32  | Mysore | 25000.00 |
| 9  | Bharath | 39  | Mysore | 85000.00 |
+----+-----+-----+-----+-----+
9 rows in set (0.01 sec)
```

MySQL Aggregate Functions

An SQL group function or aggregate functions performs an operation on a group of rows and returns a single result. You may want retrieve group of item-prices and return total-price. This type of scenario is where you would use a group functions.

Syntax:

The following are the syntax to use aggregate functions in MySQL:

function_name (DISTINCT | ALL expression)

In the above syntax, we had used the following parameters:

- First, we need to specify the name of the aggregate function.
- Second, we use the DISTINCT modifier when we want to calculate the result based on distinct values or ALL modifiers when we calculate all values, including duplicates.
- The default is ALL.
- Third, we need to specify the expression that involves columns and arithmetic operators.
- There are various aggregate functions available in MySQL.
- Some of the most commonly used aggregate functions are summarised in the below table;;

Count():

Count(*): Returns total number of records .

Count(salary): Return number of Non Null values over the column salary.

Count(Distinct Salary): Return number of distinct Non Null values over the column salary

Sum():

sum(salary): Sum all Non Null values of Column salary

sum(Distinct salary): Sum of all distinct Non-Null values

Avg():

Avg(salary) = Sum(salary) / count(salary) = 310/5

Avg(Distinct salary) = sum(Distinct salary) / Count(Distinct Salary)

Min() and Max():

Min(salary): Minimum value in the salary column except NULL

Max(salary): Maximum value in the salary

The following table is summary of some SQL group function & query examples.

<u>Function</u>	<u>Description</u>	<u>Query Example</u>
AVG(fieldname)	Returns average value of a column	SELECT AVG(salary) FROM CUSTOMER;
COUNT(fieldname)	Returns number of items in Table or queried items	SELECT COUNT (salary) FROM CUSTOMER;
MAX(fieldname)	Returns maximum value of Column	SELECT MAX (salary) FROM CUSTOMER;
MIN(fieldname)	Returns minimum value of Column	SELECT MIN (salary) FROM CUSTOMER;
SUM(fieldname)	Returns total value of Column	SELECT SUM (salary) FROM CUSTOMER;

Below are Sample queries which use Aggregate function

Q1. Write a query to find the average salary of employees in customer table

SELECT AVG(salary) FROM CUSTOMER;

Output:

```
mysql> SELECT AVG(salary) FROM CUSTOMER;
+-----+
| AVG(salary) |
+-----+
| 46888.888889 |
+-----+
1 row in set (0.02 sec)

mysql> _
```

Q2. Write a query to find the number of employees in customer table

SELECT COUNT(ID) FROM CUSTOMER;

Output:

```
mysql> SELECT COUNT(ID) FROM CUSTOMER;
+-----+
| COUNT(ID) |
+-----+
|          9 |
+-----+
1 row in set (0.00 sec)

mysql> _
```

Q3 Write a query to find the maximum salary of employees in customer table

SELECT MAX(salary) FROM CUSTOMER;

Output:

```
mysql> SELECT MAX(salary) FROM CUSTOMER;
+-----+
| MAX(salary) |
+-----+
| 85000.00 |
+-----+
1 row in set (0.00 sec)

mysql> _
```

Q4. Write a query to find the minimum salary of employees in customer table

SELECT MIN(salary) FROM CUSTOMER;

Output:

```
mysql> SELECT MIN(salary) FROM CUSTOMER;
+-----+
| MIN(salary) |
+-----+
| 20000.00 |
+-----+
1 row in set (0.00 sec)

mysql> _
```

Q5. Write a query to find the sum of salary of all employees in customer table

SELECT SUM(salary) FROM CUSTOMER;

Output

```
mysql> SELECT SUM(salary)FROM CUSTOMER;
+-----+
| SUM(salary) |
+-----+
| 422000.00 |
+-----+
1 row in set (0.00 sec)

mysql>
```

GROUP BY Clause

The MYSQL GROUP BY Clause is used to collect data from multiple records and group the result by one or more column. It is generally used in a SELECT statement.

You can also use some aggregate functions like COUNT, SUM, MIN, MAX, AVG etc. on the grouped column.

SQL GROUP BY Syntax

Now that we know what the SQL GROUP BY clause is, let's look at the syntax for a basic group by query.

SELECT statements... GROUP BY column_name1[,column_name2,...] [HAVING condition];
HERE

- "SELECT statements..." is the standard SQL SELECT command query.
- "**GROUP BY** column_name1" is the clause that performs the grouping based on column_name1.
- "[column_name2,...]" is optional; represents other column names when the grouping is done on more than one column.
- "[HAVING condition]" is optional; it is used to restrict the rows affected by the GROUP BY clause. It is similar to the WHERE clause.

Pre-RequisiteData:employeesTABLE

emp_id	emp_name	emp_age	city	salary
101	Hemanth	32	Mysore	20000.00
102	Mohan	32	Belgaum	30000.00
103	Deepak	40	Mangalore	100000.00
104	Nitin	35	Bangalore	40000.00
105	Sandeep	32	Mangalore	50000.00
106	Yogesh	45	Mysore	70000.00
107	Rohit	35	Bangalore	60000.00
108	Bharath	40	Hubli	80000.00

Below is script for creating table employees

```
create table employees
(
emp_id int primary key,
emp_name varchar(200),
emp_age int ,
city varchar(200).
salary decimal(15,2)
);
```

Below is script for Inserting values into CUSTOMER Table

```
Insert into employees values(101,'Hemanth',32,'Mysore',20000);
Insert into employees values(102,'Mohan',32,'Belgaum',30000);
Insert into employees values(103,'Deepak',40,'Mangalore',100000)
Insert into employees values(104,'Nitin',35,'Bangalore',40000)
Insert into employees values(105,'Sandeep',32,'Mangalore',50000);
Insert into employees values(106,'Yogesh',45,'Mysore',70000)
Insert into employees values(107,'Rohit',35,'Bangalore',60000)
Insert into employees values(108,'Bharath',40,'Hubli',80000);
```

Below is the screen shot showing contents of employees table.

```
mysql> SELECT * FROM EMPLOYEES;
+-----+-----+-----+-----+-----+
| emp_id | emp_name | emp_age | city | salary |
+-----+-----+-----+-----+-----+
| 101 | Hemanth | 32 | Mysore | 20000.00 |
| 102 | Mohan | 32 | Belgaum | 30000.00 |
| 103 | Deepak | 40 | Mangalore | 100000.00 |
| 104 | Nitin | 35 | Bangalore | 40000.00 |
| 105 | Sandeep | 32 | Mangalore | 50000.00 |
| 106 | Yogesh | 45 | Mysore | 70000.00 |
| 107 | Rohit | 35 | Bangalore | 60000.00 |
| 108 | Bharath | 40 | Hubli | 80000.00 |
+-----+-----+-----+-----+-----+
8 rows in set (0.00 sec)

mysql>
```

MySQL Count() Function with GROUP BY Clause

We can also use the count() function with the GROUP BY clause that returns the count of the element in each group. For example, the following statement returns the number of employee staying in each city:

SELECT city, COUNT(*) FROM employees GROUP BY city;

After the successful execution, we will get the result as below:

```
mysql> SELECT city, COUNT(*) FROM employees GROUP BY city;
+-----+-----+
| city | COUNT(*) |
+-----+-----+
| Bangalore | 2 |
| Belgaum | 1 |
| Hubli | 1 |
| Mangalore | 2 |
| Mysore | 2 |
+-----+-----+
5 rows in set (0.00 sec)

mysql>
```

MySQL Count() Function with HAVING and ORDER BY Clause

Let us see another clause that uses ORDER BY and Having clause with the count() function. Execute the following statement that gives the employee age who has at least two ages and sort them based on the count result:

```
SELECT emp_age, COUNT(*) FROM employees GROUP BY emp_age having count(*)>1 order by count(*);
```

After the successful execution, we will get the result as below:

```
mysql> SELECT emp_age, COUNT(*) FROM employees group by emp_age having count(*)>1
order by count(*);
```

emp_age	COUNT(*)
40	2
35	2
32	3

```
3 rows in set (0.00 sec)

mysql>
```

MySQL sum() Function with GROUP BY Clause

We can also use the sum () function with the GROUP BY clause that returns the sum of the element in each group. For example, the following statement returns the sum of salary of employees in each city:

```
SELECT city, sum(salary) FROM employees GROUP BY city
```

After the successful execution, we will get the result as below

```
mysql> SELECT city, sum(SALARY) FROM employees GROUP BY city ;
```

city	sum(SALARY)
Bangalore	100000.00
Belgaum	30000.00
Hubli	80000.00
Mangalore	150000.00
Mysore	90000.00

```
5 rows in set (0.00 sec)

mysql>
```

MySQL sum() Function with HAVING and ORDER BY Clause

Let us see another clause that uses ORDER BY and Having clause with the sum() function. Execute the following statement that gives the sum of salary who has at least two city and sum of salary should be greater than or equal to 100000 and sort them based on the salary

```
SELECT city, sum(salary) FROM employees GROUP BY city having sum(salary)
>=100000 ;
```

After the successful execution, we will get the result as below:

```
mysql> SELECT city, sum(salary) FROM employees GROUP BY city having sum(salary)
>=100000;
+-----+-----+
| city | sum(salary) |
+-----+-----+
| Bangalore | 100000.00 |
| Mangalore | 150000.00 |
+-----+-----+
2 rows in set (0.00 sec)

mysql> _
```

In Above Output ,salary can sorted in descending order by salary using order by clause

Select city,sum(salary) from employee group by city having sum(salary)>=100000

Order by sum(salary) desc;

```
mysql> SELECT city, sum(salary) FROM employees GROUP BY city having sum(salary)
>=100000 order by sum(salary) desc;
+-----+-----+
| city | sum(salary) |
+-----+-----+
| Mangalore | 150000.00 |
| Bangalore | 100000.00 |
+-----+-----+
2 rows in set (0.00 sec)

mysql> _
```

INTRODUCTION TO JOINS

- Joins help retrieving data from two or more database tables.
- A JOIN clause is used to combine rows from two or more tables, based on a related column between them.
- Join establishes temporarily relationship between two or more tables. The tables are mutually related using primary and foreign keys.

```
CREATE TABLE MOVIESs (  
MOVIE_ID INT (5) PRIMARY KEY,MOVIE_NAME VARCHAR(50));
```

```
CREATE TABLE ACTORS(ACTOR_ID INT(5) PRIMARY KEY,ACTOR_NAME  
VARCHAR(50),MOVIE_ID INT(5),FOREIGN KEY(MOVIE_ID) REFERENCES  
MOVIES(MOVIE_ID));
```

HERE IS INSERT SCRIPTS FOR BOTH TABLES MOVIES AS WELL AS ACTORS

```
INSERT INTO MOVIES VALUES(1000,'SHOLAY');  
INSERT INTO MOVIES VALUES(1001,'ITTEFAQ');  
INSERT INTO MOVIES VALUES(1002,'TEESRI MANZIL');  
INSERT INTO MOVIES VALUES(1003,'JEWEL THIEF ');  
INSERT INTO MOVIES VALUES(1004,'CARAVAN');  
INSERT INTO MOVIES VALUES(1005,' GUMNAAM');
```

```
INSERT INTO ACTORS VALUES(1,'AMITABH BACHCHAN',1000);  
INSERT INTO ACTORS VALUES(2,'RAJESH KHANNA',1001);  
INSERT INTO ACTORS VALUES(3,'SHAMI KAPOOR',1002);  
INSERT INTO ACTORS VALUES(4,'DEV ANAND',1003);  
INSERT INTO ACTORS VALUES(5,'NULL',1004);
```

```
SELECT * FROM MOVIES;
```

MOVIE_ID	MOVIE_NAME
1000	SHOLAY
1001	ITTEFAQ
1002	TEESRI MANZIL
1003	JEWEL THIEF
1004	CARAVAN
1005	GUMNAAM

SELECT * FROM ACTORS;

ACTOR_ID	ACTOR_NAME	MOVIE_ID
1	AMITABH BACHCHAN	1000
2	RAJESH KHANNA	1001
3	SHAMI KAPOOR	1002
4	DEV ANAND	1003
5	NULL	1004

Types of JOINS

Cross JOIN

Cross JOIN is a simplest form of JOINS which matches each row from one database table to all rows of another.

In other words it gives us combinations of each row of first table with all records in second table.

Select * FROM TableA CROSS JOIN TableB;

//OR//

Select * FROM Table1 A1,Table1 A2;

SELECT * FROM MOVIES CROSS JOIN ACTORS;

Executing the above script in MySQL workbench gives us the following results.

MOVIE_ID	MOVIE_NAME	ACTOR_ID	ACTOR_NAME	MOVIE_ID
1000	SHOLAY	1	AMITABH BACHCHAN	1000
1000	SHOLAY	2	RAJESH KHANNA	1001
1000	SHOLAY	3	SHAMI KAPOOR	1002
1000	SHOLAY	4	DEV ANAND	1003
1000	SHOLAY	5	NULL	1004
1001	ITTEFAQ	1	AMITABH BACHCHAN	1000
1001	ITTEFAQ	2	RAJESH KHANNA	1001
1001	ITTEFAQ	3	SHAMI KAPOOR	1002
1001	ITTEFAQ	4	DEV ANAND	1003
1001	ITTEFAQ	5	NULL	1004
1002	TEESRI MANZIL	1	AMITABH BACHCHAN	1000
1002	TEESRI MANZIL	2	RAJESH KHANNA	1001
1002	TEESRI MANZIL	3	SHAMI KAPOOR	1002
1002	TEESRI MANZIL	4	DEV ANAND	1003

1002	TEESRI MANZIL	5	NULL	1004
1003	JEWEL THIEF	1	AMITABH BACHCHAN	1000
1003	JEWEL THIEF	2	RAJESH KHANNA	1001
1003	JEWEL THIEF	3	SHAMI KAPOOR	1002
1003	JEWEL THIEF	4	DEV ANAND	1003
1003	JEWEL THIEF	5	NULL	1004
1004	CARAVAN	1	AMITABH BACHCHAN	1000
1004	CARAVAN	2	RAJESH KHANNA	1001
1004	CARAVAN	3	SHAMI KAPOOR	1002
1004	CARAVAN	4	DEV ANAND	1003
1004	CARAVAN	5	NULL	1004
1005	GUMNAAM	1	AMITABH BACHCHAN	1000
1005	GUMNAAM	2	RAJESH KHANNA	1001
1005	GUMNAAM	3	SHAMI KAPOOR	1002
1005	GUMNAAM	4	DEV ANAND	1003
1005	GUMNAAM	5	NULL	1004

INNER JOIN

Technically, Join made by using equality-operator (=) to compare values of PrimaryKey of one table and Foreign Key values of another table, hence result set includes common(matched) records from both tables

The inner JOIN is used to return rows from both tables that satisfy the given condition.

SELECT * FROM Table1 A INNER JOIN Table2 B ON A.<PrimaryKey>=B.<ForeignKey>;

SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M INNER JOIN ACTORS A ON M.MOVIE_ID=A.MOVIE_ID;

Executing the above script in MySQL workbench gives us the following result

MOVIE_NAME	ACTOR_NAME	ACTOR_ID
SHOLAY	AMITABH BACHCHAN	1
ITTEFAQ	RAJESH KHANNA	2
TEESRI MANZIL	SHAMI KAPOOR	3
JEWEL THIEF	DEV ANAND	4
CARAVAN	NULL	5

INNER JOIN CONSISTING OF WHERE CONDITION AND ACTOR NAME SHOULD NOT BE NULL

```
SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M INNER JOIN
ACTORS A ON M.MOVIE_ID=A.MOVIE_ID WHERE ACTOR_NAME!='NULL';
```

OR

```
SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M INNER JOIN
ACTORS A ON M.MOVIE_ID=A.MOVIE_ID WHERE ACTOR_NAME<>'NULL';
```

Executing the above script in MySQL workbench gives us the following results.

MOVIE_NAME	ACTOR_NAME	ACTOR_ID
SHOLAY	AMITABH BACHCHAN	1
ITTEFAQ	RAJESH KHANNA	2
TEESRI MANZIL	SHAMI KAPOOR	3
JEWEL THIEF	DEV ANAND	4

INNER JOIN CONSISTING OF WHERE CONDITION AND ACTOR NAME FIELDS ARE HAVING NULL VALUE

```
SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M INNER JOIN
ACTORS A ON M.MOVIE_ID=A.MOVIE_ID WHERE ACTOR_NAME=NULL;
```

Executing the above script in MySQL workbench gives us the following results.

MOVIE_NAME	ACTOR_NAME	ACTOR_ID
CARAVAN	NULL	5

OUTER-JOIN

A full outer join, or full join, which is not supported by the popular MySQL database management system, However, can customized selection of un-matched rows e.g, selecting unmatched row from first table or second table by sub-types: LEFT OUTER JOIN and RIGHT OUTER JOIN.

It can detect records having no match in joined table. It returns NULL values for records of joined table if no match is found.

LEFT JOIN

The LEFT JOIN returns all the rows from the table on the left even if no matching rows have been found in the table on the right. Where no matches have been found in the table on the right, NULL is returned.

```
Select * FROM Table1 A LEFT OUTER JOIN Table2 B On A.<PrimaryKey>=B.<ForeignKey>;
```

```
SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M LEFT
OUTER JOIN ACTORS A ON M.MOVIE_ID=A.MOVIE_ID;
```

Executing the above script in MySQL workbench gives below result. You can see that in the returned result which is listed below that for movies which do not have an actor, actor name fields are having NULL values. That means no matching member found actor table for that particular movie.

MOVIE_NAME	ACTOR_NAME	ACTOR_ID
SHOLAY	AMITABH BACHCHAN	1
ITTEFAQ	RAJESH KHANNA	2
TEESRI MANZIL	SHAMI KAPOOR	3
JEWEL THIEF	DEV ANAND	4
CARAVAN	NULL	5
GUMNAAM	NULL	NULL

RIGHT JOIN

RIGHT JOIN is obviously the opposite of LEFT JOIN. The RIGHT JOIN returns all the columns from the table on the right even if no matching rows have been found in the table on the left. Where no matches have been found in the table on the left, NULL is returned.

Select * FROM Table1 A RIGHT OUTER JOIN Table2 B on A.<PrimaryKey>=B.<ForeignKey>;

SELECT MOVIE_NAME, ACTOR_NAME, ACTOR_ID FROM MOVIES M RIGHT OUTER JOIN ACTORS A ON M.MOVIE_ID=A.MOVIE_ID;

Executing the above script in MySQL workbench gives the following results.

MOVIE_NAME	ACTOR_NAME	ACTOR_ID
SHOLAY	AMITABH BACHCHAN	1
ITTEFAQ	RAJESH KHANNA	2
TEESRI MANZIL	SHAMI KAPOOR	3
JEWEL THIEF	DEV ANAND	4
CARAVAN	NULL	5

INTRODUCTION TO SUBQUERY

- A subquery is a query within another query. The outer query is called as main query and inner query is called as subquery.
- Subqueries are nested queries that provide data to the enclosing query.
- Subquery must be enclosed in parentheses.
- Subqueries can return individual values or a list of records
- You can place the Subquery in a number of SQL clauses: WHERE clause, HAVING clause, FROM clause.
- Subqueries can be used with SELECT, UPDATE, INSERT, DELETE statements along with expression operator. It could be equality operator or comparison operator such as =, >, <, <= and Like operator.
- The subquery generally executes first, and its output is used to complete the query condition for the main or outer query.
- Subqueries are on the right side of the comparison operator.
- ORDER BY command **cannot** be used in a Subquery. GROUPBY command can be used to perform same function as ORDER BY command.
- Use single-row operators with singlerow Subqueries. Use multiple-row operators with multiple-row Subqueries.

Syntax:

- There is not any general syntax for Subqueries. However, Subqueries are seen to be used most frequently with SELECT statement as shown below:

**SELECT column_name FROM table_name WHERE column_name expression operator
(SELECT COLUMN_NAME from TABLE_NAME WHERE ...);**

Below is sample table StudentDetails and StudentSection we have created to demonstrate working of subquesry

```
create tab StudentDetails
(
  Student_ID int primary key
  NAME      varchar(100),
  ROLL_NO   int,
  LOCATION  varchar(100),
  PHONE_NUMBER bigint
);
```

```
create table StudentSection
(
NAME varchar(100),
ROLL_NO int,
Section char(1)
);
```

Below is sample insert scripts for inserting information into StudentDetails

```
insert into StudentDetails values(1000,'Hemanth',101,'Mysore',9845113337);
insert into StudentDetails values(2000,'Nitin',102,'Banglore',8877665544);
insert into StudentDetails values(3000,'Sandeep',103,'Kodagu',9538945623);
insert into StudentDetails values(4000,'Sashank Hegde',104,'Udupi',8989898989);
insert into StudentDetails values(5000,'Nagendra',105,'Banglore',9901478945);
```

Below is sample insert scripts for inserting information into StudentSection

```
insert into StudentSection values('Sashank Hegde',104,'A');
insert into StudentSection values('Nagendra',105,'B');
insert into StudentSection values('Nitin',102,'A');
insert into StudentSection values('Hemanth',101,'B');
```

select * from StudentDetails

