Experiment 1

E-R Model

Analyze and come up with the entities in it. Identify what data has to be persisted in the database. This contains the entities, attributes etc.
Identify the primary keys for all the entities. Identify the other keys like Foreign Key and constraints likeNULL, NOT NULL, CHECK etc.
Example to create for **products**, **customers**, **suppliers**, **orders**, , **employees, order details, categories**, amongothers.

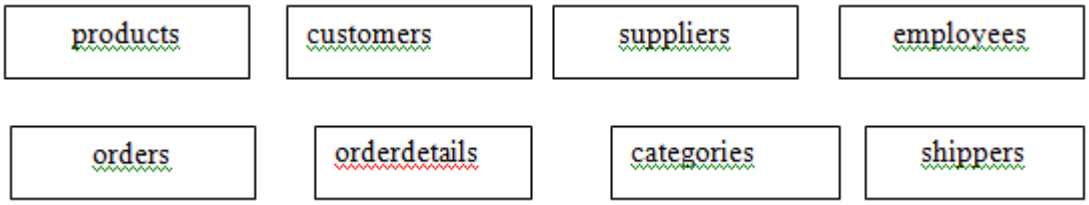
Students should submit E-R diagrams using the above tables.

MODEL INPUT

DEFINITIONS

Entity: the object in the **ER** Model represents is an entity which is thing in the real world with an independent existence.

Eg:



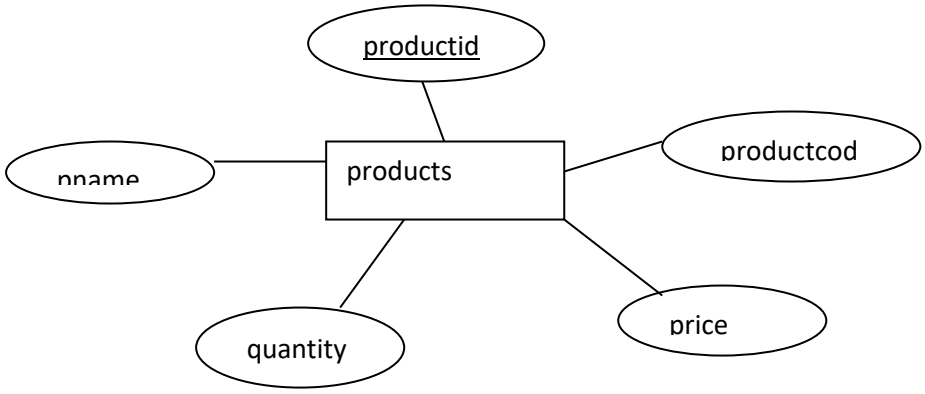
ER-MODEL

Describes data as entities, relationships and attributes .The ER-Model is important preliminary for its role in database design. ER Model is usually shown pictorially using entity relationship diagrams.

ATTRIBUTES

The properties that characterize an entity set are called its attributes. An attribute is referred to by the terms data items, data element, data field item.

Ex: attributes for products entity.



Candidate key:

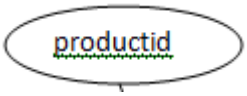
It can be defined as minimal super key or irreducible super key. In other words an attribute or combination of attributes that identifies the record uniquely but none of its proper subsets can identify the record uniquely.

productid	Productcode	price	quantity	pname

productid,productcode---------->candidate key

Primary key:

A candidate key that is used by the database designer for unique identification of each row in a table is known as primary key. A primary key consists of one or more attributes of the table.



Partial key:

A weak entity type normally has a partial key which is the set of attributes that can uniquely identify weak entity that are related to the same owner entity.