```
mysql> select * from StudentDetails;
+-----+-----+-----+-----+-----+
| Student_ID | NAME          | ROLL_NO | LOCATION | PHONE_NUMBER |
+-----+-----+-----+-----+-----+
| 1000       | Hemanth      | 101     | Mysore   | 9845113337   |
| 2000       | Nitin        | 102     | Bangalore| 8877665544   |
| 3000       | Sandeep      | 103     | Kodagu   | 9538945623   |
| 4000       | Sashank Hegde| 104     | Udupi    | 8989898989   |
| 5000       | Nagendra     | 105     | Bangalore| 9901478945   |
+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)

mysql>
```

select * from StudentSection

```
mysql> select * from StudentSection;
+-----+-----+-----+
| NAME          | ROLL_NO | Section |
+-----+-----+-----+
| Sashank Hegde | 104     | A       |
| Nagendra      | 105     | B       |
| Nitin         | 102     | A       |
| Hemanth       | 101     | B       |
+-----+-----+-----+
4 rows in set (0.00 sec)

mysql>
```

Query1: To display NAME, LOCATION, PHONE_NUMBER of the StudentDetails table whose section is A

Select NAME,LOCATION,PHONE_NUMBER from StudentDetails WHERE ROLL_NO IN(SELECT ROLL_NO from StudentSection where SECTION='A');

Explanation : First subquery executes “ SELECT ROLL_NO from STUDENT where SECTION='A' ” returns ROLL_NO from STUDENT table whose SECTION is ‘A’. Then outer-query executes it and return the NAME, LOCATION, PHONE_NUMBER from the DATABASE table of the student whose ROLL_NO is returned from inner subquery.

Below is snapshot of output of above executed subquery

```
mysql> Select NAME,LOCATION,PHONE_NUMBER from StudentDetails
-> WHERE ROLL_NO IN(SELECT ROLL_NO from StudentSection where SECTION='A');
+-----+-----+-----+
| NAME      | LOCATION | PHONE_NUMBER |
+-----+-----+-----+
| Nitin     | Bangalore | 8877665544   |
| Sashank Hegde | Udupi    | 8989898989   |
+-----+-----+-----+
2 rows in set (0.00 sec)

mysql>
```

Query2: To update name from StudentDetails table whose rollno is same as that in StudentSection table and having name as Nitin by Using subquery

UPDATE StudentDetails SET NAME='Nitin Jain'

WHERE ROLL_NO IN(SELECT ROLL_NO FROM StudentSection where NAME='Nitin');

```
mysql> select * from studentdetails;
+-----+-----+-----+-----+-----+
| Student_ID | NAME      | ROLL_NO | LOCATION | PHONE_NUMBER |
+-----+-----+-----+-----+-----+
| 1000      | Hemanth  | 101     | Mysore   | 9845113337   |
| 2000      | Nitin     | 102     | Bangalore | 8877665544   |
| 3000      | Sandeep  | 103     | Kodagu   | 9538945623   |
| 4000      | Sashank Hegde | 104     | Udupi    | 8989898989   |
| 5000      | Nagendra | 105     | Bangalore | 9901478945   |
+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)

mysql> UPDATE StudentDetails SET NAME='Nitin Jain'
-> WHERE ROLL_NO IN(SELECT ROLL_NO FROM StudentSection where NAME='Nitin');
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from studentdetails;
+-----+-----+-----+-----+-----+
| Student_ID | NAME      | ROLL_NO | LOCATION | PHONE_NUMBER |
+-----+-----+-----+-----+-----+
| 1000      | Hemanth  | 101     | Mysore   | 9845113337   |
| 2000      | Nitin Jain | 102     | Bangalore | 8877665544   |
| 3000      | Sandeep  | 103     | Kodagu   | 9538945623   |
| 4000      | Sashank Hegde | 104     | Udupi    | 8989898989   |
| 5000      | Nagendra | 105     | Bangalore | 9901478945   |
+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

Query3: To delete students from Student2 table whose rollno is same as that in Student1 table and having location as chennai

```
DELETE FROM StudentDetails WHERE ROLL_NO IN ( SELECT ROLL_NO
FROM StudentSection WHERE NAME ='Nagendra');
```

```
mysql> select * from StudentDetails;
+-----+-----+-----+-----+-----+
| Student_ID | NAME          | ROLL_NO | LOCATION | PHONE_NUMBER |
+-----+-----+-----+-----+-----+
| 1000       | Hemanth S R   | 101     | Mysore   | 9845113337   |
| 2000       | Hemanth S R   | 102     | Banglore | 8877665544   |
| 3000       | Sandeep       | 103     | Kodagu   | 9538945623   |
| 4000       | Sashank Hegde | 104     | Udupi    | 8989898989   |
| 5000       | Nagendra      | 105     | Banglore | 9901478945   |
+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)

mysql> DELETE FROM StudentDetails WHERE ROLL_NO IN (SELECT ROLL_NO
-> FROM StudentSection WHERE NAME = 'Nagendra');
Query OK, 1 row affected (0.00 sec)

mysql> select * from StudentDetails;
+-----+-----+-----+-----+-----+
| Student_ID | NAME          | ROLL_NO | LOCATION | PHONE_NUMBER |
+-----+-----+-----+-----+-----+
| 1000       | Hemanth S R   | 101     | Mysore   | 9845113337   |
| 2000       | Hemanth S R   | 102     | Banglore | 8877665544   |
| 3000       | Sandeep       | 103     | Kodagu   | 9538945623   |
| 4000       | Sashank Hegde | 104     | Udupi    | 8989898989   |
+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)

mysql> _
```

Join vs. Subquery

- JOINS are faster than a subquery and it is very rare that the opposite.
- In JOINS the RDBMS calculates an execution plan, that can predict, what data should be loaded and how much it will take to processed and as a result this process save some times, unlike the subquery there is no pre-process calculation and run all the queries and load all their data to do the processing.
- A JOIN is checked conditions first and then put it into table and displays; where as a subquery take separate temp table internally and checking condition.
- When joins are using, there should be connection between two or more than two tables and each table has a relation with other while subquery means query inside another query, has no need to relation, it works on columns and conditions

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.

Views syntax

Let's now look at the basic syntax used to create a view in MySQL.

```
CREATE VIEW `view_name` AS SELECT statement;
```

WHERE

- **"CREATE VIEW "view_name"** tells MySQL server to create a view object in the database
- **"AS SELECT statement"** is the SQL statements to be packed in the views. It can be a SELECT statement can contain data from one table or multiple tables.

Example1-Simple View consisting of only one tables

```
CREATE VIEW VW_BOOKDETAILS AS SELECT BOOK_NAME, BOOK_AUTHOR,  
PUBLISHER FROM BOOK_DETAILS;
```

Example of Simple View consisting of two tables and using where condition

```
CREATE VIEW VW_ORDERS AS SELECT BOOK_NAME, BOOK_AUTHOR,  
PUBLISHER FROM ORDERS A, BOOK_DETAILS B WHERE  
A.ORDER_ID=B.ORDER_ID;
```

Example of View consisting of inner join

```
CREATE VIEW VW_BOOK1 AS SELECT A.ORDER_ID, ORDER_DATE, BOOK_NAME,  
BOOK_AUTHOR, PUBLISHER FROM ORDERS A INNER JOIN BOOK_DETAILS B ON  
A.ORDER_ID=B.ORDER_ID;
```

Example of View consisting of inner join and where condition

```
CREATE VIEW VW_BOOK2 AS SELECT A.ORDER_ID, ORDER_DATE, BOOK_NAME,  
BOOK_AUTHOR, PUBLISHER FROM ORDERS A INNER JOIN BOOK_DETAILS B ON  
A.ORDER_ID=B.ORDER_ID AND PUBLISHER='Tata McGraw-Hill'
```

```
SELECT * FROM VW_BOOKDETAILS  
SELECT * FROM VW_ORDERS  
SELECT * FROM VW_BOOK1  
SELECT * FROM VW_BOOK2
```

SHOW TABLES

Tables_in_naveen
VW_BOOKDETAILS
VW_ORDERS
VW_BOOK1
VW_BOOK2

Example2-Simple View

CREATE VIEW VW_PUBLICATION AS SELECT PUB_YEAR FROM BOOK;

SELECT * FROM VW_PUBLICATION

```
mysql> SELECT * FROM VW_PUBLICATION;
+-----+
| PUB_YEAR |
+-----+
| JAN-2017 |
| JUN-2016 |
| SEP-2016 |
| SEP-2015 |
| MAY-2016 |
+-----+
5 rows in set (0.00 sec)
```

DROPPING VIEWS

The DROP command can be used to delete a view from the database that is no longer required.

The basic syntax to drop a view is as follows.

DROP VIEW VIEWNAME;

DROP VIEW V_PUBLICATION;

You may want to use views primarily for following 3 reasons

- Ultimately , you will use your SQL knowledge , to create applications , which will use a database for data requirements. It's recommended that you use VIEWS of the original table structure in your application instead of using the tables themselves. This ensures that when you refactor your DB, your legacy code will see the original schema via the view without breaking the application.
- **VIEWS increase re-usability.** You will not have to create complex queries involving joins repeatedly. All the complexity is converted into a single line of query use VIEWS. Such condensed code will be easier to integrate in your application. This will eliminate chances of typos and your code will be more readable.
- **VIEWS help in data security.** You can use views to show only authorized information to users and hide sensitive data like credit card numbers, pass

INTRODUCTION TO STORED PROCEDURES

- A stored procedure is a prepared SQL code that you can save, so the code can be reused over and over again. So if you have an SQL query that you write over and over again, save it as a stored procedure, and then just call it to execute it.
- You can also pass parameters to a stored procedure, so that the stored procedure can act based on the parameter value(s) that is passed.
- A procedure can return one or more than one value through parameters or may not return at all. The procedure can be used in SQL queries.

Creating a procedure

Syntax

```
CREATE PROCEDURE procedure_name
(
parameter datatype ,
parameter datatype
)
BEGIN
    Declaration_section
    Executable_section
END;
```

Parameter

procedure_name: name of the stored procedure.

Parameter: number of parameters. It can be one or more than one.

declaration_section: all variables are declared.

executable_section: code is written here.

A variable is a named data object whose value can change during the stored procedure execution. We typically use the variables in stored procedures to hold the immediate results. These variables are local to the stored procedure. You must declare a variable before using it.

```
DELIMITER //
CREATE PROCEDURE sp_name
(
p_1 INT
)
BEGIN
    ...code goes here...
END //
DELIMITER ;
```

- Replace `procedure_name` with `sp_procedure_name` whatever name you'd like to use for the stored procedure. The parentheses are required — they enclose any parameters. If no parameters are required, the parentheses can be empty.
- The main body of the stored procedure goes in between the `BEGIN` and `END` keywords. These keywords are used for writing compound statements. A compound statement can contain multiple statements, and these can be nested if required. Therefore, you can nest `BEGIN` and `END` blocks.
- In most cases, you will also need to surround the `CREATE PROCEDURE` statement with `DELIMITER` commands and change `END;` to `END //`. Like this:

About the DELIMITER Command

- The first command is `DELIMITER //`, which is not related to the stored procedure syntax. The `DELIMITER` statement changes the standard delimiter which is a semicolon (;) to another.
- In this case, the delimiter is changed from the semicolon(;) to double-slashes(//) We need to change delimiter from ; to //.Because we want to pass the stored procedure to the server as a whole rather than letting mysql tool interpret each statement at a time.
- Following the `END` keyword, we use the delimiter `//` to indicate the end of the stored procedure. The last command (`DELIMITER;`)changes the delimiter back to the semicolon (;).

How to Execute a Stored Procedure

Call `sp_procedure_name()`;

Writing the first MySQL stored procedure

Here we are creating sample table named employee

```
create table employee
(
employee_id int primary key,
Name varchar(50),
Designation varchar(50),
Salary decimal(10,2)
)
```

```
insert into employee values(100,'vishwanath','clerk',20000.00);
insert into employee values(101,'shashikiran','instructor',20000.00);
insert into employee values(102,'nitin','assitiant professor',25000.00);
insert into employee values(103,'deepak','associate professor',40000.00);
insert into employee values(104,'sanjay','professor',80000.00);
insert into employee values(105,'yogesh','system admin',30000.00);
insert into employee values(106,'anand','clerk',20000.00);
insert into employee values(107,'Hemanth','professor',80000.00);
insert into employee values(108,'Robert','cashier',15000.00);
insert into employee values(109,'amit','clerk',20000.00);
insert into employee values(110,'george','HR Manager',30000.00);
```

```
mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00

```
11 rows in set (0.00 sec)
```

Example

We are going to develop a simple stored procedure named SP_getEmployee to help you get familiar with the syntax. The SP_getEmployee() stored procedure selects all employee information from the employee table.:

```
DELIMITER $$
```

```
DROP PROCEDURE IF EXISTS SP_getEmployee $$
```

```
CREATE PROCEDURE SP_getEmployee()
```

```
BEGIN
```

```
SELECT * FROM employee;
```

```
END$$
```

Execute the stored procedure above as follows:

call SP_getEmployee();

```
mysql> call SP_getEmployee();
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00

```
11 rows in set (0.00 sec)

Query OK, 0 rows affected (0.03 sec)

mysql> _
```

Introduction to MySQL stored procedure parameters

Almost stored procedures that you develop require parameters. The parameters make the stored procedure more flexible and useful.

The syntax of defining a parameter in the stored procedures is as follows:

```
MODE param_name param_type(param_size)
```

The MODE could be IN , OUT or INOUT , depending on the purpose of the parameter in the stored procedure.

The param_name is the name of the parameter. The name of the parameter must follow the naming rules of the column name in MySQL.

Followed the parameter name is its data type and size. Like a variable, the data type of the parameter can be any valid MySQL data type.

Each parameter is separated by a comma (,) if the stored procedure has more than one parameter

IN – is the default mode. When you define an IN parameter in a stored procedure, the calling program has to pass an argument to the stored procedure. In addition, the value of an IN parameter is protected. It means that even the value of the IN parameter is changed inside the stored procedure, its original value is retained after the stored procedure ends. In other words, the stored procedure only works on the copy of the IN parameter.

OUT – the value of an OUT parameter can be changed inside the stored procedure and its new value is passed back to the calling program. Notice that the stored procedure cannot access the initial value of the OUT parameter when it starts.

INOUT – an INOUT parameter is a combination of IN and OUT parameters. It means that the calling program may pass the argument, and the stored procedure can modify the INOUT parameter, and pass the new value back to the calling program.

MySQL Procedure : Parameter IN example**Stored Procedure With One Parameter**

The following SQL statement creates a stored procedure that selects employee information from a employee Table based on employee_id from the " SP_getEmployeeid .:

```
//SP_getEmployeeid
```

```
DELIMITER $$
```

```
DROP PROCEDURE IF EXISTS SP_getEmployeeid $$
```

```
CREATE PROCEDURE SP_getEmployeeid
```

```
(
  IN emp_id INT(10)
)
BEGIN
select * FROM employee where employee_id=emp_id;
END$$
```

Execute the stored procedure below..... as follows:

```
mysql> call SP_getEmployeeid<110>;
+-----+-----+-----+-----+
| employee_id | Name   | Designation | Salary |
+-----+-----+-----+-----+
|          110 | george | HR Manager  | 30000.00 |
+-----+-----+-----+-----+
1 row in set (0.00 sec)

Query OK, 0 rows affected (0.01 sec)

mysql> call SP_getEmployeeid<104>;
+-----+-----+-----+-----+
| employee_id | Name   | Designation | Salary |
+-----+-----+-----+-----+
|          104 | sanjay | professor   | 80000.00 |
+-----+-----+-----+-----+
1 row in set (0.01 sec)

Query OK, 0 rows affected (0.01 sec)

mysql> _
```

Stored Procedure With Multiple Parameters

Setting up multiple parameters is very easy. Just list each parameter and the data type separated by a comma as shown below.

The following SQL statement creates a stored procedure that selects studentdetails from a particular USN with a particular NAME from the " studentmarks " table:

Example

```
DELIMITER $$
DROP PROCEDURE IF EXISTS SP_getStudentdetails $$
CREATE PROCEDURE SP_getStudentdetails
(
  IN usn1 varchar(50),
  IN name1 varchar(50)
)
BEGIN
select * FROM studentmarks where usn=usn1 and name=name1;
```

END\$\$

Execute the stored procedure above as follows:

```
mysql> select * from studentmarks;
```

USN	NAME	PHONE	GENDER	Marks
4AD17CS010	ARVIND	9900211201	M	21
4AD17CS011	AJAY	9845091341	M	17
4AD17CS020	AKSHAY	8877881122	M	25
4AD17CS025	AKSHATHA	7894737377	F	18
4AD17CS029	CHANDANA	7696772121	F	16
4AD17CS032	BHASKAR	9923211099	M	19
4AD17CS045	JEEVAN	9944850121	M	15
4AD17CS062	SANDHYA	7722829912	F	24
4AD17CS066	VEENA	877881122	F	22
4AD17CS091	TARANATH	7712312312	M	23

```
10 rows in set (0.00 sec)
```

```
mysql> call SP_getStudentdetails('4AD17CS010','ARVIND');
```

USN	NAME	PHONE	GENDER	Marks
4AD17CS010	ARVIND	9900211201	M	21

```
1 row in set (0.00 sec)
```

MySQL Procedure : Parameter OUT example

The following example shows a simple stored procedure that uses an OUT parameter. Within the procedure MySQL MAX() function retrieves maximum salary from MAX_SALARY of employee . table.

DELIMITER \$\$

DROP PROCEDURE IF EXISTS sp_getemployemaxsalary()\$\$

CREATE PROCEDURE sp_getemployemaxsalary

(

out max_salary float(10,2)

)

BEGIN

SELECT max(Salary) into max_salary from employee;

END\$\$

DELIMITER ;

In the body of the procedure, the parameter max_salary will get the highest salary from Salary column of Employee Table. After calling the procedure the word OUT tells the MYSQL that the value goes out from the procedure.

Here max_salary is the name of the output parameter and we have passed its value to a session variable named @ m, in the CALL statement.

```
mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	Project Manager	90000.00
112	Kiran	Insurance Manager	35000.00

```
13 rows in set (0.00 sec)

mysql>
```

```
mysql> call sp_getemployemaxsalary(0m);
Query OK, 0 rows affected (0.02 sec)

mysql> select 0m;
+-----+
| 0m |
+-----+
| 90000 |
+-----+
1 row in set (0.00 sec)

mysql>
```

MySQL Procedure : Parameter INOUT example

Here we are creating sample table STUDENT with USN as primary key

```
CREATE TABLE STUDENT
```

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

Here we are inserting sample data into STUDENT Table

```
INSERT INTO STUDENT VALUES ('4AD16CS020','AKSHAY','BELAGAVI', 8877881122,'M');
INSERT INTO STUDENT VALUES ('4AD16CS062','SANDHYA','BENGALURU',
7722829912,'F');
INSERT INTO STUDENT VALUES ('4AD16CS091','TARANATH','BENGALURU',
7712312312,'M');
INSERT INTO STUDENT VALUES ('4AD16CS066','SUPRIYA','MANGALURU',
```

```

8877881122,'F');
INSERT INTO STUDENT VALUES ('4AD16CS010','ABHAY','BENGALURU', 9900211201,'M');
INSERT INTO STUDENT VALUES ('4AD16CS032','BHASKAR','BENGALURU',
9923211099,'M');
INSERT INTO STUDENT VALUES ('4AD16CS025','AKSHATHA','BENGALURU',
7894737377,'F');
INSERT INTO STUDENT VALUES ('4AD16CS011','AJAY','TUMKUR', 9845091341,'M');
INSERT INTO STUDENT VALUES ('4AD16CS029','CHITRA','DAVANGERE', 7696772121,'F');
INSERT INTO STUDENT VALUES ('4AD16CS045','JEEVAN','BELLARY', 9944850121,'M');

```

```
mysql> SELECT * FROM STUDENT;
```

USN	SNAME	ADDRESS	PHONE	GENDER
4AD16CS010	ABHAY	BENGALURU	9900211201	M
4AD16CS011	AJAY	TUMKUR	9845091341	M
4AD16CS020	AKSHAY	BELAGAVI	8877881122	M
4AD16CS025	AKSHATHA	BENGALURU	7894737377	F
4AD16CS029	CHITRA	DAVANGERE	7696772121	F
4AD16CS032	BHASKAR	BENGALURU	9923211099	M
4AD16CS045	JEEVAN	BELLARY	9944850121	M
4AD16CS062	SANDHYA	BENGALURU	7722829912	F
4AD16CS066	SUPRIYA	MANGALURU	8877881122	F
4AD16CS091	TARANATH	BENGALURU	7712312312	M

```

10 rows in set (0.01 sec)

```

The following example shows a simple stored procedure that uses an INOUT parameter and an IN parameter. The user will supply 'M' or 'F' through IN parameter to count a number of male or female gender from STUDENT table. The INOUT parameter (countgender) will return the result to a user. Here is the code and output of the procedure

```
DELIMITER $$
```

```
DROP PROCEDURE IF EXISTS sp_ studentcountgender $$
```

```
create procedure sp_ studentcountgender
```

```
(
```

```
IN studentgender char(1),
```

```
OUT countgender int
```

```
)
```

```
begin
```

```
select COUNT(GENDER) INTO countgender FROM STUDENT WHERE
```

```
GENDER=studentgender;
```

```
END$$
```

```
DELIMITER ;
```

```
mysql> call sp_studentcountgender('M',@CountGender);
Query OK, 0 rows affected (0.00 sec)

mysql> select @CountGender;
+-----+
| @CountGender |
+-----+
|           6 |
+-----+
1 row in set (0.00 sec)

mysql> call sp_studentcountgender('F',@CountGender);
Query OK, 0 rows affected (0.00 sec)

mysql> select @CountGender;
+-----+
| @CountGender |
+-----+
|           4 |
+-----+
1 row in set (0.00 sec)

mysql>
```

Other examples of stored procedure are as follows

This an example of inserting information into table employee through stored procedure

// INSERT STORED PROCEDURE

DELIMITER \$\$

DROP PROCEDURE IF EXISTS sp_InsertEmployee \$\$

CREATE PROCEDURE sp_InsertEmployee

(

IN employee_id INT(10),

IN Name VARCHAR(255),

IN Designation VARCHAR(255),

IN Salary float(10,2)

)

BEGIN

INSERT INTO employee values(employee_id ,Name,Designation, Salary);

END\$\$