EXPECTED OUTPUT

The entities in the "product sales" is

1) Products 2)customers 3)suppliers 4)orders 5) employees 6)order details 7)categories 8)shippers

Products entity:

Attributes for the products entity are

Productid, productName,SupplierID,CustomerID, quantityperunit,unitPrice,ReorderLevel and discontinued.

products schema:

productid	**SupplierID**	**CustomerID**	productName	Quantityperunit	unitPrice	UnitsInStock	UnitsOnOrder	ReorderLevel	Discontinued

Productid, productcode---------->candidate key

Productid ----------> primary key

Suppliers entity:

Attributes for the supplier entity are

Supplierid ,CompanyName,ContactName,ContactJobTitle,Address,phone

Suppliers schema:

Supplierid	CompanyName	ContactName	ContactJobTitle	Address	phone

Supplierid,productid------- >Super key

productid----------> candidate key

supplierid---------- >primary key

Shippers entity:

Attributes for the shippers entity are

Shipperid, CompanyName,phone

Shippers schema:

Shipperid	CompanyName	Phone

Supplierid,productid------- >Super key

productid----------> candidate key

supplierid---------- >primary key

Employees entity:

Attributes for the employees entity are

EmployeeId,LastName,FirstName,JobTitle,BirthDate,HireDate,Address,City,PostalCode,Country, Phone,ReportsTo,Salary

Employees schema

EmployeeId	LastName	FirstName	JobTitle	BirthDate	HireDate	Address	City	PostalCode	Country	Phone	ReportsTo	Salary

empno,name---------- super key

empno ---------- candidate key

empno ----------primary key

Customers Entity:

Attributes for the Customers entity are

customerId,CompanyName,ContactName,ContactTitle,Address,City,PostalCode,Country,Phone ,fax

Customers schema:

customerId	CompanyName	ContactName	ContactTitle	Address	City	PostalCode	Country	Phone	fax	customerId

Orders Entity:

Attributes for the Orders entity are

OrderID,CustomerID,EmployeeID,OrderDate,RequiredDate,ShippedDate,ShipID,ShipName,ShipAddress

Orders Schema:

OrderID	CustomerID	EmployeeID	OrderDate	RequiredDate	ShippedDate	ShipID	ShipName	ShipAddress

Categories Entity:

Attributes for the Categories entity are

CategoryID,CategoryName

Categories Schema:

CategoryID	CategoryName

OrderDetails Entity:

Attributes for the OrderDetails entity are

OrderID,ProductID,UnitPrice,Quantity

OrderDetails Schema:

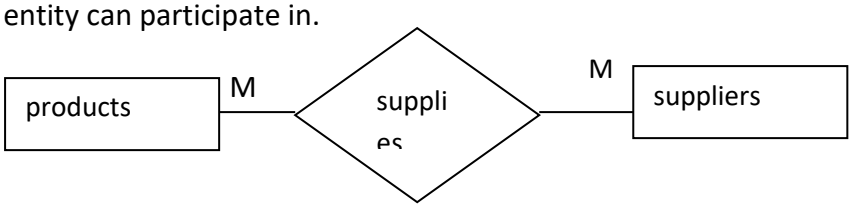
OrderID	ProductID	UnitPrice	Quantity

Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities and weak entities (if any). Indicate the type of relationship (total/partial). Try to incorporate generalization, aggregation, specialization etc wherever required.

MODEL INPUT

DEFINITIONS:

The cardinality ratio: - for a binary relationship specifies the maximum number of relationships that an entity can participate in.