```
mysql> call sp_InsertEmployee(111,'Jagdish','System Engineer',40000);
Query OK, 1 row affected (0.02 sec)

mysql> call SP_getEmployee();
+-----+-----+-----+-----+
| employee_id | Name       | Designation      | Salary    |
+-----+-----+-----+-----+
| 100         | vishwanath | clerk            | 20000.00  |
| 101         | shashikiran | instructor       | 20000.00  |
| 102         | nitin      | assistant professor | 25000.00  |
| 103         | deepak     | associate professor | 40000.00  |
| 104         | sanjay     | professor        | 80000.00  |
| 105         | yogesh     | system admin     | 30000.00  |
| 106         | anand      | clerk            | 20000.00  |
| 107         | Hemanth    | professor        | 80000.00  |
| 108         | Robert     | cashier          | 15000.00  |
| 109         | amit       | clerk            | 20000.00  |
| 110         | george     | HR Manager       | 30000.00  |
| 111         | Jagdish    | System Engineer  | 40000.00  |
+-----+-----+-----+-----+
12 rows in set (0.01 sec)

Query OK, 0 rows affected (0.06 sec)

mysql> _
```

This an example of updating information into table employee through stored procedure

// UPDATE STORED PROCEDURE

DELIMITER \$\$

DROP PROCEDURE IF EXISTS sp_UpdateEmployee \$\$

CREATE PROCEDURE sp_UpdateEmployee

(

IN emp_id INT(10),

IN Name VARCHAR(255),

IN Designation VARCHAR(255),

IN Salary float(10,2)

)

BEGIN

UPDATE EMPLOYEE SET Name= Name, Designation= Designation, Salary= Salary WHERE
employee_id = emp_id ;

END\$\$

```
mysql> call sp_getemployee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jagdish	System Engineer	40000.00

```
12 rows in set (0.00 sec)

Query OK, 0 rows affected (0.05 sec)

mysql> call sp_UpdateEmployee(111,'Jaishankar','Project Manager',90000);
Query OK, 1 row affected (0.04 sec)

mysql> call sp_getemployee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	Project Manager	90000.00

```
12 rows in set (0.00 sec)
```

```
CREATE PROCEDURE SP_InsertUpdateemployee
(
  IN emp_id int,
  IN Name VARCHAR(255),
  IN Designation VARCHAR(255),
  IN Salary float(10,2)
)
BEGIN
  DECLARE counta int;
  SELECT count(*) INTO counta FROM employee WHERE employee_id=emp_id;
  IF counta=0
```

```

THEN
INSERT INTO employee values(emp_id,Name,Designation,Salary);
ELSEIF counta>0
THEN
UPDATE EMPLOYEE SET Name=Name,Designation=Designation,Salary=Salary
WHERE employee_id=emp_id;
END IF;
END $$

```

```

mysql> call SP_getEmployee;
+-----+-----+-----+-----+
| employee_id | Name       | Designation      | Salary   |
+-----+-----+-----+-----+
| 100         | vishwanath | clerk            | 20000.00 |
| 101         | shashikiran | instructor       | 20000.00 |
| 102         | nitin      | assitiant professor | 25000.00 |
| 103         | deepak     | associate professor | 40000.00 |
| 104         | sanjay     | professor        | 80000.00 |
| 105         | yogesh     | system admin     | 30000.00 |
| 106         | anand      | clerk            | 20000.00 |
| 107         | Hemanth   | professor        | 80000.00 |
| 108         | Robert    | cashier          | 15000.00 |
| 109         | amit      | clerk            | 20000.00 |
| 110         | george     | HR Manager       | 30000.00 |
| 111         | Jaishankar | Project Manager   | 90000.00 |
+-----+-----+-----+-----+
12 rows in set (0.00 sec)

Query OK, 0 rows affected (0.07 sec)

mysql> call sp_InsertUpdateEmployee(112,'Kishore','Insurance Agent',25000);
Query OK, 1 row affected (0.03 sec)

mysql> call SP_getEmployee;
+-----+-----+-----+-----+
| employee_id | Name       | Designation      | Salary   |
+-----+-----+-----+-----+
| 100         | vishwanath | clerk            | 20000.00 |
| 101         | shashikiran | instructor       | 20000.00 |
| 102         | nitin      | assitiant professor | 25000.00 |
| 103         | deepak     | associate professor | 40000.00 |
| 104         | sanjay     | professor        | 80000.00 |
| 105         | yogesh     | system admin     | 30000.00 |
| 106         | anand      | clerk            | 20000.00 |
| 107         | Hemanth   | professor        | 80000.00 |
| 108         | Robert    | cashier          | 15000.00 |
| 109         | amit      | clerk            | 20000.00 |
| 110         | george     | HR Manager       | 30000.00 |
| 111         | Jaishankar | Project Manager   | 90000.00 |
| 112         | Kishore    | Insurance Agent   | 25000.00 |
+-----+-----+-----+-----+
13 rows in set (0.00 sec)

```

```
mysql> call SP_getEmployee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	Project Manager	90000.00
112	Kishore	Insurance Agent	25000.00

```

13 rows in set (0.00 sec)

Query OK, 0 rows affected (0.08 sec)

mysql> call sp_InsertUpdateEmployee(112,'Kiran','Insurance Manager',35000);
Query OK, 1 row affected (0.03 sec)

mysql> call SP_getEmployee;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	Project Manager	90000.00
112	Kiran	Insurance Manager	35000.00

```

13 rows in set (0.00 sec)
```

An example of deleting record in table named employee by using stored procedure

// DELETE STORED PROCEDURE

DELIMITER \$\$

DROP PROCEDURE IF EXISTS sp_DeletetEmployee \$\$

CREATE PROCEDURE sp_DeletetEmployee

(

IN emp_id INT(10)

)

BEGIN

Delete from employee where employee_id= emp_id;

END\$\$

```
mysql> SELECT * FROM EMPLOYEE;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	project manager	90000.00
112	arun	Graphics Engineer	35000.00
113	Frank	Finance Manager	40000.00

```
14 rows in set (0.00 sec)

mysql> CALL sp_DeletetEmployee(113);
Query OK, 1 row affected (0.13 sec)

mysql> SELECT * FROM EMPLOYEE;
```

employee_id	Name	Designation	Salary
100	vishwanath	clerk	20000.00
101	shashikiran	instructor	20000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	20000.00
107	Hemanth	professor	80000.00
108	Robert	cashier	15000.00
109	amit	clerk	20000.00
110	george	HR Manager	30000.00
111	Jaishankar	project manager	90000.00
112	arun	Graphics Engineer	35000.00

```
13 rows in set (0.00 sec)

mysql> _
```

Variables scope

A variable has its own scope that defines its lifetime. If you declare a variable inside a stored procedure, it will be out of scope when the END statement of stored procedure reaches.

If you declare a variable inside BEGIN END block, it will be out of scope if the END is reached. You can declare two or more variables with the same name in different scopes because a variable is only effective in its own scope. However, declaring variables with the same name in different scopes is not good programming practice.

A variable whose name begins with the @ sign is a session variable. It is available and accessible until the session ends.

Declare a Variable:

```
DECLARE var_name [, var_name] ... type [DEFAULT value]
```

To provide a default value for a variable, include a DEFAULT clause. The value can be specified as an expression; it need not be constant. If the DEFAULT clause is missing, the initial value is NULL.

Example1: Local variables

Local variables are declared within stored procedures and are only valid within the BEGIN...END block where they are declared. Local variables can have any SQL data type. The following example shows the use of local variables in a stored procedure.

Here below is an example of stored procedure which is used to insert as well both update contents of employee table

```
DELIMITER $$
DROP PROCEDURE IF EXISTS SP_InsertUpdateemployee $$
CREATE PROCEDURE SP_InsertUpdateemployee
(
  IN emp_id int,
  IN Name VARCHAR(255),
  IN Designation VARCHAR(255),
  IN Salary float(10,2)
)
BEGIN
  DECLARE counta int;
  SELECT count(*) INTO counta FROM employee WHERE employee_id=emp_id;
  IF counta=0
  THEN
    INSERT INTO employee values(emp_id,Name,Designation,Salary);
  ELSEIF counta>0
  THEN
    UPDATE EMPLOYEE SET Name=Name,Designation=Designation,Salary=Salary
    WHERE employee_id=emp_id;
  END IF;
END $$
```

TO DROP STORED PROCEDURE

Once you have created your procedure in MySQL, you might find that you need to remove it from the database. This statement is used to drop a stored procedure .

```
DROP procedure IF EXISTS procedure_name;
```

procedure_name: The name of the procedure that you wish to drop.'

Example of Dropping Stored Procedure

```
drop procedure IF EXISTS SP_getcustomerid;
```

or

```
drop procedure SP_getcustomerid;
```

MySQL stored procedures advantages

- **Reduce Network Traffic** : Stored procedures help reduce the traffic between application and database server because instead of sending multiple lengthy SQL statements, the application has to send only the name and parameters of the stored procedure.
- **Faster Query Execution** : Since stored procedures are Parsed, Compiled at once, and the executable is cached in the Database. Therefore if same query is repeated multiple times then Database directly executes the executable and hence Time is saved in Parse,Compile etc.
- **Secure:** MySQL stored procedures are secure because the database administrator can grant appropriate permissions to applications that access stored procedures in the database without giving any permissions on the underlying database table

MySQL stored procedures disadvantages

- Stored procedure's constructs are not designed for developing complex and flexible business logic.
- It is difficult to debug stored procedures. Only a few database management systems allow you to debug stored procedures. Unfortunately, MySQL does not provide facilities for debugging stored procedures.
- Memory usage increased: If we use many stored procedures, the memory usage of every connection that is using those stored procedures will increase substantially.

INTRODUCTION TO MYSQL TRIGGER

- A trigger is a set of SQL Statements that are run automatically when a specified change operation (SQL INSERT, UPDATE, or DELETE statement) is performed on a specified table.
- A SQL trigger is a special type of stored procedure. It is special because it is not called directly like a stored procedure. The main difference between a trigger and a stored procedure is that a trigger is called automatically when a data modification event is made against a table whereas a stored procedure must be called explicitly.
- A trigger can be defined to be invoked either before or after the data is changed by INSERT, UPDATE or DELETE statement
- Triggers are useful for tasks such as enforcing business rules, validating input data, and keeping an audit trail. A trigger can be set to activate either before or after the trigger event. For example, you can have a trigger activate before each row that is inserted into a table or after each row that is updated
- It is important to understand the SQL trigger's advantages and disadvantages so that you can use it appropriately. In the following sections, we will discuss the advantages and disadvantages of using SQL triggers.

Advantages of using SQL triggers

- SQL triggers provide an alternative way to check the integrity of data.
- SQL triggers can catch errors in business logic in the database layer.
- SQL triggers provide an alternative way to run scheduled tasks. By using SQL triggers, you don't have to wait to run the scheduled tasks because the triggers are invoked automatically before or after a change is made to the data in the tables.
- SQL triggers are very useful to audit the changes of data in tables.

Disadvantages of using SQL triggers

- SQL triggers only can provide an extended validation and they cannot replace all the validations. Some simple validations have to be done in the application layer. For example, you can validate user's inputs in the client side by using JavaScript or on the server side using server-side scripting languages such as JSP, PHP, ASP.NET, Perl.
- SQL triggers are invoked and executed invisible from the client applications, therefore, it is difficult to figure out what happens in the database layer.
- SQL triggers may increase the overhead of the database server.

In MySQL, trigger can also be created. There are 6 type of triggers that can be made they are:-

- 1.After/Before insert
- 2.After/Before update
- 3.After/Before delete

```
CREATE TRIGGER trigger_name
trigger_event ON table_name
FOR EACH ROW
BEGIN
...
END;
Here,
```

- Trigger_name is the name of the trigger which must be put after CREATE TRIGGER statement.
- The naming convention for trigger_name can be like [trigger time]_[table name]_[trigger event]. For example, before_student_update or after_student_insert can be a name of the trigger.
- Trigger_time is the time of trigger activation and it can be BEFORE or AFTER. We must have to specify the activation time while defining a trigger. We must to use BEFORE if we want to process action prior to the change made on the table and AFTER if we want to process action post to the change made on the table.
- Trigger_event can be INSERT, UPDATE or DELETE. This event causes the trigger to be invoked. A trigger only can be invoked by one event. To define a trigger that is invoked by multiple events, we have to define multiple triggers, one for each event.
- Table_name is the name of the table. Actually, a trigger is always associated with a specific table. Without a table, a trigger would not exist hence we have to specify the table name after the 'ON' keyword.
- BEGIN...END is the block in which we will define the logic for the trigger.

AFTER/BEFORE INSERT TRIGGER

```
CREATE TRIGGER trigger_name
AFTER/BEFORE INSERT ON table_name
FOR EACH ROW
BEGIN
--variable declarations
--trigger code
END;
```

Parameter:

- trigger_name: name of the trigger to be created.
- AFTER/BEFORE INSERT: It points the trigger after or before insert query is executed.
- table_name: name of the table in which a trigger is created.

AFTER/ BEFORE UPDATE Trigger

- In MySQL, AFTER/BEFORE UPDATE trigger can also be created.
- AFTER/BEFORE UPDATE trigger means trigger will invoke after/before the record is updated.

Syntax:

```
CREATE TRIGGER trigger_name  
AFTER/BEFORE UPDATE ON table_name  
FOR EACH ROW  
BEGIN  
--variable declarations  
--trigger code  
END;
```

Parameter:

- trigger_name: name of the trigger to be created.
- AFTER UPDATE: It points the trigger update query is executed.
- table_name: name of the table in which a trigger is created.

AFTER/BEFORE DELETE Trigger

- In MySQL, AFTER/BEFORE DELETE trigger can also be created.
- AFTER/BEFORE DELETE trigger means trigger will invoke after/before the record is deleted.

Syntax:

```
CREATE TRIGGER trigger_name  
AFTER/BEFORE DELETE ON table_name  
FOR EACH ROW  
BEGIN  
--variable declarations  
--trigger code  
END;
```

Parameter:

- trigger_name: name of the trigger to be created.
- AFTER/BEFORE DELETE: It points the trigger after/before delete query is executed.
- table_name: name of the table in which a trigger is created.

AUDIT TRACKING

EXAMPLES OF TRIGGERS FOR AUDIT PURPOSE

```
CREATE TABLE Employee_Details
(
Emp_ID int primary key ,
Emp_Name varchar(55),
Emp_Sal decimal (10,2)
);
```

```
CREATE TABLE Employee_Details_Audit
(
Emp_ID int,
Emp_Name varchar(55),
Emp_Sal decimal (10,2),
Action varchar(55)
);
```

Above we have two scripts for creating two table Employee_Details and Employee_Details_Audit. Both tables have same no of column names,same column name and same data type.In second table,Employee_Details_Audit keeps track of what kind of operations are performed on table Employee_Details and any insert ,update and delete operation value are stored in Employee_Details_Audit

For the First table Employee_Details we insert five records .

```
Insert into Employee_Details values (1000,'Amit',10000);
Insert into Employee_Details values (1001,'Hemanth',12000);
Insert into Employee_Details values (1002,'George',20000);
Insert into Employee_Details values (1003,'Nitin',30000);
Insert into Employee_Details values (1004,'Riyaz',40000);
```

```
mysql> select * from Employee_Details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Amit     | 10000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
+-----+-----+-----+
5 rows in set (0.00 sec)

mysql>
```

Below we have written three types of trigger meant for auditing purpose. whatever operations performed on table Employee_Details gets automatically reflected in Employee_Details_Audit. For example we perform any insert, update or delete operations on Employee_Details, its get automatically get reflected in Employee_Details_Audit table because we have written triggers on Employee_Details table.

TRIGGER EXAMPLE 1

EXAMPLE OF CREATING AFTER INSERT TRIGGER FOR AUDIT PURPOSE

```
CREATE TRIGGER TriggerAfterInsert
AFTER INSERT ON Employee_Details
FOR EACH ROW
insert into Employee_Details_Audit
values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'INSERT')
```

In above example, TriggerAfterInsert, an Insert Trigger written on table Employee_Details. whenever we perform insert operation on Employee_Details table, automatically TriggerAfterInsert is fired and whatever records we have inserted in Employee_Details the same records gets inserted in Employee_Details_Audit along with what action we performed for example Insert action we have performed that too get inserted in Employee_Details_Audit.

```
mysql> select * from employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Amit     | 10000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
+-----+-----+-----+
5 rows in set (0.00 sec)

mysql> select * from employee_details_audit;
Empty set (0.00 sec)
```

Below is a screen shot of output of TriggerAfterInsert fired on table Employee_Details

```
mysql> CREATE TRIGGER TriggerAfterInsert
-> AFTER INSERT ON Employee_Details
-> FOR EACH ROW
-> insert into Employee_Details_Audit
-> values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'INSERT')
-> ;
Query OK, 0 rows affected (0.05 sec)

mysql> insert into employee_details values(1005,'Sanjay',50000);
Query OK, 1 row affected (0.02 sec)

mysql> select * from employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000 | Amit | 10000.00 |
| 1001 | Hemanth | 12000.00 |
| 1002 | George | 20000.00 |
| 1003 | Nitin | 30000.00 |
| 1004 | Riyaz | 40000.00 |
| 1005 | Sanjay | 50000.00 |
+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> select * from employee_details_audit;
+-----+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal | Action |
+-----+-----+-----+-----+
| 1005 | Sanjay | 50000.00 | INSERT |
+-----+-----+-----+-----+
1 row in set (0.00 sec)

mysql> _
```

TRIGGER EXAMPLE 2

EXAMPLE OF CREATING AFTER UPDATE TRIGGER FOR AUDIT PURPOSE

```
create trigger TriggerAfterUpdate
AFTER UPDATE ON Employee_Details
FOR EACH ROW
insert into Employee_Details_Audit
values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'UPDATE')
```

In above example, TriggerAfterUpdate, an Update Trigger written on table Employee_Details. whenever we perform Update operation on Employee_Details table, automatically TriggerAfterUpdate is fired and whatever records we have updated in Employee_Details same records get updated in Employee_Details_Audit along with what action we performed for example Update action we have performed that too get inserted in Employee_Details_Audit

```
mysql> select * from Employee_Details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Amit     | 10000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
| 1005   | Sanjay   | 50000.00 |
+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> select * from Employee_Details_Audit;
+-----+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal | Action |
+-----+-----+-----+-----+
| 1005   | Sanjay   | 50000.00 | INSERT |
+-----+-----+-----+-----+
1 row in set (0.00 sec)

mysql>
```

Below is an screen shot of output of TriggerAfterUpdate fired on table Employee_Details

```
mysql> create trigger TriggerAfterUpdate
-> AFTER UPDATE ON Employee_Details
-> FOR EACH ROW
-> insert into Employee_Details_Audit
-> values(new.Emp_ID,new.Emp_Name,new.Emp_Sal,'UPDATE')
-> ;
Query OK, 0 rows affected (0.05 sec)

mysql> update employee_details set Emp_Name='Ajay',Emp_Sal=50000 where Emp_ID=1000;
Query OK, 1 row affected (0.03 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> SELECT * FROM employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Ajay     | 50000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
| 1005   | Sanjay   | 50000.00 |
+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> SELECT * FROM employee_details_audit;
+-----+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal | Action |
+-----+-----+-----+-----+
| 1005   | Sanjay   | 50000.00 | INSERT |
| 1000   | Ajay     | 50000.00 | UPDATE |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> _
```

TRIGGER EXAMPLE 3**EXAMPLE OF CREATING AFTER DELETE TRIGGER FOR AUDIT PURPOSE**

```

create trigger TriggerAfterDelete
AFTER DELETE ON Employee_Details
FOR EACH ROW
insert into Employee_Details_Audit
values(old.Emp_ID, old.Emp_Name, old.Emp_Sal,'DELETE')

```

```

mysql> SELECT * FROM employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Ajay     | 50000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
| 1005   | Sanjay    | 50000.00 |
+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> SELECT * FROM employee_details_audit;
+-----+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal | Action |
+-----+-----+-----+-----+
| 1005   | Sanjay    | 50000.00 | INSERT |
| 1000   | Ajay     | 50000.00 | UPDATE |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> _

```

```

mysql> create trigger TriggerAfterDelete
-> AFTER DELETE ON Employee_Details
-> FOR EACH ROW
-> insert into Employee_Details_Audit
-> values(old.Emp_ID, old.Emp_Name, old.Emp_Sal,'DELETE');
Query OK, 0 rows affected (0.05 sec)

mysql> select * from employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000   | Ajay     | 50000.00 |
| 1001   | Hemanth  | 12000.00 |
| 1002   | George   | 20000.00 |
| 1003   | Nitin    | 30000.00 |
| 1004   | Riyaz    | 40000.00 |
| 1005   | Sanjay    | 50000.00 |
+-----+-----+-----+
6 rows in set (0.00 sec)

```

Below is a screen shot of output of TriggerAfterDelete fired on table Employee_Details

```
mysql> delete from employee_details where Emp_ID=1005;
Query OK, 1 row affected (0.00 sec)

mysql> select * from employee_details;
+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal |
+-----+-----+-----+
| 1000 | Ajay | 50000.00 |
| 1001 | Hemanth | 12000.00 |
| 1002 | George | 20000.00 |
| 1003 | Nitin | 30000.00 |
| 1004 | Riyaz | 40000.00 |
+-----+-----+-----+
5 rows in set (0.00 sec)

mysql> select * from employee_details_audit;
+-----+-----+-----+-----+
| Emp_ID | Emp_Name | Emp_Sal | Action |
+-----+-----+-----+-----+
| 1005 | Sanjay | 50000.00 | INSERT |
| 1000 | Ajay | 50000.00 | UPDATE |
| 1005 | Sanjay | 50000.00 | DELETE |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql>
```

Write a Trigger To Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students By Using Trigger.

```
CREATE TABLE IAMARKS
(
USN VARCHAR (10) PRIMARY KEY,
SUBCODE VARCHAR (8),
SSID VARCHAR (5),
TEST1 INT (2),
TEST2 INT (2),
TEST3 INT (2),
FINALIA INT (2)
);
```

Above is script for creating for IAMARKS table. Here is table named IAMARKS where we enter Marks of TEST1, TEST2 and TEST3 but FINALIA is calculated by taking best of two test marks divide by two.

Below is structure of IAMARKS Table.

```
mysql> DESC IAMARKS;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| USN | varchar(10) | NO | PRI | NULL | |
| SUBCODE | varchar(8) | YES | | NULL | |
| SSID | varchar(5) | YES | | NULL | |
| TEST1 | int(2) | YES | | NULL | |
| TEST2 | int(2) | YES | | NULL | |
| TEST3 | int(2) | YES | | NULL | |
| FINALIA | int(2) | YES | | NULL | |
+-----+-----+-----+-----+-----+-----+
7 rows in set (0.01 sec)

mysql> SELECT * FROM IAMARKS;
Empty set (0.00 sec)

mysql> _
```

TRIGGER EXAMPLE 4

This is trigger is an example of Before Insert Trigger

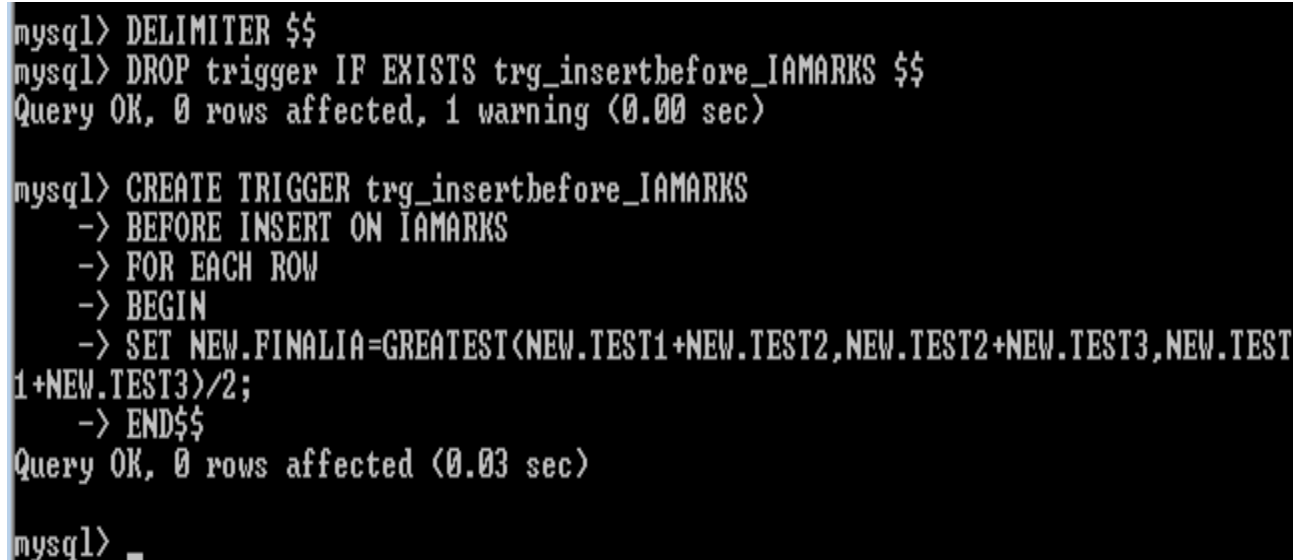
```
DELIMITER $$
DROP trigger IF EXISTS trg_insertbefore_IAMARKS $$
CREATE TRIGGER trg_insertbefore_IAMARKS
BEFORE INSERT ON IAMARKS
FOR EACH ROW
BEGIN
SETNEW.FINALIA=GREATEST(NEW.TEST1+NEW.TEST2,NEW.TEST2+NEW.TEST3,
NEW.TEST1+NEW.TEST3)/2;
END$$
```

Below is insert script for Student Info and marks into table IAMARKS

Please note that we are inserting 0 marks into table IAMARKS containing columnnameFINALIA.

```
INSERT INTO IAMARKS VALUES ('4AD18CS002','15CS51','CSE5A', 25, 16, 24,0);
INSERT INTO IAMARKS VALUES ('4AD18CS072','15CS52','CSE5B', 22, 19, 14,0);
INSERT INTO IAMARKS VALUES ('4AD18CS091','15CS53','CSE5C', 19, 15, 20,0);
INSERT INTO IAMARKS VALUES ('4AD18CS011','15CS54','CSE5A', 20, 16, 19,0);
INSERT INTO IAMARKS VALUES ('4AD18CS075','15CS55','CSE5B', 19, 18, 22,0);
INSERT INTO IAMARKS VALUES ('4AD18CS095','15CS56','CSE5C', 23, 17, 24,0);
```

Above ,we have written trigger name before_IAMARKS_insert on IAMARKS table which automatically calculates FINALIA by using Greatest function and inserts into values into FINALIA column of table IAMARKS while trying to insert record on IAMARKS



```
mysql> DELIMITER $$
mysql> DROP trigger IF EXISTS trg_insertbefore_IAMARKS $$
Query OK, 0 rows affected, 1 warning (0.00 sec)

mysql> CREATE TRIGGER trg_insertbefore_IAMARKS
-> BEFORE INSERT ON IAMARKS
-> FOR EACH ROW
-> BEGIN
-> SET NEW.FINALIA=GREATEST(NEW.TEST1+NEW.TEST2,NEW.TEST2+NEW.TEST3,NEW.TEST
1+NEW.TEST3)/2;
-> END$$
Query OK, 0 rows affected (0.03 sec)

mysql>
```

Below is snap shot of output generated by trigger before_IAMARKS_insert on table IAMARKS

```

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS002','18CS51','CSE5A', 25, 16, 24,0);
Query OK, 1 row affected (0.02 sec)

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS072','18CS52','CSE5B', 22, 19, 14,0);
Query OK, 1 row affected (0.00 sec)

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS091','18CS53','CSE5C', 19, 15, 20,0);
Query OK, 1 row affected (0.00 sec)

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS011','18CS54','CSE5A', 20, 16, 19,0);
Query OK, 1 row affected (0.00 sec)

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS075','18CS55','CSE5B', 19, 18, 22,0);
Query OK, 1 row affected (0.00 sec)

mysql> INSERT INTO IAMARKS VALUES ('4AD18CS095','18CS56','CSE5C', 23, 17, 24,0);
Query OK, 1 row affected (0.00 sec)

mysql> SELECT * FROM IAMARKS;
+-----+-----+-----+-----+-----+-----+-----+
| USN      | SUBCODE | SSID   | TEST1 | TEST2 | TEST3 | FINALIA |
+-----+-----+-----+-----+-----+-----+-----+
| 4AD18CS002 | 18CS51  | CSE5A  | 25    | 16    | 24    | 25      |
| 4AD18CS072 | 18CS52  | CSE5B  | 22    | 19    | 14    | 21      |
| 4AD18CS091 | 18CS53  | CSE5C  | 19    | 15    | 20    | 20      |
| 4AD18CS011 | 18CS54  | CSE5A  | 20    | 16    | 19    | 20      |
| 4AD18CS075 | 18CS55  | CSE5B  | 19    | 18    | 22    | 21      |
| 4AD18CS095 | 18CS56  | CSE5C  | 23    | 17    | 24    | 24      |
+-----+-----+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)

mysql> _

```

OTHER TRIGGER EXAMPLES

Example Of Creating Before Insert Trigger Having The If Conditional Statements for incrementing salary of employee based on certain condition

TRIGGER EXAMPLE 5

DELIMITER \$\$

DROP trigger IF EXISTS increment_Salary_Employee \$\$

CREATE TRIGGER increment_Salary_Employee

BEFORE insert ON employee

FOR EACH ROW

IF NEW.Salary>20000 and NEW.Salary<40000

THEN

SET NEW.salary=NEW.salary*1.1;

ELSEIF NEW.Salary>=40000 and NEW.Salary<90000

THEN

SET NEW.Salary=NEW.Salary*1.2;

END IF;

END\$\$

Above trigger increment_Salary_Employee is written on table employee. this trigger checks salary of employee table during insertion if salary is greater than 20000 and salary is lesser than 40000, it automatically increments salary by 10%. if salary is greater than or equal to 40000 and salary is lesser than 90000, salary is automatically incremented by 20%

Here is snapshot of output of trigger increment_Salary_Employee fired on Employee table when any records is inserted into table Employee

```
mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	harsha	clerk	15000.00
101	shashikiran	instructor	19000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	15000.00
107	ARUN	TEST ENGINEER	25000.00
108	robert	hr manager	35000.00
109	amit	salesman	40000.00
110	kumar	salesmanager	42000.00

```
11 rows in set (0.00 sec)

mysql> insert into employee values (111,'ashok','doctor',70000);
Query OK, 1 row affected (0.03 sec)

mysql> insert into employee values (112,'sunil','test engineer',30000);
Query OK, 1 row affected (0.02 sec)

mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	harsha	clerk	15000.00
101	shashikiran	instructor	19000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	15000.00
107	ARUN	TEST ENGINEER	25000.00
108	robert	hr manager	35000.00
109	amit	salesman	40000.00
110	kumar	salesmanager	42000.00
111	ashok	doctor	84000.00
112	sunil	test engineer	33000.00

```
13 rows in set (0.00 sec)
```

TRIGGER EXAMPLE 6

```
DELIMITER $$
DROP trigger IF EXISTS trg_insertbefore_trimupper $$
CREATE TRIGGER trg_insertbefore_trimupper
BEFORE INSERT ON employee
FOR EACH ROW
BEGIN
SET NEW.Name = UPPER(NEW.Name);
SET NEW.Designation = UPPER(NEW.Designation);
END IF;
END$$
```

Above trigger name trg_insertbefore_trimupper is create on table employee which automatically converts Name and Designation columns in table employee into upper case letters and inserts automatically into Table employee when any employee record is inserted in employee table.

Here is example of snapshot of output of trigger trg_insertbefore_trimupper

```
mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	harsha	clerk	15000.00
101	shashikiran	instructor	19000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	15000.00

```
7 rows in set (0.00 sec)

mysql> insert into employee values(107,'deepak','system engineer',25000);
Query OK, 1 row affected (0.01 sec)

mysql> select * from employee;
```

employee_id	Name	Designation	Salary
100	harsha	clerk	15000.00
101	shashikiran	instructor	19000.00
102	nitin	assitiant professor	25000.00
103	deepak	associate professor	40000.00
104	sanjay	professor	80000.00
105	yogesh	system admin	30000.00
106	anand	clerk	15000.00
107	DEEPAK	SYSTEM ENGINEER	25000.00

```
8 rows in set (0.00 sec)

mysql>
```

Below is screen shot for creating simple table people which has 2 columns age and name

```
mysql> use atme;
Database changed
mysql> CREATE TABLE people
-> (
-> age INT,
-> name varchar(150)
-> );
Query OK, 0 rows affected (0.05 sec)

mysql> insert into people values(20,'ajay');
Query OK, 1 row affected (0.02 sec)

mysql> insert into people values(50,'sanjay');
Query OK, 1 row affected (0.00 sec)

mysql> select * from people;
```

age	name
20	ajay
50	sanjay

```
2 rows in set (0.00 sec)

mysql>
```

TRIGGER EXAMPLE 7

```
mysql> DELIMITER $$
mysql> DROP trigger IF EXISTS beforeinsert_agecheck$$
Query OK, 0 rows affected, 1 warning (0.00 sec)

mysql> CREATE TRIGGER beforeinsert_agecheck
-> BEFORE INSERT ON people
-> FOR EACH ROW
-> IF NEW.age < 0
-> THEN SET NEW.age = 0;
-> ELSEIF NEW.age > 100 THEN
-> SET NEW.age = 60;
-> END IF;
-> END$$
Query OK, 0 rows affected (0.05 sec)
```

Above trigger beforeinsert _agecheck is created on table people which checks age being inserted into Table people if age is less than 0 or negative values ,it automatically insert age value has 0.if we are trying to insert into table people suppose age value is greater than 100,then automatically inserts 60 as default value in age column of people table.

Here is example of snapshot of output of beforeinsert_agecheck

```
mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
+-----+-----+
2 rows in set (0.00 sec)

mysql> insert into people values(-70,'hemanth');
Query OK, 1 row affected (0.00 sec)

mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
| 0 | hemanth |
+-----+-----+
3 rows in set (0.00 sec)

mysql> insert into people values(1000,'nitin');
Query OK, 1 row affected (0.00 sec)

mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
| 60 | nitin |
| 0 | hemanth |
+-----+-----+
4 rows in set (0.00 sec)

mysql>
```

TRIGGER EXAMPLE 8

This is trigger is an example of Before Update Trigger

```
mysql>
mysql> DELIMITER $$
mysql> DROP trigger IF EXISTS beforeupdate_agecheck$$
Query OK, 0 rows affected, 1 warning (0.00 sec)

mysql> CREATE TRIGGER beforeupdate_agecheck
-> BEFORE update ON people
-> FOR EACH ROW
-> IF NEW.age < 0
-> THEN SET NEW.age = 0;
-> ELSEIF NEW.age > 100 THEN
-> SET NEW.age = 60;
-> END IF;
-> END$$
Query OK, 0 rows affected (0.03 sec)
```

Above trigger beforeupdate_agecheck is created on table people which checks age being updated into Table people if age is less than 0 or negative values ,it automatically updates age value has 0. suppose if we are trying to update age value is greater than 100,then automatically updates 60 in age column of people table.

Below is snap shot of output of trigger beforeupdate_agecheck

```
mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
| 60 | nitin |
| 0 | hemanth |
+-----+-----+
4 rows in set (0.00 sec)

mysql> update people set age=1000 where name='hemanth';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1 Changed: 1 Warnings: 0

mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
| 60 | nitin |
| 60 | hemanth |
+-----+-----+
4 rows in set (0.00 sec)
```

```
mysql> update people set age=-55 where name='nitin';
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from people;
+-----+-----+
| age | name |
+-----+-----+
| 20 | ajay |
| 50 | sanjay |
| 0 | nitin |
| 60 | hemanth |
+-----+-----+
4 rows in set (0.01 sec)

mysql>
```

How to DROP TRIGGER

DROP TRIGGER IF EXISTS *schema_name.trigger_name*;

In this syntax:

- First, specify the name of the trigger that you want to drop after the DROP TRIGGER keywords.
- Second, specify the name of the schema to which the trigger belongs. If you skip the schema name, the statement will drop the trigger in the current database.
- Third, use IF EXISTS option to conditionally drops the trigger if the trigger exists. The IF EXISTS clause is optional.

DROP TRIGGER IF EXISTS *employee.trg_insertbefore_IAMARKS*;

or

DROP TRIGGER *trg_insertbefore_IAMARKS*;

Above statement drops trigger *trg_insertbefore_IAMARKS* created on table *IAMARKS*

Note that if you drop a table, MySQL will automatically drop all triggers associated with the table

LAB EXPERIMENTS PART A: SQLPROGRAMMING

A. Consider the following schema for a LibraryDatabase:

BOOK (Book_id, Title, Publisher_Name, Pub_Year)

BOOK_AUTHORS (Book_id, Author_Name)

PUBLISHER (Name, Address, Phone)

BOOK_COPIES(Book_id, Programme_id, No-of_Copies)

BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)

LIBRARY_PROGRAMME(Programme_id, Programme_Name,Address)

Write SQL queries to

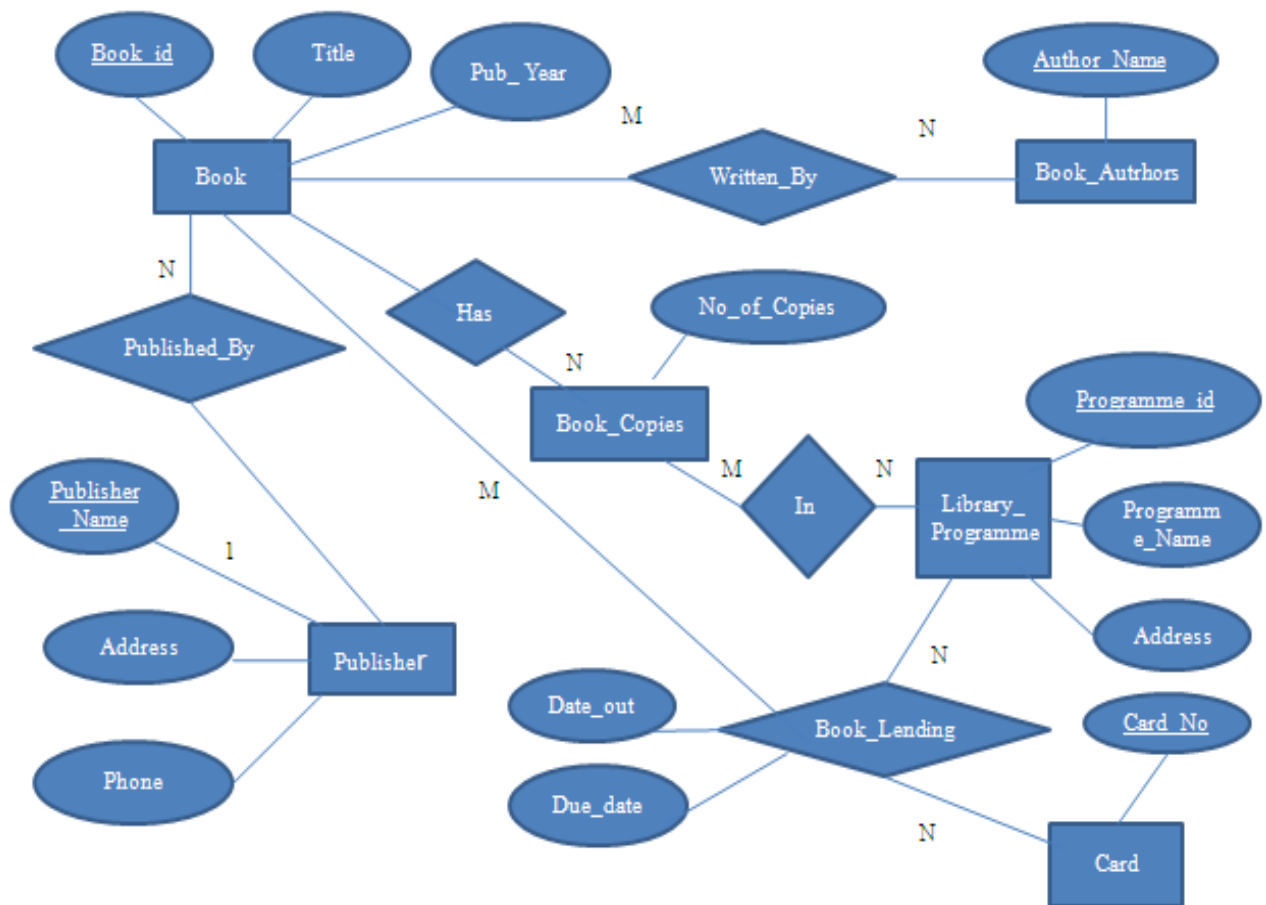
1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017
3. Delete a book in BOOK table. Update the contents of other tables 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.

Program 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.

Solution:
Entity-Relationship Diagram



Schema Diagram

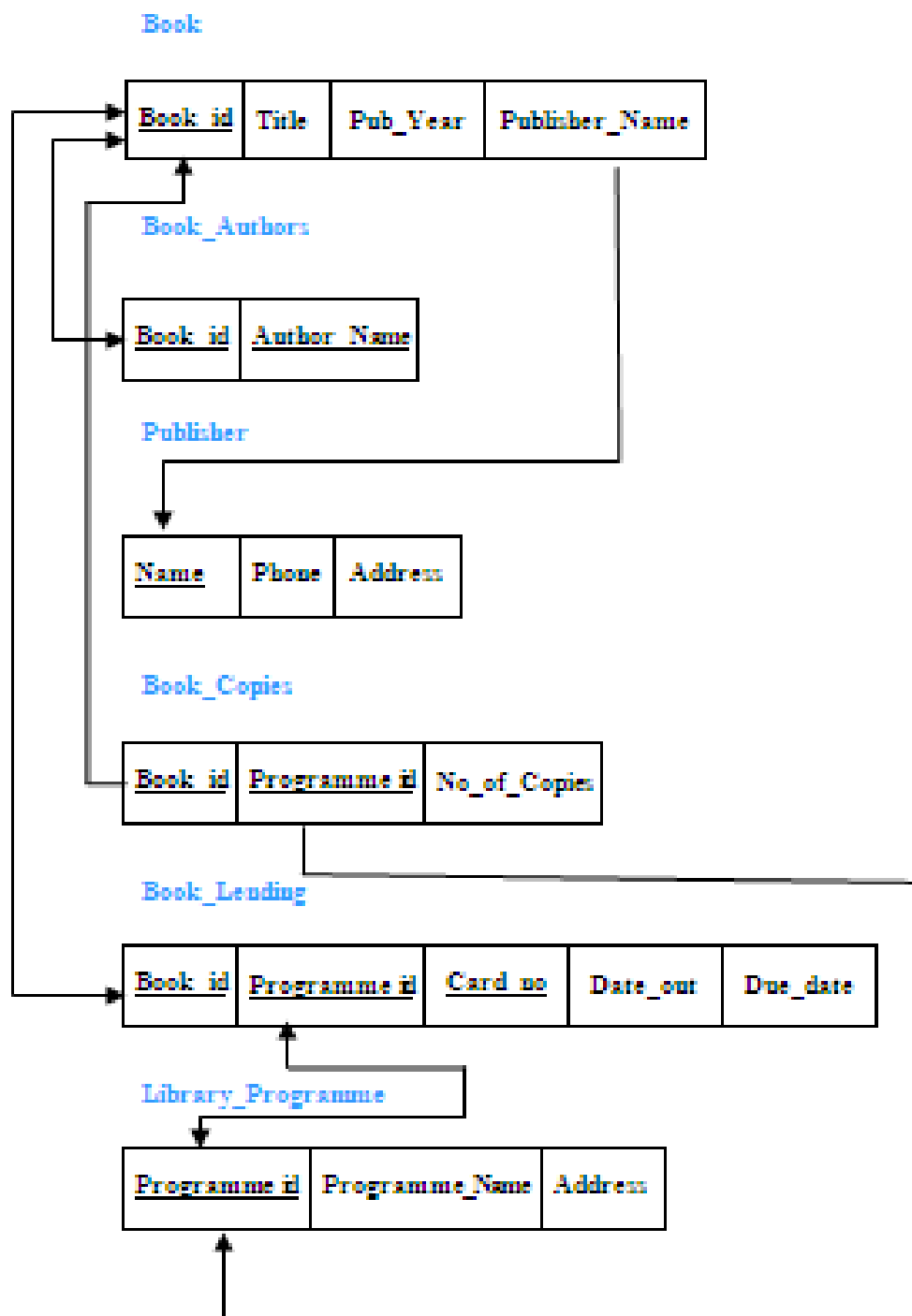


Table Creation