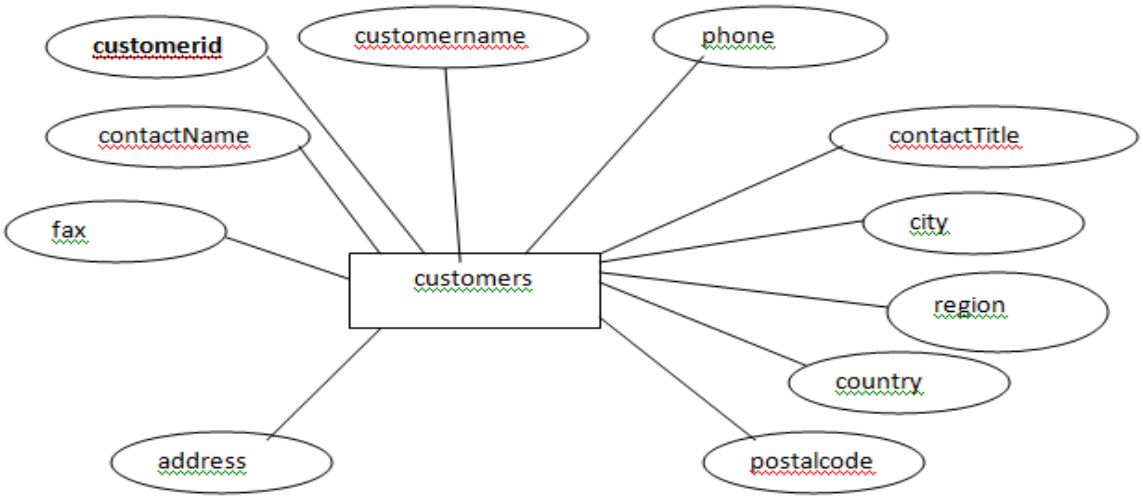


Relationship: - it is defined as an association among two or more entities.

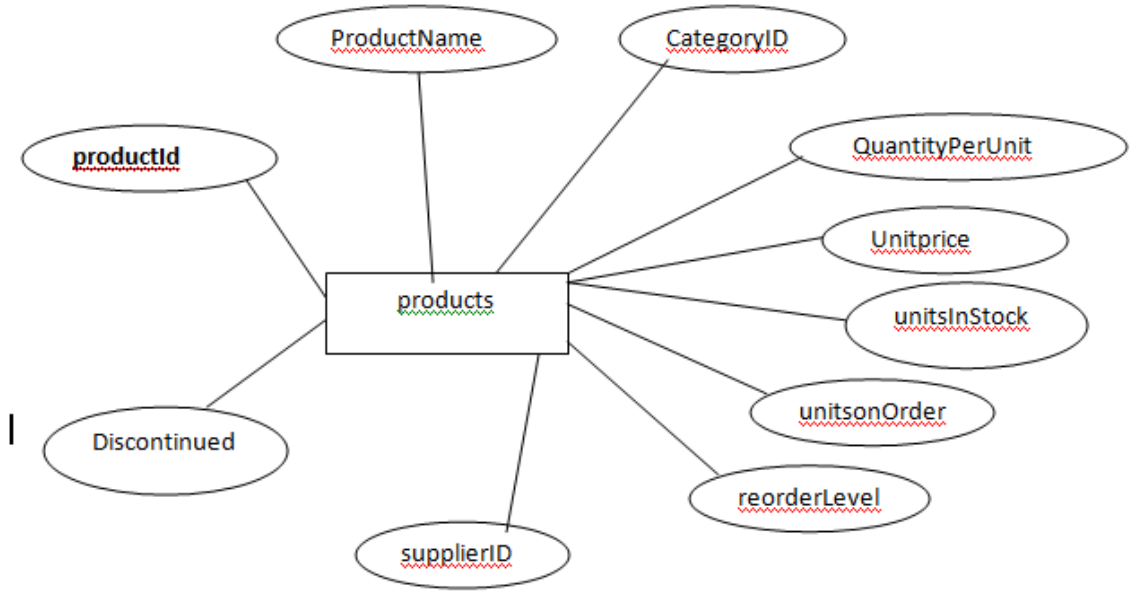
Weak and strong entity: - an entity set may not have sufficient attributes to form a primary key. Such an entity set is termed a weak entity set. An entity set that has primary key is termed a strong entity set.