```
CREATE TABLE PUBLISHERs (  
  NAME VARCHAR (20) PRIMARY KEY,  
  PHONE BIGINT (20),  
  ADDRESS VARCHAR (100));
```

```
CREATE TABLE BOOK (  
  BOOK_ID INT (10) PRIMARY KEY,  
  TITLE VARCHAR (20),  
  PUB_YEAR VARCHAR (20),  
  PUBLISHER_NAME VARCHAR (20),  
  FOREIGN KEY (PUBLISHER_NAME) REFERENCES PUBLISHER (NAME) ON DELETE  
  CASCADE);
```

```
CREATE TABLE BOOK_AUTHORS (  
  AUTHOR_NAME VARCHAR (20),  
  BOOK_ID INT (10),  
  PRIMARY KEY (BOOK_ID, AUTHOR_NAME),  
  FOREIGN KEY (BOOK_ID) REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE);
```

```
CREATE TABLE LIBRARY_PROGRAMME (  
  PROGRAMME_ID INT (10) PRIMARY KEY,  
  PROGRAMME_NAME VARCHAR (50),  
  ADDRESS VARCHAR (100));
```

```
CREATE TABLE BOOK_COPIES (  
  NO_OF_COPIES INT (5),  
  BOOK_ID INT (10),  
  PROGRAMME_ID INT (10),  
  PRIMARY KEY (BOOK_ID,PROGRAMME_ID),  
  FOREIGN KEY (BOOK_ID) REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE,  
  FOREIGN KEY (PROGRAMME_ID) REFERENCES LIBRARY_PROGRAMME  
  (PROGRAMME_ID) ON DELETE CASCADE);
```

```
CREATE TABLE CARD (CARD_NO INT (10) PRIMARY KEY);
```

```
CREATE TABLE BOOK_LENDING (  
  DATE_OUT DATE,  
  DUE_DATE DATE,  
  BOOK_ID INT (10),  
  PROGRAMME_ID INT (10),  
  CARD_NO INT (10),  
  PRIMARY KEY (BOOK_ID,PROGRAMME_ID, CARD_NO),  
  FOREIGN KEY (BOOK_ID) REFERENCES BOOK (BOOK_ID) ON DELETE CASCADE,  
  FOREIGN KEY (PROGRAMME_ID) REFERENCES  
  LIBRARY_PROGRAMME(PROGRAMME_ID) ON DELETE CASCADE,  
  FOREIGN KEY (CARD_NO) REFERENCES CARD (CARD_NO) ON DELETE CASCADE);
```

Table Descriptions

DESC BOOK

```
mysql> DESC BOOK;
```

Field	Type	Null	Key	Default	Extra
BOOK_ID	int(10)	NO	PRI	NULL	
TITLE	varchar(20)	YES		NULL	
PUB_YEAR	varchar(20)	YES		NULL	
PUBLISHER_NAME	varchar(20)	YES	MUL	NULL	

```
4 rows in set (0.00 sec)
```

DESC BOOK_AUTHORS;

```
mysql> DESC BOOK_AUTHORS;
```

Field	Type	Null	Key	Default	Extra
AUTHOR_NAME	varchar(20)	NO	PRI		
BOOK_ID	int(10)	NO	PRI	0	

```
2 rows in set (0.00 sec)
```

DESC PUBLISHER;

```
mysql> DESC PUBLISHER;
```

Field	Type	Null	Key	Default	Extra
NAME	varchar(20)	NO	PRI	NULL	
PHONE	bigint(20)	YES		NULL	
ADDRESS	varchar(100)	YES		NULL	

```
3 rows in set (0.00 sec)
```

DESC BOOK_COPIES

```
mysql> DESC BOOK_COPIES;
```

Field	Type	Null	Key	Default	Extra
NO_OF_COPIES	int(5)	YES		NULL	
BOOK_ID	int(10)	NO	PRI	NULL	
PROGRAMME_ID	int(10)	NO	PRI	NULL	

```
3 rows in set (0.00 sec)
```

```
mysql>
```

DESC BOOK_LENDING;

```
mysql> DESC BOOK_LENDING;
+-----+-----+-----+-----+-----+-----+
| Field      | Type      | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| DATE_OUT   | date      | YES  |     | NULL    |       |
| DUE_DATE   | date      | YES  |     | NULL    |       |
| BOOK_ID    | int(10)   | NO   | PRI | NULL    |       |
| PROGRAMME_ID | int(10)   | NO   | PRI | NULL    |       |
| CARD_NO    | int(10)   | NO   | PRI | NULL    |       |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.03 sec)

mysql>
```

DESC CARD;

```
mysql> DESC CARD;
+-----+-----+-----+-----+-----+-----+
| Field      | Type      | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| CARD_NO    | int(10)   | NO   | PRI | NULL    |       |
+-----+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)

mysql> _
```

DESC LIBRARY_PROGRAMME;

```
mysql> DESC LIBRARY_PROGRAMME;
+-----+-----+-----+-----+-----+-----+
| Field      | Type      | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| PROGRAMME_ID | int(10)   | NO   | PRI | NULL    |       |
| PROGRAMME_NAME | varchar(50) | YES  |     | NULL    |       |
| ADDRESS      | varchar(100) | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql> _
```

Insertion of Values to Tables

```
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, 'CD','SEP-2016','PEARSON');
INSERT INTO BOOK VALUES (4,' ALGORITHMS ','SEP-2015',' MIT');
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 ('ULLMAN',3);
INSERT INTO BOOK_AUTHORS VALUES ('CHARLES', 4);
INSERT INTO BOOK_AUTHORS VALUES('GALVIN', 5);
```

```
INSERT INTO PUBLISHER VALUES ('MCGRAW-HILL', 9989076587,'BANGALORE');
INSERT INTO PUBLISHER VALUES ('PEARSON', 9889076565,'NEWDELHI');
INSERT INTO PUBLISHER VALUES ('PRENTICE HALL', 7455679345,'HYEDRABAD');
INSERT INTO PUBLISHER VALUES ('WILEY', 8970862340,'CHENNAI');
INSERT INTO PUBLISHER VALUES ('MIT',7756120238,'BANGALORE');
```

```
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 BOOK_LENDING VALUES ('2017-01-01','2017-06-01', 1, 10, 101);
INSERT INTO BOOK_LENDING VALUES ('2017-01-11 ','2017-03-11', 3, 14, 101);
INSERT INTO BOOK_LENDING VALUES ('2017-02-21','2017-04-21', 2, 13, 101);
INSERT INTO BOOK_LENDING VALUES ('2017-03-15 ','2017-07-15', 4, 11, 101);
INSERT INTO BOOK_LENDING VALUES ('2017-04-12','2017-05-12', 1, 11, 104);
```

```
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 LIBRARY_PROGRAMME VALUES (10,'VIJAY NAGAR','MYSURU');
INSERT INTO LIBRARY_PROGRAMME VALUES (11,'VIDYANAGAR','HUBLI'); ;
INSERT INTO LIBRARY_PROGRAMME VALUES(12,'KUVEMPUNAGAR','MYSURU');
INSERT INTO LIBRARY_PROGRAMME VALUE(13,'RAJAJINAGAR','BANGALORE');
INSERT INTO LIBRARY_PROGRAMME VALUES (14,'MANIPAL','UDUPI');
```

SELECT * FROM BOOK;

BOOK_ID	TITLE	PUB_YEAR	PUBLISHER_NAME
1	DBMS	Jan-2017	MCGRAW-HILL
2	ADBMS	Jun-2017	MCGRAW-HILL
3	CD	Sep-2016	PEARSON
4	ALGORITHMS	Sep-2015	MIT
5	OS	May-2016	PEARSON

SELECT * FROM BOOK_AUTHORS;

AUTHOR_NAME	BOOK_ID
NAVATHE	1
NAVATHE	2
ULLMAN	3
CHARLES	4
GALVIN	5

SELECT * FROM PUBLISHER;

NAME	PHONE	ADDRESS
MCGRAW-HILL	9989076587	BANGALORE
MIT	7756120238	BANGALORE
PEARSON	9889076565	NEWDELHI
PRENTICE HALL	7455679345	HYEDRABAD
WILEY	8970862340	CHENNAI

SELECT * FROM BOOK_COPIES;

NO_OF_COPIES	BOOK_ID	PROGRAMME_ID
10	1	10
5	1	11
2	2	12
5	2	13
7	3	14
1	5	10
3	4	11

SELECT * FROM BOOK_LENDING;

DATEOUT	DUE DATE	BOOKID	PROGRAMME_ID	CARDNO
2017-01-01	2017-06-01	1	10	
2017-01-11	2017-03-11	3	4	101
2017-02-21	2017-04-21	2	13	101
2017-03-15	2017-07-15	4	11	101
2017-04-12	2017-05-12	1	11	104

SELECT * FROM CARD;

CARD NO
101
102
103
104
105

SELECT * FROM LIBRARY_PROGRAMME;

PROGRAMME_ID	PROGRAMME_NAME	ADDRESS
10	VIJAY NAGAR	MYSURU
11	VIDYANAGAR	HUBLI
12	KUVEMPUNAGAR	MYSURU
13	RAJAJINAGAR	BANGALORE
14	MANIPAL	UDUPI

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.PROGRAMME_ID FROM BOOK B, BOOK_AUTHORS A, BOOK_COPIES
C, LIBRARY_PROGRAMME L WHERE B.BOOK_ID=A.BOOK_ID AND
B.BOOK_ID=C.BOOK_ID AND L.PROGRAMME_ID=C.PROGRAMME_ID;
```

BOOK_ID	TITLE	PUBLISHER_NAME	AUTHOR_NAME	NO_OF_COPIES	PROGRAMME_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	CD	PEARSON	ULLMAN	7	14
4	ALGORITHMS	MIT	CHARLES	1	11
5	OS	PEARSON	GALVIN	3	10

2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun2017.

```
SELECT CARD_NO FROM BOOK_LENDING WHERE DATE_OUT
BETWEEN '2017-01-01'AND '2017-07-01' GROUP BY CARD_NO
HAVING COUNT(*)>3;
```

```
+-----+
| CARD_NO |
+-----+
|      101 |
+-----+
1 row in set (0.03 sec)

mysql> _
```

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;

```
mysql> SELECT * FROM BOOK;
+-----+-----+-----+-----+
| BOOK_ID | TITLE   | PUB_YEAR | PUBLISHER_NAME |
+-----+-----+-----+-----+
| 1       | DBMS    | JAN-2017 | MCGRAW-HILL    |
| 2       | ADBMS   | JUN-2016 | MCGRAW-HILL    |
| 3       | CD      | SEP-2016 | PEARSON        |
| 4       | ALGORITHMS | SEP-2015 | MIT            |
| 5       | OS      | MAY-2016 | PEARSON        |
+-----+-----+-----+-----+
5 rows in set (0.00 sec)

mysql> DELETE FROM BOOK WHERE BOOK_ID=3;
Query OK, 1 row affected (0.03 sec)

mysql> SELECT * FROM BOOK;
+-----+-----+-----+-----+
| BOOK_ID | TITLE   | PUB_YEAR | PUBLISHER_NAME |
+-----+-----+-----+-----+
| 1       | DBMS    | JAN-2017 | MCGRAW-HILL    |
| 2       | ADBMS   | JUN-2016 | MCGRAW-HILL    |
| 4       | ALGORITHMS | SEP-2015 | MIT            |
| 5       | OS      | MAY-2016 | PEARSON        |
+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

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

CREATE VIEW VW_PUBLICATION AS SELECT PUB_YEAR FROM BOOK;

SELECT * FROM VW_PUBLICATION

```
mysql> SELECT * FROM VW_PUBLICATION;
+-----+
| PUB_YEAR |
+-----+
| JAN-2017 |
| JUN-2016 |
| SEP-2016 |
| SEP-2015 |
| MAY-2016 |
+-----+
5 rows in set (0.00 sec)
```

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

CREATE VIEW VW_BOOKS AS SELECT B.BOOK_ID, B.TITLE, C.NO_OF_COPIES
FROM BOOK B, BOOK_COPIES C, LIBRARY_PROGRAMME L WHERE
B.BOOK_ID=C.BOOK_ID AND C.PROGRAMME_ID=L.PROGRAMME_ID;

```
SELECT * FROM VW_BOOKS;
```

```
mysql> SHOW TABLES;
+-----+
| Tables_in_library |
+-----+
| book               |
| book_authors       |
| book_copies        |
| book_lending       |
| card               |
| library_programme  |
| publisher           |
| vw_books            |
+-----+
8 rows in set (0.00 sec)

mysql> SELECT * FROM VW_BOOKS;
+-----+-----+-----+
| BOOK_ID | TITLE          | NO_OF_COPIES |
+-----+-----+-----+
| 1       | DBMS           | 10            |
| 1       | DBMS           | 5             |
| 2       | ADBMS          | 2             |
| 2       | ADBMS          | 5             |
| 3       | CD             | 7             |
| 5       | OS             | 1             |
| 4       | ALGORITHMS     | 3             |
+-----+-----+-----+
7 rows in set (0.00 sec)

mysql>
```

Program Outcomes:

The students are 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.

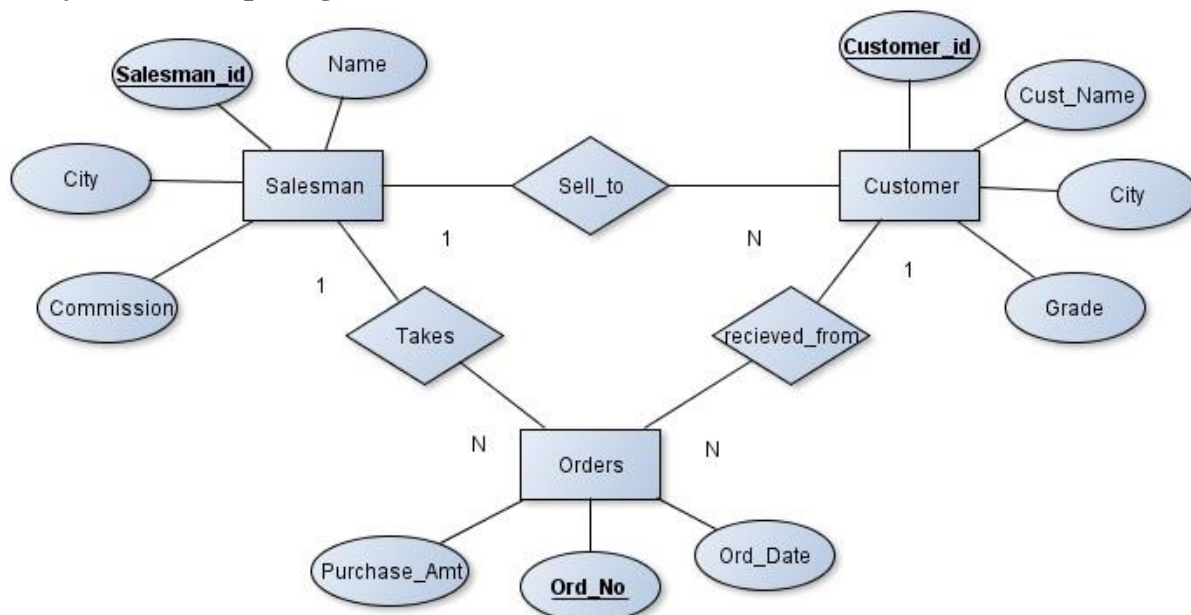
B. Consider the following schema for OrderDatabase:**SALESMAN** (Salesman_id, Name, City, Commission)**CUSTOMER** (Customer_id, Cust_Name, City, Grade, Salesman_id)**ORDERS** (Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

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

Program 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.

Solution:**Entity-Relationship Diagram**

Schema Diagram

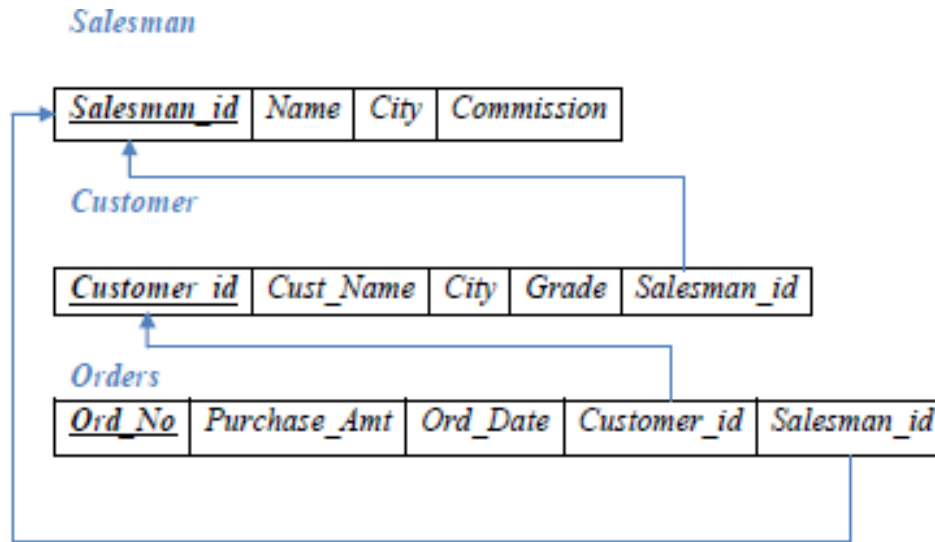


Table Creation

```

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

```

CREATE TABLE CUSTOMER (
    CUSTOMER_ID INT (5) PRIMARY KEY,
    CUST_NAME VARCHAR (20),
    CITY VARCHAR (20), GRADE INT (4),
    SALESMAN_ID INT (6),
    FOREIGN KEY (SALESMAN_ID) REFERENCES SALESMAN (SALESMAN_ID) ON DELETE
    SET NULL);
  
```

```

CREATE TABLE ORDERS (
    ORD_NO INT (5) PRIMARY KEY,
    PURCHASE_AMT DECIMAL (10, 2),
    ORD_DATE DATE,
    CUSTOMER_ID INT (4),
    SALESMAN_ID INT (4),
    FOREIGN KEY (CUSTOMER_ID) REFERENCES CUSTOMER (CUSTOMER_ID) ON DELETE
    CASCADE,
    FOREIGN KEY (SALESMAN_ID) REFERENCES SALESMAN (SALESMAN_ID) ON DELETE
    CASCADE);
  
```

Table Descriptions

DESC SALESMAN;

```
mysql> DESC SALESMAN;
+-----+-----+-----+-----+-----+-----+
| Field      | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| SALESMAN_ID | int(4)        | NO   | PRI | NULL    |       |
| NAME        | varchar(20)   | YES  |     | NULL    |       |
| CITY        | varchar(20)   | YES  |     | NULL    |       |
| COMMISSION  | varchar(20)   | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

DESC CUSTOMER;

```
mysql> DESC CUSTOMER;
+-----+-----+-----+-----+-----+-----+
| Field      | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| CUSTOMER_ID | int(5)        | NO   | PRI | NULL    |       |
| CUST_NAME   | varchar(20)   | YES  |     | NULL    |       |
| CITY        | varchar(20)   | YES  |     | NULL    |       |
| GRADE       | int(4)        | YES  |     | NULL    |       |
| SALESMAN_ID | int(6)        | YES  | MUL | NULL    |       |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

DESC ORDERS;

```
mysql> DESC ORDERS;
+-----+-----+-----+-----+-----+-----+
| Field      | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| ORD_NO     | int(5)        | NO   | PRI | NULL    |       |
| PURCHASE_AMT | decimal(10,2) | YES  |     | NULL    |       |
| ORD_DATE   | date          | YES  |     | NULL    |       |
| CUSTOMER_ID | int(4)        | YES  | MUL | NULL    |       |
| SALESMAN_ID | int(4)        | YES  | MUL | NULL    |       |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

```
INSERT INTO SALESMAN VALUES(101,'RICHARD','LOS ANGELES','18%');
INSERT INTO SALESMAN VALUES(103,'GEORGE','NEWYORK','32%');
INSERT INTO SALESMAN VALUES(110,'CHARLES','BANGALORE','54%');
INSERT INTO SALESMAN VALUES(122,'ROWLING','PHILADELPHIA','46%');
INSERT INTO SALESMAN VALUES(126,'KURT','CHICAGO','52%');
INSERT INTO SALESMAN VALUES(132,'EDWIN','PHOENIX','41%');
```

```
INSERT INTO CUSTOMER VALUES(501,'SMITH','LOS ANGELES',10,103);
INSERT INTO CUSTOMER VALUES(510,'BROWN','ATLANTA',14,122);
INSERT INTO CUSTOMER VALUES(522,'LEWIS','BANGALORE',10,132);
INSERT INTO CUSTOMER VALUES(534,'PHILIPS','BOSTON',17,103);
INSERT INTO CUSTOMER VALUES(543,'EDWARD','BANGALORE',14,110);
INSERT INTO CUSTOMER VALUES(550,'PARKER','ATLANTA',19,126);
```

```

INSERT INTO ORDERS VALUES(1,1000,'2017-05-04',501,103);
INSERT INTO ORDERS VALUES(2,4000,'2017-01-20',522,132);
INSERT INTO ORDERS VALUES(3,2500,'2017-02-24',550,126);
INSERT INTO ORDERS VALUES(5,6000,'2017-04-13',522,103);
INSERT INTO ORDERS VALUES(6,7000,'2017-03-09',550,126);
INSERT INTO ORDERS VALUES (7,3400,'2017-01-20',501,122);

```

```
SELECT * FROM SALESMAN;
```

```

mysql> SELECT * FROM SALESMAN;
+-----+-----+-----+-----+
| SALESMAN_ID | NAME      | CITY          | COMMISSION |
+-----+-----+-----+-----+
| 101         | RICHARD   | LOS ANGELES   | 18%        |
| 103         | GEORGE    | NEWYORK       | 32%        |
| 110         | CHARLES   | BANGALORE     | 54%        |
| 122         | ROWLING   | PHILADELPHIA  | 46%        |
| 126         | KURT      | CHICAGO       | 52%        |
| 132         | EDWIN     | PHOENIX       | 41%        |
+-----+-----+-----+-----+
6 rows in set (0.00 sec)

```

```
SELECT * FROM CUSTOMER;
```

```

mysql> SELECT * FROM CUSTOMER;
+-----+-----+-----+-----+-----+
| CUSTOMER_ID | CUST_NAME | CITY          | GRADE | SALESMAN_ID |
+-----+-----+-----+-----+-----+
| 501         | SMITH     | LOS ANGELES   | 10    | 103          |
| 510         | BROWN     | ATLANTA       | 14    | 122          |
| 522         | LEWIS     | BANGALORE     | 10    | 132          |
| 534         | PHILIPS    | BOSTON        | 17    | 103          |
| 543         | EDWARD    | BANGALORE     | 14    | 110          |
| 550         | PARKER    | ATLANTA       | 19    | 126          |
+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)

```

```
SELECT * FROM ORDERS;
```

```

mysql> select * from orders;
+-----+-----+-----+-----+-----+
| ORD_NO | PURCHASE_AMT | ORD_DATE   | CUSTOMER_ID | SALESMAN_ID |
+-----+-----+-----+-----+-----+
| 1      | 1000.00      | 2017-05-04 | 501         | 103          |
| 2      | 4000.00      | 2017-01-20 | 522         | 132          |
| 3      | 2500.00      | 2017-02-24 | 550         | 126          |
| 5      | 6000.00      | 2017-04-13 | 522         | 103          |
| 6      | 7000.00      | 2017-03-09 | 550         | 126          |
| 7      | 3400.00      | 2017-01-20 | 501         | 122          |
+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)

```

Queries

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

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

```
+-----+-----+
| GRADE | COUNT(DISTINCT CUSTOMER_ID) |
+-----+-----+
| 14    | 2                             |
| 17    | 1                             |
| 19    | 1                             |
+-----+-----+
3 rows in set (0.03 sec)
```

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

```
+-----+-----+
| SALESMAN_ID | NAME      |
+-----+-----+
| 103         | GEORGE    |
+-----+-----+
1 row in set (0.00 sec)
```

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

```
+-----+-----+-----+-----+
| SALESMAN_ID | NAME      | CUST_NAME | COMMISSION |
+-----+-----+-----+-----+
| 122         | ROWLING   | NO MATCH  | 46%        |
| 101         | RICHARD   | SMITH     | 18%        |
| 126         | KURT      | NO MATCH  | 52%        |
| 103         | GEORGE    | NO MATCH  | 32%        |
| 132         | EDWIN     | NO MATCH  | 41%        |
| 110         | CHARLES   | LEWIS     | 54%        |
| 110         | CHARLES   | EDWARD    | 54%        |
+-----+-----+-----+-----+
7 rows in set (0.03 sec)
```

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

```
CREATE VIEW VW_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);
```

```
SELECT * FROM VW_ELITSALESMAN
```

```
mysql> SELECT * FROM VW_ELITSALESMAN;
+-----+-----+-----+
| ORD_DATE | SALESMAN_ID | NAME |
+-----+-----+-----+
| 2017-05-04 | 103 | GEORGE |
| 2017-01-20 | 132 | EDWIN |
| 2017-02-24 | 126 | KURT |
| 2017-04-13 | 103 | GEORGE |
| 2017-03-09 | 126 | KURT |
+-----+-----+-----+
5 rows in set (0.00 sec)
```

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:

```
DELETE FROM SALESMAN WHERE SALESMAN_ID=101;
```

```
mysql> SELECT * FROM SALESMAN;
+-----+-----+-----+-----+
| SALESMAN_ID | NAME | CITY | COMMISSION |
+-----+-----+-----+-----+
| 101 | RICHARD | LOS ANGELES | 18% |
| 103 | GEORGE | NEWYORK | 32% |
| 110 | CHARLES | BANGALORE | 54% |
| 122 | ROWLING | PHILADELPHIA | 46% |
| 126 | KURT | CHICAGO | 52% |
| 132 | EDWIN | PHOENIX | 41% |
+-----+-----+-----+-----+
6 rows in set (0.02 sec)

mysql> DELETE FROM SALESMAN WHERE SALESMAN_ID=101;
Query OK, 1 row affected (0.02 sec)

mysql> SELECT * FROM SALESMAN;
+-----+-----+-----+-----+
| SALESMAN_ID | NAME | CITY | COMMISSION |
+-----+-----+-----+-----+
| 103 | GEORGE | NEWYORK | 32% |
| 110 | CHARLES | BANGALORE | 54% |
| 122 | ROWLING | PHILADELPHIA | 46% |
| 126 | KURT | CHICAGO | 52% |
| 132 | EDWIN | PHOENIX | 41% |
+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

Program Outcomes:

The students are 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.

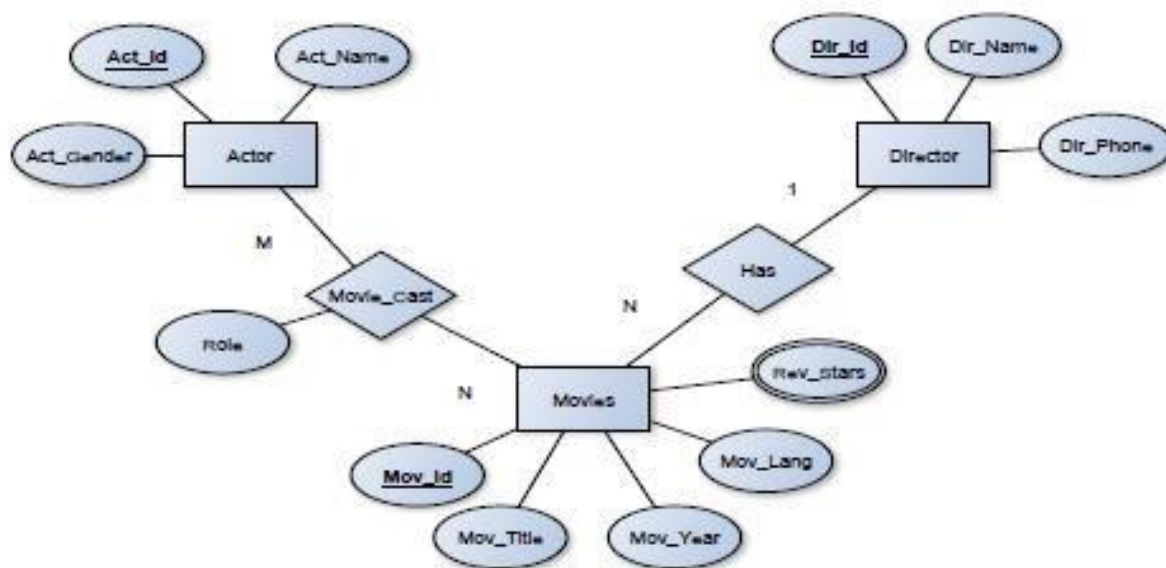
C. Consider the schema for MovieDatabase:**ACTOR** (Act_id, Act_Name, Act_Gender)**DIRECTOR** (Dir_id, Dir_Name, Dir_Phone)**MOVIES** (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)**MOVIE_CAST** (Act_id, Mov_id, Role)**RATING** (Mov_id, Rev_Stars) Write SQL queries to

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

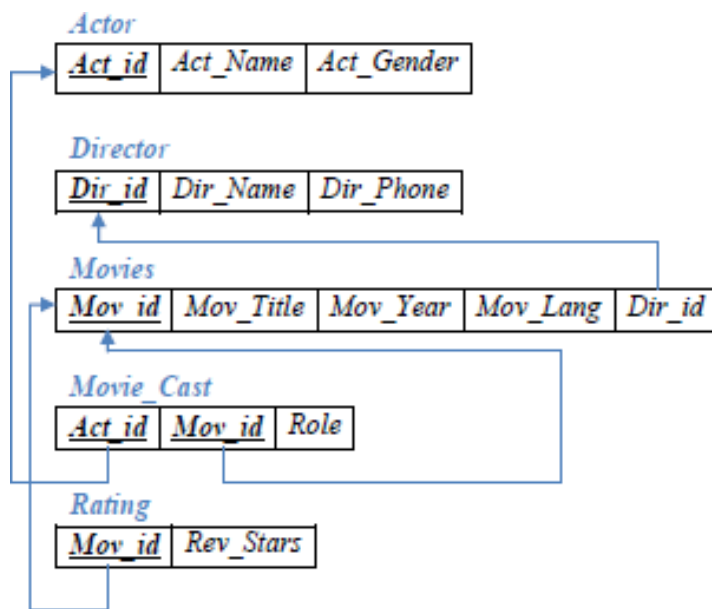
Program Objectives:

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.

Solution:**Entity-Relationship Diagram**

Schema Diagram

**Table Creation**

```

CREATE TABLE ACTOR (
  ACT_ID INT (5) PRIMARY KEY,
  ACT_NAME VARCHAR (20),
  ACT_GENDER CHAR (1));
  
```

```

CREATE TABLE DIRECTOR (
  DIR_ID INT (5) PRIMARY KEY,
  DIR_NAME VARCHAR (20),
  DIR_PHONE BIGINT);
  
```

```

CREATE TABLE MOVIES
(MOV_ID INT (4) PRIMARY KEY,
MOV_TITLE VARCHAR (50),
MOV_YEAR INT (4),
MOV_LANG VARCHAR (20),
DIR_ID INT (5),
FOREIGN KEY (DIR_ID) REFERENCES DIRECTOR(DIR_ID));
  
```

```

CREATE TABLE MOVIES_CAST (
  ACT_ID INT (5),
  MOV_ID INT (5),
  ROLE VARCHAR (20),
  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 INT (5) PRIMARYKEY,
REV_STARS VARCHAR (25),
FOREIGN KEY (MOV_ID) REFERENCES MOVIES (MOV_ID));
```

Table Descriptions

DESC ACTOR;

```
mysql> DESC ACTOR;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| ACT_ID | int(5) | NO   | PRI | NULL    |       |
| ACT_NAME | varchar(20) | YES |     | NULL    |       |
| ACT_GENDER | char(1) | YES |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

DESC DIRECTOR;

```
mysql> DESC DIRECTOR;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| DIR_ID | int(5) | NO   | PRI | NULL    |       |
| DIR_NAME | varchar(20) | YES |     | NULL    |       |
| DIR_PHONE | bigint(20) | YES |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

DESC MOVIES;

```
mysql> DESC MOVIES;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| MOV_ID | int(4) | NO   | PRI | NULL    |       |
| MOV_TITLE | varchar(50) | YES |     | NULL    |       |
| MOV_YEAR | int(4) | YES |     | NULL    |       |
| MOV_LANG | varchar(20) | YES |     | NULL    |       |
| DIR_ID | int(5) | YES | MUL | NULL    |       |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

DESC MOVIES_CAST;

```
mysql> DESC MOVIES_CAST;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| ACT_ID | int(5) | NO   | PRI | 0       |       |
| MOV_ID | int(5) | NO   | PRI | 0       |       |
| ROLE | varchar(20) | YES |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

DESC RATING;

```
mysql> DESC RATING;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| MOU_ID | int(5) | NO | PRI | NULL | |
| REV_STARS | varchar(25) | YES | | NULL | |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)
```

Insertion of Values to Tables

INSERT INTO ACTOR VALUES (1,'MADHURI DIXIT','F');

INSERT INTO ACTOR VALUES (2,'AAMIR KHAN','M');

INSERT INTO ACTOR VALUES (3,'JUHI CHAWLA','F');

INSERT INTO ACTOR VALUES (4,'SRIDEVI','F');

INSERT INTO DIRECTOR VALUES (100,'SUBHASH KAPOOR', 9563400156);

INSERT INTO DIRECTOR VALUES(102,'ALAN TAYLOR',9971960035);

INSERT INTO DIRECTOR VALUES (103,'SANTHOSH ANANDDRAM', 9934611125);

INSERT INTO DIRECTOR VALUES (104,'IMTIAZ ALI', 8539920975);

INSERT INTO DIRECTOR VALUES (105,'HITCHCOCK',7766138911);

INSERT INTO DIRECTOR VALUES (106,'STEVEN SPIELBERG',9966138934);

INSERT INTO MOVIES VALUES (501,'JAB HARRY MET SEJAL',2017,'HINDI',104);

INSERT INTO MOVIES VALUES (502,'RAJAKUMARA',2017,'KANNADA',103);

INSERT INTO MOVIES VALUES (503,'JOLLY LLB 2', 2013,'HINDI', 100);

INSERT INTO MOVIES VALUES (504,'TERMINATOR GENESYS',2015,'ENGLISH',102);

INSERT INTO MOVIES VALUES (505,'JAWS',1975,'ENGLISH',106);

INSERT INTO MOVIES VALUES (506,'BRIDGE OF SPIES',2015,'ENGLISH', 106);

INSERT INTO MOVIES VALUES (507,'VERTIGO',1943,'ENGLISH',105);

INSERT INTO MOVIES VALUES (508,'SHADOW OF A DOUBT',1943,'ENGLISH', 105);

INSERT INTO MOVIES_CAST VALUES (1, 501,'HEROINE');

INSERT INTO MOVIES_CAST VALUES (1, 502,'HEROINE');

INSERT INTO MOVIES_CAST VALUES (3, 503,'COMEDIAN');

INSERT INTO MOVIES_CAST VALUES (4, 504,'GUEST');

INSERT INTO MOVIES_CAST VALUES (4, 501,'HERO');

INSERT INTO RATING VALUES (501, 4);

INSERT INTO RATING VALUES (502, 2);

INSERT INTO RATING VALUES (503, 5);

INSERT INTO RATING VALUES (504, 4);

INSERT INTO RATING VALUES (505, 3);

INSERT INTO RATING VALUES (506, 2);

SELECT * FROM ACTOR;

ACT_ID	ACT_NAME	ACT
1	MADHURI DIXIT	F
2	AAMIR KHAN	M
3	JUHI CHAWLA	F
4	SRIDEVI	F

SELECT * FROM DIRECTOR;

DIR_ID	DIR_NAME	DIR_PHONE
100	SUBHASH KAPOOR	56340015
102	ALAN TAYLOR	719600310
103	SANTHOSH ANANDDRAM	99346111
104	IMTIAZ ALI	85399209
105	HITCHCOCK	7766138911
106	STEVEN SPIELBERG	9966138934

SELECT * FROM MOVIES;

MOV_ID	MOV_TITLE	MOV_YEAR	MOV_LANG	DIR_ID
501	JAB HARRY MET SEJAL	2017	HINDI	104
502	RAJAKUMARA	2017	KANNADA	103
503	JOLLY LLB 2	2013	HINDI	100
504	TERMINATOR GENESYS	2015	ENGLISH	102
505	JAWS	1975	ENGLISH	106
506	BRIDGE OF SPIES	2015	ENGLISH	106
507	VERTIGO	1958	ENGLISH	105
508	SHADOW OF A DOUBT	1943	ENGLISH	105

SELECT * FROM MOVIE_CAST;

ACT_ID	MOV_ID	ROLE
1	501	HEROINE
1	502	HEROINE
3	503	COMEDIAN
4	504	GUEST
4	501	HERO

SELECT * FROM RATING;

MOV_ID	REV_STARS
501	4
502	2
503	5
504	4
505	3
506	2
507	2
508	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');
```

OR

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

```
+-----+
| MOV_TITLE |
+-----+
| VERTIGO   |
| SHADOW OF A DOUBT |
+-----+
2 rows in set (0.00 sec)
```

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

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

```
+-----+
| MOV_TITLE |
+-----+
| JAB HARRY MET SEJAL |
+-----+
1 row in set (0.00 sec)
```

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 INNER JOIN MOVIES M
ON C.MOV_ID=M.MOV_ID WHERE M.MOV_YEAR NOT BETWEEN 2000 AND 2015;
```

```
+-----+-----+-----+
| ACT_NAME | MOV_TITLE | MOV_YEAR |
+-----+-----+-----+
| MADHURI DIXIT | JAB HARRY MET SEJAL | 2017 |
| MADHURI DIXIT | RAJAKUMARA | 2017 |
| SRIDEVI | JAB HARRY MET SEJAL | 2017 |
+-----+-----+-----+
3 rows in set (0.00 sec)
```

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 movietitle.
 SELECT MOV_TITLE,MAX(REV_STARS) FROM MOVIES M ,RATING R WHERE
 M.MOV_ID=R.MOV_ID GROUP BY MOV_TITLE HAVING MAX(REV_STARS)>0 ORDER
 BY MOV_TITLE;

MOV_TITLE	MAX<REV_STARS>
BRIDGE OF SPIES	2
JAB HARRY MET SEJAL	4
JAWS	3
JOLLY LLB 2	5
RAJAKUMARA	2
TERMINATOR GENESYS	4

6 rows in set (0.00 sec)

5. Update rating of all movies directed by 'Steven Spielberg' to 5
 UPDATE RATING SET REV_STARS=5 WHERE MOV_ID IN(SELECT MOV_ID FROM
 MOVIES WHERE DIR_ID IN(SELECT DIR_ID FROM DIRECTOR
 WHERE DIR_NAME='STEVEN SPIELBERG'));
OR
 UPDATE RATING R, MOVIES M, DIRECTOR D SET REV_STARS=5 WHERE
 R.MOV_ID=M.MOV_ID AND M.DIR_ID=D.DIR_ID AND DIR_NAME='STEVEN
 SPIELBERG';

```
mysql> SELECT * FROM RATING;
```

MOV_ID	REV_STARS
501	4
502	2
503	5
504	4
505	5
506	5

6 rows in set (0.00 sec)

Program Outcomes:

The students are 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.

D. Consider the schema for CollegeDatabase:**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)

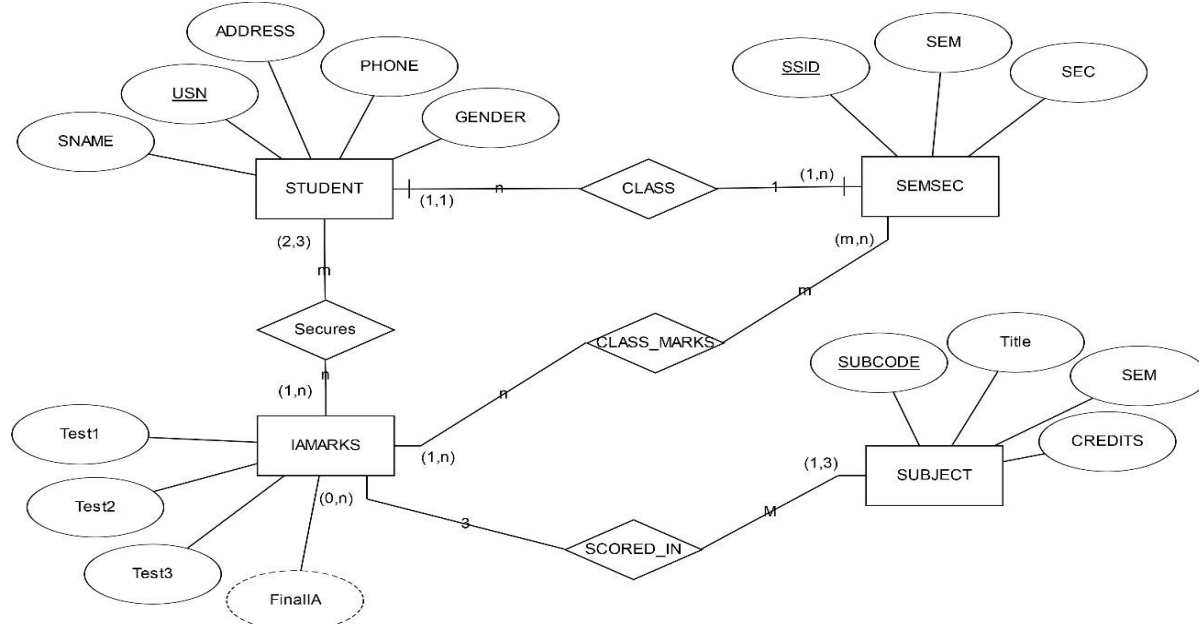
Write SQL queries to

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.

Program 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.