EXPECTED OUTPUT

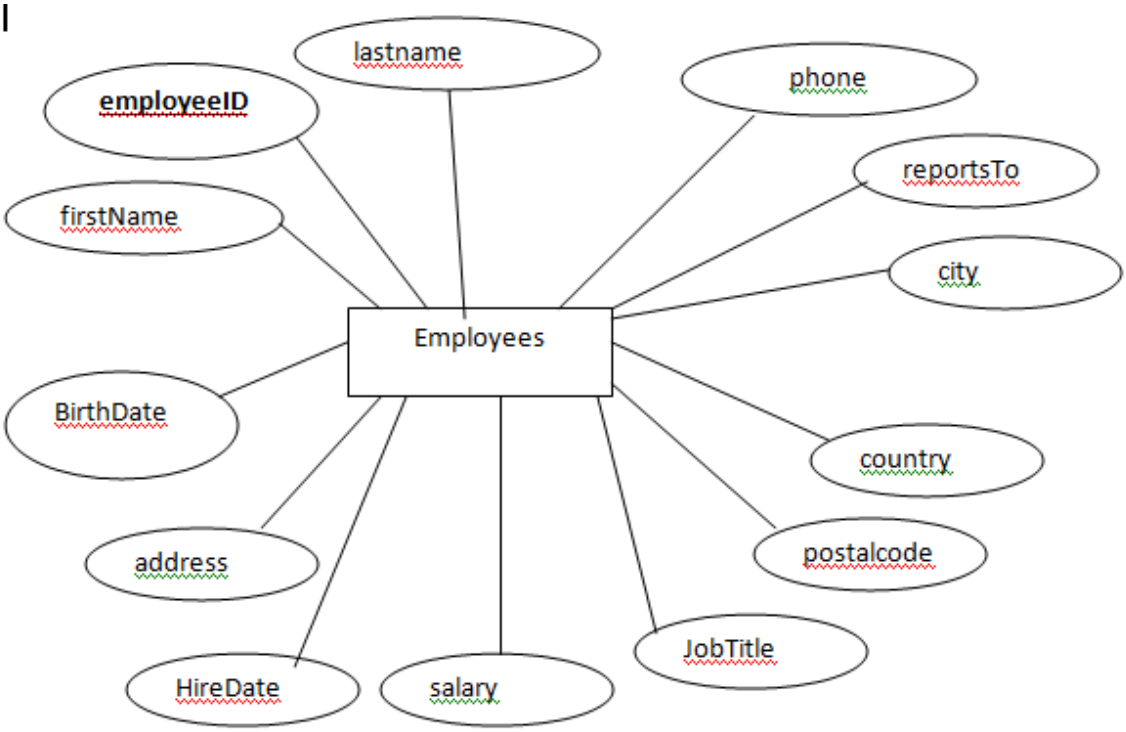
Entity diagram for Customers



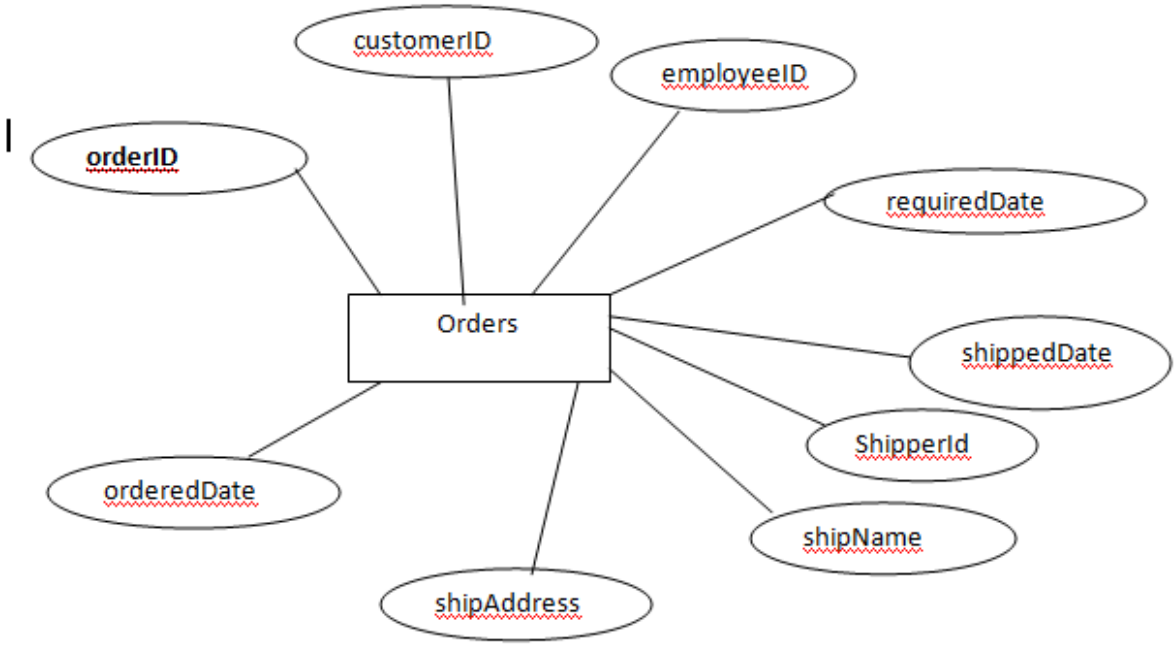
Entity diagram for Products