Solution:**Entity - Relationship Diagram**

Schema Diagram

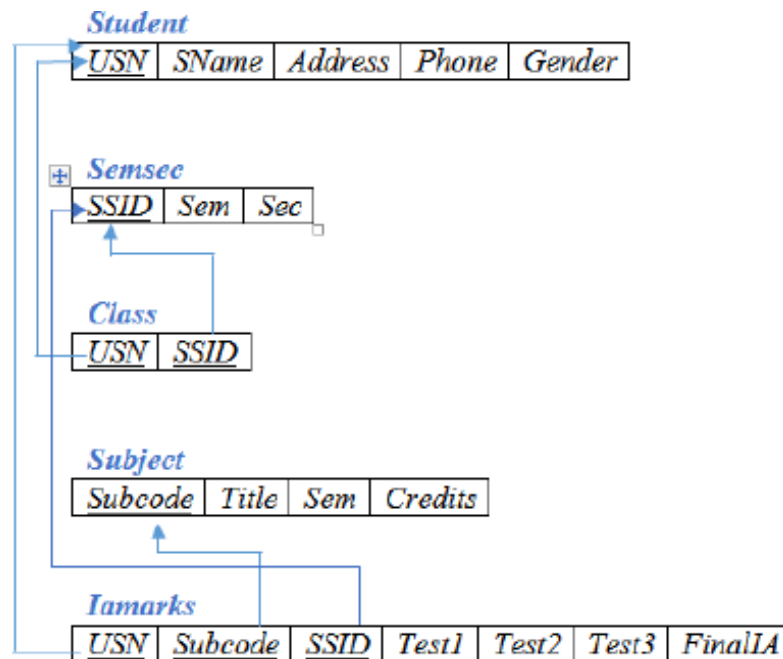


Table Creation

```

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

```

CREATE TABLE SEMSEC (
  SSID VARCHAR (5) PRIMARY KEY,
  SEM INT (5),
  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(10)
  PRIMARY KEY,
  TITLE VARCHAR(20),
  SEM INT,
  CREDITS INT);
  
```

```
CREATE TABLE IAMARKS (
USN VARCHAR (10),
SUBCODE VARCHAR (8),
SSID VARCHAR (5),
TEST1 INT (2),
TEST2 INT (2),
TEST3 INT (2),
FINALIA INT (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;

```
mysql> DESC STUDENT;
+-----+-----+-----+-----+-----+-----+
| Field | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| USN    | varchar(10)   | NO   | PRI | NULL    |       |
| SNAME  | varchar(25)   | YES  |     | NULL    |       |
| ADDRESS | varchar(25)   | YES  |     | NULL    |       |
| PHONE  | bigint(10)    | YES  |     | NULL    |       |
| GENDER | char(1)       | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
5 rows in set (0.00 sec)
```

DESC SEMSEC;

```
mysql> DESC SEMSEC;
+-----+-----+-----+-----+-----+-----+
| Field | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| SSID  | varchar(5)    | NO   | PRI | NULL    |       |
| SEM   | int(5)        | YES  |     | NULL    |       |
| SEC   | char(1)       | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

DESC CLASS;

```
mysql> DESC CLASS;
+-----+-----+-----+-----+-----+-----+
| Field | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| USN    | varchar(10)   | NO   | PRI |         |       |
| SSID   | varchar(5)    | NO   | PRI |         |       |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)
```

DESC SUBJECT;

```
mysql> DESC SUBJECT;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| SUBCODE | varchar(10) | NO   | PRI | NULL    |       |
| TITLE   | varchar(20) | YES  |     | NULL    |       |
| SEM     | int(11)    | YES  |     | NULL    |       |
| CREDITS | int(11)    | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

DESC IAMARKS;

```
mysql> DESC IAMARKS;
+-----+-----+-----+-----+-----+-----+
| Field | Type   | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| USN    | varchar(10) | NO   | PRI |         |       |
| SUBCODE | varchar(8)  | NO   | PRI |         |       |
| SSID   | varchar(5)  | NO   | PRI |         |       |
| TEST1  | int(2)      | YES  |     | NULL    |       |
| TEST2  | int(2)      | YES  |     | NULL    |       |
| TEST3  | int(2)      | YES  |     | NULL    |       |
| FINALIA | int(2)      | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

Insertion of values to tables

```
INSERT INTO STUDENT VALUES ('4AD13CS020','AKSHAY','BELAGAVI', 8877881122,'M');
INSERT INTO STUDENT VALUES ('4AD13CS062','SANDHYA','BENGALURU',
7722829912,'F');
INSERT INTO STUDENT VALUES ('4AD13CS091','TEESHA','BENGALURU', 7712312312,'F');
INSERT INTO STUDENT VALUES ('4AD13CS066','SUPRIYA','MANGALURU',
8877881122,'F');
INSERT INTO STUDENT VALUES ('4AD14CS010','ABHAY','BENGALURU', 9900211201,'M');
INSERT INTO STUDENT VALUES ('4AD14CS032','BHASKAR','BENGALURU',
9923211099,'M');
INSERT INTO STUDENT VALUES ('4AD14CS025','ASMI','BENGALURU', 7894737377,'F');
INSERT INTO STUDENT VALUES ('4AD15CS011','AJAY','TUMKUR', 9845091341,'M');
INSERT INTO STUDENT VALUES ('4AD15CS029','CHITRA','DAVANGERE', 7696772121,'F');
INSERT INTO STUDENT VALUES ('4AD15CS045','JEEVA','BELLARY', 9944850121,'M');
INSERT INTO STUDENT VALUES ('4AD15CS091','SANTOSH','MANGALURU',
8812332201,'M');
INSERT INTO STUDENT VALUES ('4AD16CS045','ISMAIL','KABURGI', 9900232201,'M');
INSERT INTO STUDENT VALUES ('4AD16CS088','SAMEERA','SHIMOGA', 9905542212,'F');
INSERT INTO STUDENT VALUES ('4AD16CS122','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 ('4AD13CS020','CSE8A');
INSERT INTO CLASS VALUES ('4AD13CS062','CSE8A');
INSERT INTO CLASS VALUES ('4AD13CS066','CSE8B');
INSERT INTO CLASS VALUES ('4AD13CS091','CSE8C');
INSERT INTO CLASS VALUES ('4AD14CS010','CSE7A');
INSERT INTO CLASS VALUES ('4AD14CS025','CSE7A');
INSERT INTO CLASS VALUES ('4AD14CS032','CSE7A');
INSERT INTO CLASS VALUES ('4AD15CS011','CSE4A');
INSERT INTO CLASS VALUES ('4AD15CS029','CSE4A');
INSERT INTO CLASS VALUES ('4AD15CS045','CSE4B');
INSERT INTO CLASS VALUES ('4AD15CS091','CSE4C');
INSERT INTO CLASS VALUES ('4AD16CS045','CSE3A');
INSERT INTO CLASS VALUES ('4AD16CS088','CSE3B');
INSERT INTO CLASS VALUES ('4AD16CS122','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','DWDW', 7, 4); I
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 VALUES ('4AD13CS091','10CS81','CSE8C', 15, 16, 18,0);
INSERT INTO IAMARKS VALUES ('4AD13CS091','10CS82','CSE8C', 12, 19, 14,0);
INSERT INTO IAMARKS VALUES ('4AD13CS091','10CS83','CSE8C', 19, 15, 20,0);
INSERT INTO IAMARKS VALUES ('4AD13CS091','10CS84','CSE8C', 20, 16, 19,0);
INSERT INTO IAMARKS VALUES ('4AD13CS091','10CS85','CSE8C', 15, 15, 12,0);

```

```
SELECT * FROM STUDENT;
```

```

mysql> SELECT * FROM STUDENT;
+-----+-----+-----+-----+-----+
| USN   | SNAME | ADDRESS | PHONE | GENDER |
+-----+-----+-----+-----+-----+
| 4AD13CS020 | AKSHAY | BELAGAVI | 8877881122 | M |
| 4AD13CS062 | SANDHYA | BENGALURU | 7222829912 | F |
| 4AD13CS066 | SUPRIYA | MANGALURU | 8877881122 | F |
| 4AD13CS091 | TEESHA | BENGALURU | 7712312312 | F |
| 4AD14CS010 | ABHAY | BENGALURU | 9900211201 | M |
| 4AD14CS025 | ASMI | BENGALURU | 7894737377 | F |
| 4AD14CS032 | BHASKAR | BENGALURU | 9923211099 | M |
| 4AD15CS011 | AJAY | TUMKUR | 9845091341 | M |
| 4AD15CS029 | CHITRA | DAUANGERE | 7696772121 | F |
| 4AD15CS045 | JEEVA | BELLARY | 9944850121 | M |
| 4AD15CS091 | SANTOSH | MANGALURU | 8812332201 | M |
| 4AD16CS045 | ISMAIL | KABURGI | 9900232201 | M |
| 4AD16CS088 | SAMEERA | SHIMOGA | 9905542212 | F |
| 4AD16CS122 | VINAYAKA | CHIKAMAGALUR | 8800880011 | M |
+-----+-----+-----+-----+-----+
14 rows in set (0.00 sec)

```

```
SELECT * FROM SEMSEC;
```

```
mysql> SELECT * FROM SEMSEC;
+----+-----+-----+
| SSID | SEM | SEC |
+----+-----+-----+
| CSE1A | 1 | A |
| CSE1B | 1 | B |
| CSE1C | 1 | C |
| CSE2A | 2 | A |
| CSE2B | 2 | B |
| CSE2C | 2 | C |
| CSE3A | 3 | A |
| CSE3B | 3 | B |
| CSE3C | 3 | C |
| CSE4A | 4 | A |
| CSE4B | 4 | B |
| CSE4C | 4 | C |
| CSE5A | 5 | A |
| CSE5B | 5 | B |
| CSE5C | 5 | C |
| CSE6A | 6 | A |
| CSE6B | 6 | B |
| CSE6C | 6 | C |
| CSE7A | 7 | A |
| CSE7B | 7 | B |
| CSE7C | 7 | C |
| CSE8A | 8 | A |
| CSE8B | 8 | B |
| CSE8C | 8 | C |
+----+-----+-----+
24 rows in set (0.00 sec)
```

```
SELECT * FROM CLASS;
```

```
mysql> SELECT * FROM CLASS;
+-----+-----+
| USN | SSID |
+-----+-----+
| 4AD16CS045 | CSE3A |
| 4AD16CS088 | CSE3B |
| 4AD16CS122 | CSE3C |
| 4AD15CS011 | CSE4A |
| 4AD15CS029 | CSE4A |
| 4AD15CS045 | CSE4B |
| 4AD15CS091 | CSE4C |
| 4AD14CS010 | CSE7A |
| 4AD14CS025 | CSE7A |
| 4AD14CS032 | CSE7A |
| 4AD13CS020 | CSE8A |
| 4AD13CS062 | CSE8A |
| 4AD13CS066 | CSE8B |
| 4AD13CS091 | CSE8C |
+-----+-----+
14 rows in set (0.00 sec)
```

SELECT * FROM SUBJECT;

```
mysql> SELECT * FROM SUBJECT;
```

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

```
29 rows in set (0.00 sec)
```

SELECT * FROM IAMARKS;

```
mysql> SELECT * FROM IAMARKS;
```

USN	SUBCODE	SSID	TEST1	TEST2	TEST3	FINALIA
4AD13CS091	10CS81	CSE8C	15	16	18	0
4AD13CS091	10CS82	CSE8C	12	19	14	0
4AD13CS091	10CS83	CSE8C	19	15	20	0
4AD13CS091	10CS84	CSE8C	20	16	19	0
4AD13CS091	10CS85	CSE8C	15	15	12	0

```
5 rows in set (0.00 sec)
```

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	GENDER	SEM	SEC
4AD15CS091	SANTOSH	MANGALURU	8812332201	M	4	C

1 row in set (0.00 sec)

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
WHERE S.USN = C.USN AND SS.SSID = C.SSID
GROUP BY SS.SEM, SS.SEC, S.GENDER ORDER BY SEM;
```

SEM	SEC	GENDER	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

13 rows in set (0.00 sec)

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

```
CREATE VIEW VW_STUDENT_TEST AS SELECT TEST1, SUBCODE FROM
IAMARKS WHERE USN='4AD13CS091';
```

```
SELECT * FROM VW_STUDENT_TEST
```

```
mysql> SELECT * FROM VW_STUDENT_TEST;
```

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

5 rows in set (0.00 sec)

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

```
UPDATE IAMARKS
```

```
SET FINALIA=GREATEST(TEST1+TEST2,TEST2+TEST3,TEST1+TEST3)/2;
```

Note: Before execution above SQL statement, IAMARKS table contents are:

```
SELECT * FROM IAMARKS;
```

```
mysql> SELECT * FROM IAMARKS;
```

USN	SUBCODE	SSID	TEST1	TEST2	TEST3	FINALIA
4AD13CS091	10CS81	CSE8C	15	16	18	0
4AD13CS091	10CS82	CSE8C	12	19	14	0
4AD13CS091	10CS83	CSE8C	19	15	20	0
4AD13CS091	10CS84	CSE8C	20	16	19	0
4AD13CS091	10CS85	CSE8C	15	15	12	0

```
5 rows in set (0.00 sec)
```

```
UPDATE IAMARKS
```

```
SET FINALIA=GREATEST(TEST1+TEST2,TEST2+TEST3,TEST1+TEST3)/2;
```

After executing above SQL statement, IAMARKS table contents are:

```
mysql> SELECT * FROM IAMARKS;
```

USN	SUBCODE	SSID	TEST1	TEST2	TEST3	FINALIA
4AD13CS091	10CS81	CSE8C	15	16	18	17
4AD13CS091	10CS82	CSE8C	12	19	14	17
4AD13CS091	10CS83	CSE8C	19	15	20	20
4AD13CS091	10CS84	CSE8C	20	16	19	20
4AD13CS091	10CS85	CSE8C	15	15	12	15

```
5 rows in set (0.00 sec)
```

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	GENDER	CAT
4AD13CS091	TEESHA	BENGALURU	7712312312	F	OUTSTANDING
4AD13CS091	TEESHA	BENGALURU	7712312312	F	OUTSTANDING
4AD13CS091	TEESHA	BENGALURU	7712312312	F	OUTSTANDING
4AD13CS091	TEESHA	BENGALURU	7712312312	F	OUTSTANDING
4AD13CS091	TEESHA	BENGALURU	7712312312	F	AVERAGE

5 rows in set (0.00 sec)

Program Outcomes:

The students are 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.

E. Consider the schema for CompanyDatabase:

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)

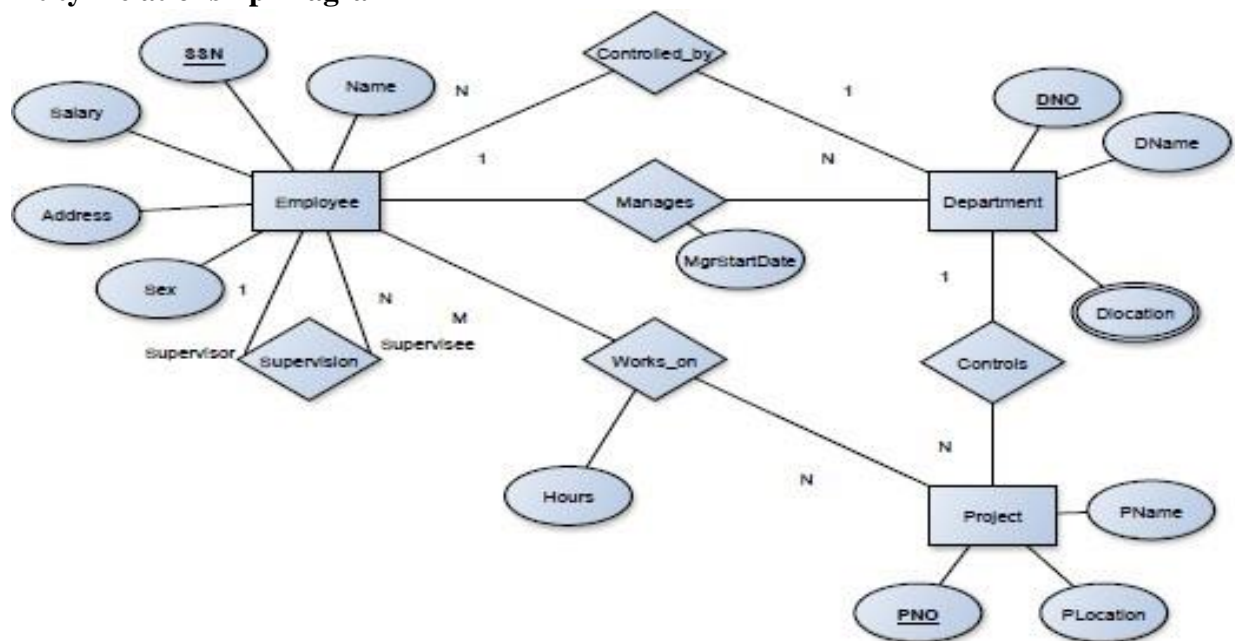
Write SQL queries to

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.

Program 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.

Solution:**Entity-Relationship Diagram**

Schema Diagram

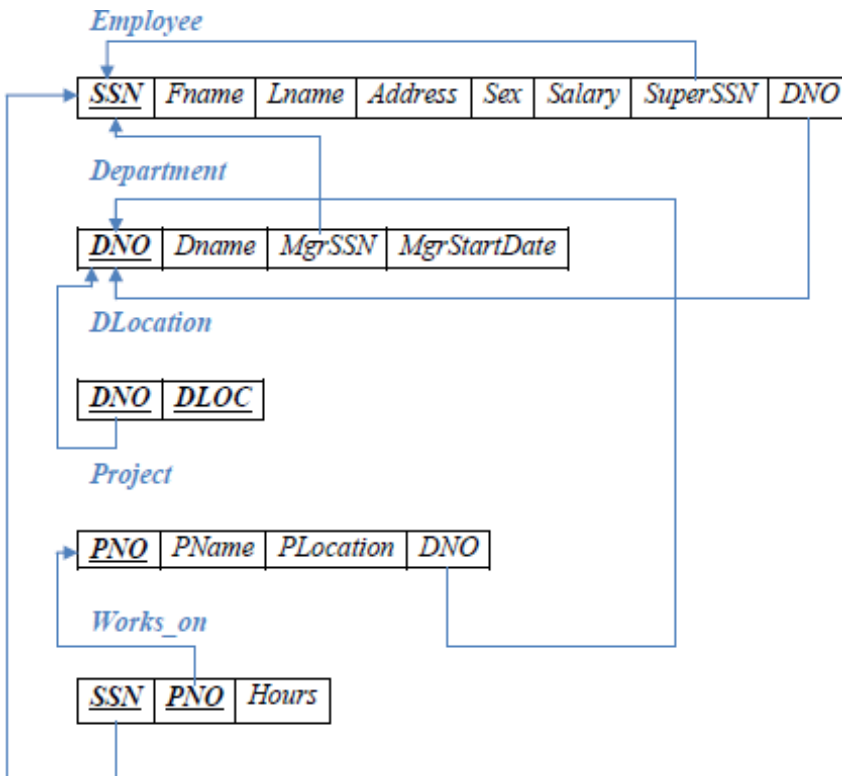


Table Creation

```

CREATE TABLE DEPARTMENT
(
DNO VARCHAR (20) PRIMARY KEY,
DNAME VARCHAR (20),
MGRSTARTDATE DATE,
MGRSSN VARCHAR (20)
);
  
```

```

CREATE TABLE EMPLOYEE (
SSN VARCHAR (20) PRIMARY KEY,
FNAME VARCHAR (20),
LNAME VARCHAR (20),
ADDRESS VARCHAR (100),
SEX CHAR (1),
SALARY INT (10),
SUPERSSN VARCHAR (20),
DNO VARCHAR (20),
FOREIGN KEY (SUPERSSN) REFERENCES EMPLOYEE (SSN),
FOREIGN KEY (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 FOREIGN KEY(MGRSSN) REFERENCES
EMPLOYEE(SSN);
CREATE TABLE DLOCATION (
DLOC VARCHAR (20),
DNO VARCHAR (20),
PRIMARY KEY (DNO, DLOC),
FOREIGN KEY (DNO) REFERENCES DEPARTMENT (DNO));

```

```

CREATE TABLE PROJECT (
PNO INT (10) PRIMARY KEY,
PNAME VARCHAR (20),
PLOCATION VARCHAR (20),
DNO VARCHAR (20),
FOREIGN KEY (DNO) REFERENCES DEPARTMENT (DNO));

```

Table Descriptions

DESC EMPLOYEE;

```
mysql> DESC EMPLOYEE;
```

Field	Type	Null	Key	Default	Extra
SSN	varchar(20)	NO	PRI	NULL	
FNAME	varchar(20)	YES		NULL	
LNAME	varchar(20)	YES		NULL	
ADDRESS	varchar(100)	YES		NULL	
SEX	char(1)	YES		NULL	
SALARY	int(10)	YES		NULL	
SUPERSSN	varchar(20)	YES	MUL	NULL	
DNO	varchar(20)	YES	MUL	NULL	

8 rows in set (0.00 sec)

DESC DEPARTMENT;

```
mysql> DESC DEPARTMENT;
```

Field	Type	Null	Key	Default	Extra
DNO	varchar(20)	NO	PRI	NULL	
DNAME	varchar(20)	YES		NULL	
MGRSTARTDATE	date	YES		NULL	
MGRSSN	varchar(20)	YES	MUL	NULL	

4 rows in set (0.00 sec)

DESC DLOCATION;

```
mysql> DESC DLOCATION;
```

Field	Type	Null	Key	Default	Extra
DLOC	varchar(20)	NO	PRI		
DNO	varchar(20)	NO	PRI		

2 rows in set (0.00 sec)

DESC PROJECT

```
mysql> DESC PROJECT;
+-----+-----+-----+-----+-----+-----+
| Field | Type      | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| PNO   | int(10)   | NO   | PRI | NULL    |       |
| PNAME | varchar(20) | YES  |     | NULL    |       |
| PLOCATION | varchar(20) | YES  |     | NULL    |       |
| DNO   | varchar(20) | YES  | MUL | NULL    |       |
+-----+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

DESC WORKS_ON;

```
mysql> DESC WORKS_ON;
+-----+-----+-----+-----+-----+-----+
| Field | Type      | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| HOURS | int(4)     | YES  |     | NULL    |       |
| SSN   | varchar(20) | NO   | PRI |         |       |
| PNO   | int(10)     | NO   | PRI | 0       |       |
+-----+-----+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

Insertion of values to tables

```
INSERT INTO EMPLOYEE VALUES ('ATMEECE01','JOHN','SCOTT','BANGALORE','M',
450000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE01','JAMES','SMITH','BANGALORE','M',
500000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE02','HEARN','BAKER','BANGALORE','M',
700000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE03','EDWARD','SCOTT','MYSORE','M',
500000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE04','PAVAN','HEGDE','MANGALORE','M',
650000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE05','GIRISH','MALYA','MYSORE','M',
450000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMECSE06','NEHA','SN','BANGALORE','F',
800000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMEACC01','AHANA','K','MANGALORE','F',
350000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMEACC02','SANTHOSH','KUMAR','MANGALORE','M', 300000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMEISE01','VEENA','M','MYSORE','F',
600000,NULL,NULL);
INSERT INTO EMPLOYEE VALUES ('ATMEIT01','NAGESH','HR','BANGALORE','M',
500000,NULL,NULL);

INSERT INTO DEPARTMENT VALUES ('1','ACCOUNTS','2001-01-01','ATMEACC02');
INSERT INTO DEPARTMENT VALUES ('2','IT','2016-08-01','ATMEIT01');
INSERT INTO DEPARTMENT VALUES ('3','ECE','2008-6-01','ATMEECE01');
INSERT INTO DEPARTMENT VALUES ('4','ISE','2015-06-01','ATMEISE01');
INSERT INTO DEPARTMENT VALUES ('5','CSE','2002-06-01','ATMECSE05');
```

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

UPDATE EMPLOYEE SET SUPERSSN='ATMECSE02', DNO='5' WHERE
SSN='ATMECSE01';

UPDATE EMPLOYEE SET SUPERSSN='ATMECSE03', DNO='5' WHERE SSN='ATMECSE02';

UPDATE EMPLOYEE SET SUPERSSN='ATMECSE04', DNO='5' WHERE SSN='ATMECSE03';

UPDATE EMPLOYEE SET DNO='5', SUPERSSN='ATMECSE05' WHERE SSN='ATMECSE04';

UPDATE EMPLOYEE SET DNO='5', SUPERSSN='ATMECSE06' WHERE SSN='ATMECSE05';
UPDATE EMPLOYEE SET DNO='5', SUPERSSN=NULL WHERE SSN='ATMECSE06';

UPDATE EMPLOYEE SET DNO='1', SUPERSSN='ATMEACC02' WHERE
SSN='ATMEACC01';

UPDATE EMPLOYEE SET DNO='1', SUPERSSN=NULL WHERE
SSN='ATMEACC02';

UPDATE EMPLOYEE SET DNO='4', SUPERSSN=NULL WHERE
SSN='ATMEISE01';

UPDATE EMPLOYEE SET DNO='2', SUPERSSN=NULL WHERE
SSN='ATMEIT01';

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, 'ATMECSE01', 100);
INSERT INTO WORKS_ON VALUES (6, 'ATMECSE01', 101);
INSERT INTO WORKS_ON VALUES (8, 'ATMECSE01', 102);
INSERT INTO WORKS_ON VALUES (10, 'ATMECSE02', 100);
INSERT INTO WORKS_ON VALUES (3, 'ATMECSE04', 100);
INSERT INTO WORKS_ON VALUES (4, 'ATMECSE05', 101);
INSERT INTO WORKS_ON VALUES (5, 'ATMECSE06', 102);

```

INSERT INTO WORKS_ON VALUES (6, 'ATMECSE03', 102);
INSERT INTO WORKS_ON VALUES (7, 'ATMEECE01', 103);
INSERT INTO WORKS_ON VALUES (5, 'ATMEACC01', 104);
INSERT INTO WORKS_ON VALUES (6, 'ATMEACC02', 105);
INSERT INTO WORKS_ON VALUES (4, 'ATMEISE01', 106);
INSERT INTO WORKS_ON VALUES (10, 'ATMEIT01', 107);

```

```
SELECT * FROM EMPLOYEE;
```

```

mysql> SELECT * FROM EMPLOYEE;
+-----+-----+-----+-----+-----+-----+-----+-----+
| SSN      | FNAME | LNAME | ADDRESS | SEX | SALARY | SUPERSSN | DNO |
+-----+-----+-----+-----+-----+-----+-----+-----+
| ATMEACC01 | AHANA  | K      | MANGALORE | F   | 350000 | ATMEACC02 | 1   |
| ATMEACC02 | SANTHOSH | KUMAR | MANGALORE | M   | 300000 | NULL      | 1   |
| ATMECSE01 | JAMES  | SMITH  | BANGALORE | M   | 500000 | ATMECSE02 | 5   |
| ATMECSE02 | HEARN  | BAKER  | BANGALORE | M   | 700000 | ATMECSE03 | 5   |
| ATMECSE03 | EDWARD | SCOTT  | MYSORE    | M   | 500000 | ATMECSE04 | 5   |
| ATMECSE04 | PAUAN  | HEGDE  | MANGALORE | M   | 650000 | ATMECSE05 | 5   |
| ATMECSE05 | GIRISH | MALYA  | MYSORE    | M   | 450000 | ATMECSE06 | 5   |
| ATMECSE06 | NEHA   | SN     | BANGALORE | F   | 800000 | NULL      | 5   |
| ATMEECE01 | JOHN   | SCOTT  | BANGALORE | M   | 450000 | NULL      | 3   |
| ATMEISE01 | VEENA  | M      | MYSORE    | F   | 600000 | NULL      | 4   |
| ATMEIT01  | NAGESH | HR     | BANGALORE | M   | 500000 | NULL      | 2   |
+-----+-----+-----+-----+-----+-----+-----+-----+
11 rows in set (0.00 sec)

mysql>

```

```
SELECT * FROM DEPARTMENT ;
```

```

mysql> SELECT * FROM DEPARTMENT;
+-----+-----+-----+-----+
| DNO | DNAME   | MGRSTARTDATE | MGRSSN |
+-----+-----+-----+-----+
| 1   | ACCOUNTS | 2001-01-01   | ATMEACC02 |
| 2   | IT       | 2016-08-01   | ATMEIT01  |
| 3   | ECE      | 2008-06-01   | ATMEECE01 |
| 4   | ISE      | 2015-06-01   | ATMEISE01 |
| 5   | CSE      | 2002-06-01   | ATMECSE05 |
+-----+-----+-----+-----+
5 rows in set (0.02 sec)

```

```
SELECT * FROM DLOCATION ;
```

```
mysql> SELECT * FROM DLOCATION;
+-----+-----+
| DLOC | DNO |
+-----+-----+
| BANGALORE | 1 |
| BANGALORE | 2 |
| BANGALORE | 3 |
| MANGALORE | 4 |
| MANGALORE | 5 |
+-----+-----+
5 rows in set (0.03 sec)
```

SELECT * FROM PROJECT ;

```
mysql> 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 |
+-----+-----+-----+-----+
8 rows in set (0.03 sec)
```

SELECT * FROM WORKS_ON

```
mysql> SELECT * FROM WORKS_ON;
+-----+-----+-----+
| HOURS | SSN | PNO |
+-----+-----+-----+
| 5 | ATMEACC01 | 104 |
| 6 | ATMEACC02 | 105 |
| 4 | ATMECSE01 | 100 |
| 6 | ATMECSE01 | 101 |
| 8 | ATMECSE01 | 102 |
| 10 | ATMECSE02 | 100 |
| 6 | ATMECSE03 | 102 |
| 3 | ATMECSE04 | 100 |
| 4 | ATMECSE05 | 101 |
| 5 | ATMECSE06 | 102 |
| 7 | ATMECE01 | 103 |
| 4 | ATMEISE01 | 106 |
| 10 | ATMEIT01 | 107 |
+-----+-----+-----+
13 rows in set (0.00 sec)
```

Queries:

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

(SELECT DISTINCT P.PNO FROM PROJECT P, DEPARTMENT D, EMPLOYEE E
WHERE E.DNO=D.DNO AND D.MGRSSN=E.SSN AND E.LNAME='SCOTT')

UNION

(SELECT DISTINCT P1.PNO FROM PROJECT P1, WORKS_ON W, EMPLOYEE E1
WHERE P1.PNO=W.PNO AND E1.SSN=W.SSN AND E1.LNAME='SCOTT')

```
+-----+
| PNO |
+-----+
| 100 |
| 101 |
| 102 |
| 103 |
| 104 |
| 105 |
| 106 |
| 107 |
+-----+
8 rows in set (0.00 sec)
```

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	550000.0
HEARN	BAKER	770000.0
PAVAN	HEGDE	715000.0

3 rows in set (0.01 sec)

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, DEPARTMENTD WHERE E.DNO=D.DNO AND
D.DNAME='ACCOUNTS';
```

| SUM(E.SALARY) | MAX(E.SALARY) | MIN(E.SALARY) | AUG(E.SALARY) |
|---------------|---------------|---------------|---------------|
| 650000        | 350000        | 300000        | 325000.0000   |

1 row in set (0.00 sec)

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 P WHERE DNO=5 AND PNO NOT IN
(SELECT PNO FROM WORKS_ON W WHERE E.SSN=SSN));
```

| FNAME | LNAME |
|-------|-------|
| JAMES | SMITH |

1 row in set (0.00 sec)

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 |
+-----+-----+
1 row in set (0.00 sec)
```

**Program Outcomes:**

**The students are 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.

**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. What are Advantages of DBMS?**

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

**6. What are Disadvantages in File Processing System?**

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

**7. 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."

**8. 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 directly 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.

**9. What is Data Model?**

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

**10. 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.

11. **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.

12. **What is an Entity?**

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

13. **What is an Entity type?**

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

14. **What is an attribute?**

It is a particular property, which describes the entity.

15. **What is degree of a Relation?**

It is the number of attribute of its relation schema.

16. **What is Relationship?**

It is an association among two or more entities.

17. **What is DDL (Data Definition Language)?**

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

18. **What is DML (Data Manipulation Language)?**

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

19. **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.

20. **What is 1 NF (Normal Form)?**

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

21. **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.

22. **What is 3NF?**

A relation schema R is in 3NF if it is in 2NF and for every FD  $X \twoheadrightarrow A$  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 non prime attribute is non-transitively dependent on primary key.

23. **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  $X \twoheadrightarrow A$ , X must be a candidate key.

24. **What is 4NF?**

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

- X is subset or equal to (or)  $XY = R$ .
- X is a superkey.

25. **What is 5NF?**

A Relation schema R is said to be 5NF if for every join dependency  $\{R_1, R_2, \dots, R_n\}$  that holds R, one the following is true

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

26. **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 standalone 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 compoundkey.

**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.

27. **What is meant by queryoptimization?**

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

28. **What do you mean by atomicity andaggregation?**

**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.

29. **What is a checkpoint and when does itoccur?**

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.

30. **What do you mean by flat filedatabase?**

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.

31. **Brief theory of Network, Hierarchical schemas and theirproperties**

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 isIMS.

32. **What is aquery?**

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.

33. **What do you mean by Correlatedsubquery?**

Subqueries, or nested queries, are used to bring back a set of rows to be used by the parent

query. Depending on how the subquery 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 subquery is executed for each row of the parent, this is called a *correlated subquery*.

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

E.g. Select \* From CUST Where '2019/03/05' IN (Select ODATE From ORDER Where CUST.CNUM = ORDER.CNUM)

**34. What are the primitive operations common to all record managementsystems?**

Addition, deletion and modification

**35. How do you communicate with anRDBMS?**

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

**36. Define SQL and state the differences between SQL and other conventional programmingLanguages**

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.

**37. What is databaseTrigger?**

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.

**38. What are stored-procedures? And what are the advantages of usingthem.**

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 return the result to the client. Stored procedures are used to reduce network traffic.

**39. Which is the subset of SQL commands used to manipulate Database structures, including tables?**

Data Definition Language (DDL)

**40. What operator performs pattern matching?**

LIKE operator

**41. What operator tests column for the absence of data?**

IS NULL operator

42. **What are the wildcards used for patternmatching?**

For single character substitution and % for multi-character substitution

43. **What are the difference between TRUNCATE and DELETE commands?**

| TRUNCATE                                                                                      | DELETE                                                                                               |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• TRUNCATE is a DDL command</li> </ul>                 | <ul style="list-style-type: none"> <li>• DELETE is a DML command</li> </ul>                          |
| <ul style="list-style-type: none"> <li>• TRUNCATE operation cannot be rolled back</li> </ul>  | <ul style="list-style-type: none"> <li>• DELETE operation can be rolled back</li> </ul>              |
| <ul style="list-style-type: none"> <li>• TRUNCATE does not invoke trigger</li> </ul>          | <ul style="list-style-type: none"> <li>• DELETE does invoke trigger</li> </ul>                       |
| <ul style="list-style-type: none"> <li>• TRUNCATE resets auto_increment value to 0</li> </ul> | <ul style="list-style-type: none"> <li>• DELETE does not resets auto_increment value to 0</li> </ul> |

44. **What is the use of the ADD OR DROP option in the ALTER TABLE command?**

It is used to add/drop columns or add/drop constraints specified on the table

45. **What is the use of DESC in SQL?**

DESC has two purposes. It is used to describe a schema as well as to retrieve rows from table in descending order.

The query SELECT \* FROM EMP ORDER BY ENAME DESC will display the output sorted on ENAME in descending order

46. **What is the use of ON DELETE CASCADE?**

Whenever rows in the master (referenced) table are deleted, the respective rows of the child (referencing) table with a matching foreign key column will get deleted as well. This is called a cascade delete

**Example Tables:**

CREATE TABLE Customer

```
(
customer_id INT (6) PRIMARY KEY,
cname VARCHAR (100),
caddress VARCHAR (100)
);
```

CREATE TABLE Order

```
(
order_id INT (6) PRIMARY KEY,
products VARCHAR (100),
payment DECIMAL(10,2),
customer_id INT (6) ,
FOREIGN KEY (customer_id) REFERENCES Customer(customer_id) ON DELETE CASCADE
```

);

Customer is the master table and Order is the child table, where 'customer\_id' is primary key in customer table and customer\_id is the foreign key in Order table and represents the customer who placed the order. When a row of Customer is deleted, any Order row matching the deleted Customer's customer\_id will also be deleted.

47. **What is the use of Floor()?**

The FLOOR() function returns the largest integer value that is smaller than or equal to a number.

**EXAMPLE;**

```
SELECT FLOOR(25.75);
```

**OUTPUT**

25

48. **What is the use of Truncate()?**

The TRUNCATE() function truncates a number to the specified number of decimal places.

**EXAMPLE;**

```
SELECT TRUNCATE(135.375, 2);
```

**OUTPUT**

135.37

49. **What is the use of CEILING?**

Return the smallest integer value that is greater than or equal to 25.75:

**EXAMPLE;**

```
SELECT CEILING(25.75)
```

**OUTPUT**

26

50. **What you mean by SQL UNIQUE Constraint?**

- The UNIQUE constraint ensures that all values in a column are different.
- Both the UNIQUE and PRIMARY KEY constraints provide a guarantee for uniqueness for a column or set of columns.
- A PRIMARY KEY constraint automatically has a UNIQUE constraint.
- However, you can have many UNIQUE constraints per table, but only one PRIMARY KEY constraint per table.

51. **How to add and drop UNIQUE Constraint in table in mysql?**

```
ALTER TABLE contacts ADD CONSTRAINT UNC_name_email UNIQUE(name,email)
```

```
ALTER TABLE contacts DROP INDEX UNC_name_email;
```

52. **What is the Group by Clause?**

- The GROUP BY clause is a SQL command that is used to group rows that have the same values.
- The GROUP BY clause is used in the SELECT statement .Optionally it is used in conjunction with aggregate functions to produce summary reports from the database.That's what it does, summarizing data from the database.
- The queries that contain the GROUP BY clause are called grouped queries and only return single row for every grouped item.

**Example:**SELECT COUNT(CustomerID), Country FROM Customers  
GROUP BY Country

53. **What is use of having clause in mysql**

- The HAVING clause is used in the SELECT statement to specify filter conditions for a group of rows or aggregates.
- The HAVING clause is often used with the GROUP BY clause to filter groups based on a specified condition. If the GROUP BY clause is omitted, the HAVING clause behaves like the WHERE clause.
- Notice that the HAVING clause applies a filter condition to each group of rows, while the WHERE clause applies the filter condition to each individual row.

**Example:**SELECT COUNT(CustomerID), Country FROM Customers  
GROUP BY CountryHAVING COUNT(CustomerID) > 5;

54. **What is distinct clause in SQL?**

When querying data from a table, you may get duplicate rows. In order to remove these duplicate rows, you use the DISTINCT clause in the SELECT statement.

**Example:**SELECT DISTINCT columns FROM table\_name WHERE where\_conditions;

55. **What is a union?**

Unions combine the results from multiple SELECT queries into a consolidated result set.

The only requirements for this to work is that the number of columns should be the same from all the SELECT queries which needs to be combined

## Additional Queries

### CREATE command

```
CREATE TABLE Employee
(
Empno int(4) primary key,
Empname varchar(50),
job varchar(40),
Hiredate date,
Salary decimal(10,2),
Deptno int(7),
Age int(10)
);
```

### DESC command

DESC Employee;

```
mysql> DESC Employee;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
Empno	int(4)	NO	PRI	NULL	
Empname	varchar(50)	YES		NULL	
job	varchar(40)	YES		NULL	
Hiredate	date	YES		NULL	
Salary	decimal(10,2)	YES		NULL	
Deptno	int(7)	YES		NULL	
Age	int(10)	YES		NULL	
+-----+-----+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

### INSERT command

Insert the values into the table as specified.

- 1) Insert into Employee values(1000,'Hemanth','Manager','2018-11-17',35000, 30, 38);
- 2) Insert into Employee values(1001, 'Nitin','Manager','2018-05-01',45000, 10, 42);
- 3) Insert into Employee values(1002, 'Sachin','Salesman','2018-01-09',18000, 20, 28);
- 4) Insert into Employee values(1003, 'Deepak','Clerk','2018-05-15',15000, 40, 34);
- 5) Insert into Employee values(1004, 'Ajay','Analyst','2018-10-22',60000, 50, 45);
- 6) Insert into Employee values(1005, 'Arun','Programmer','2018-7-24',25000, 60,25);

```
mysql> select * from Employee;
+-----+-----+-----+-----+-----+-----+
| Empno | Empname | job | Hiredate | Salary | Deptno | Age |
+-----+-----+-----+-----+-----+-----+
1000	Hemanth	Manager	2018-11-17	35000.00	30	38
1001	Nitin	Manager	2018-05-01	45000.00	10	42
1002	Sachin	Salesman	2018-01-09	18000.00	20	28
1003	Deepak	Clerk	2018-05-15	15000.00	40	34
1004	Ajay	Analyst	2018-10-22	60000.00	50	45
1005	Arun	Programmer	2018-07-24	25000.00	60	25
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)
```

### Queries:

#### Problems on select command:

- 1) Display the details of all managers of Employee Table

```
SELECT * FROM Employee WHERE job='Manager';
```

- 2) Display the details of all employees getting salary less than 30,000.

```
SELECT * FROM Employee WHERE salary<30000;
```

- 3) Display the details of employees who age is between 35 and 45

```
SELECT * FROM Employee WHERE age BETWEEN 35 AND 45;
```

- 4) Display the details of Clerks who have joined after 01-MAR-05.

```
SELECT * FROM Employee WHERE job='Clerk' AND hiredate>'2018-03-05';
```

- 5) Sort the details in descending order of Empno.

```
SELECT * FROM Employee ORDER BY Empno DESC;
```

- 6) Sort the details of employees in ascending order of name

```
SELECT * FROM Employee ORDER BY Empname
```

- 7) Display the details of employees whose names contain 'i' in them.

```
SELECT * FROM Employee WHERE Empname LIKE '%i%';
```

- 8) Display the details of employees whose names starts with 'a' in them.

```
SELECT * FROM Employee WHERE Empname LIKE 'a%';
```

- 9) Display the details of employees whose names does not starts with 'a' in them.

```
SELECT * FROM Employee WHERE Empname NOT LIKE 'a%';
```

- 10) Display the employee details whose names have exactly 4 characters.

```
SELECT * FROM Employee WHERE length(Empname)=4
```

- 11) Copy all the records of their from employee table and insert the records into a temp table with column names same as in Employee table

```
CREATE TABLE TEMP SELECT * FROM Employee;
```

#### **Problems on update command:**

1. Update the salary by 10% hike to Manager working in department number 20 and 30

```
SOL: UPDATE EMP SET SAL = SAL * 1.1 WHERE Deptno IN (20,30) AND JOB = 'Manager';
```

2. Give 5% raise in salary to all the Salesman

```
SOL1: UPDATE EMPLOYEE SET Salary=Salary*1.15 WHERE JOB='Salesman';
```

**OR**

```
SOL2 : UPDATE EMPLOYEE SET Salary=Salary+(Salary * 15/100) WHERE JOB='Salesman';
```

3. Change the department no of Sachin to 40

```
SOL: UPDATE EMP SET DEPTNO = 40 WHERE Empname = 'Sachin';
```

4. Update all employee name to uppercase

```
SOL: UPDATE EMPLOYEE SET Empname=upper(Empname);
```

#### **Problems on delete command:**

1. Delete all the records of employees

```
SOL: DELETE FROM Employee;
```

2. Delete the records of employee name Ajay's only

```
SOL: DELETE FROM EMP WHERE ENAME = 'Ajay';
```

3. Delete the record of employee table whose Empno is 1005

```
SOL: DELETE FROM EMP WHERE Empno =1005;
```

**4. Delete the first five records of employeetable**

SOL: DELETE FROM EMPLOYEE LIMIT 5;

**ALTER command****1. How to create database name COLLEGE ?**

CREATE DATABASE COLLEGE;

**2. How Modify datatype of age column in Employee table**

ALTER TABLE Employee MODIFY age int(3);

**3. How to rename column name of job to Designation in Employee table?**

ALTER TABLE Employee CHANGE job Designation varchar(40);

**4. How to add column Commission in Employee table?**

ALTER TABLE Employee add Commissionvarchar(40);

**5. How to drop column Commission in Employee table?**

ALTER TABLE Employee DROP column Commission;

**6. How to add primary key to Employee table?**

ALTER TABLE Employee add primary key(Empno);

**7. How to drop primary key to Employee table?**

ALTER TABLE Employee DROPprimary key;

**8. How to rename employee table?**

RENAME TABLE Employee to Employee\_Details

**9. How to delete contents of Employee table?**

DELETE FROM Employee;

OR

TRUNCATE Employee;

**10. How to drop Employee table?**

DROP TABLE Employee;

**11. How to drop database name COLLEGE?**

DROP DATABASE COLLEGE