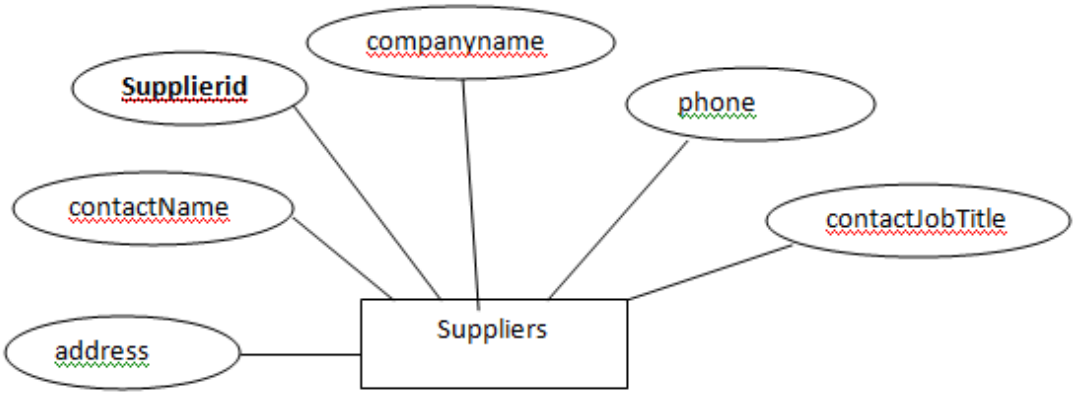
Entity diagram for Employees



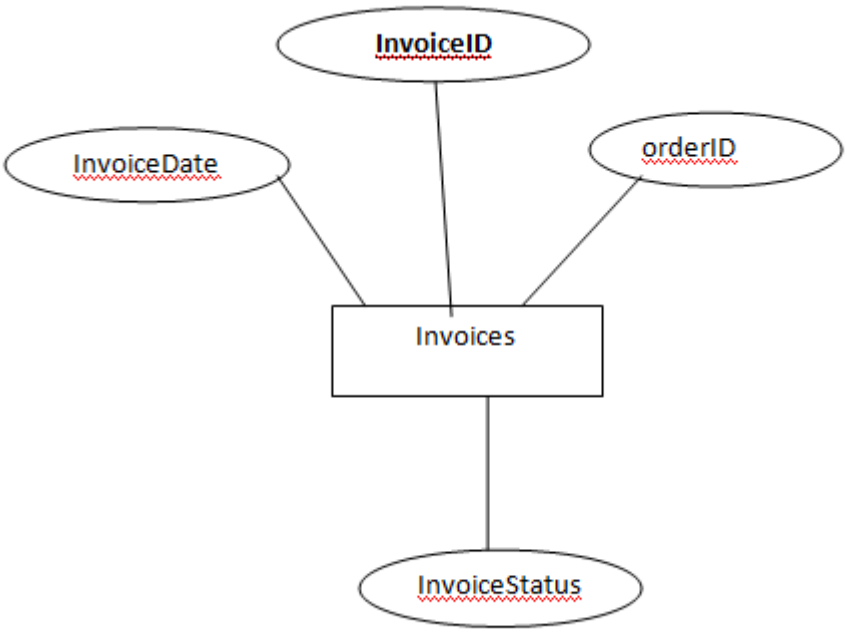
Entity diagram for Orders



Entity diagram for Suppliers:

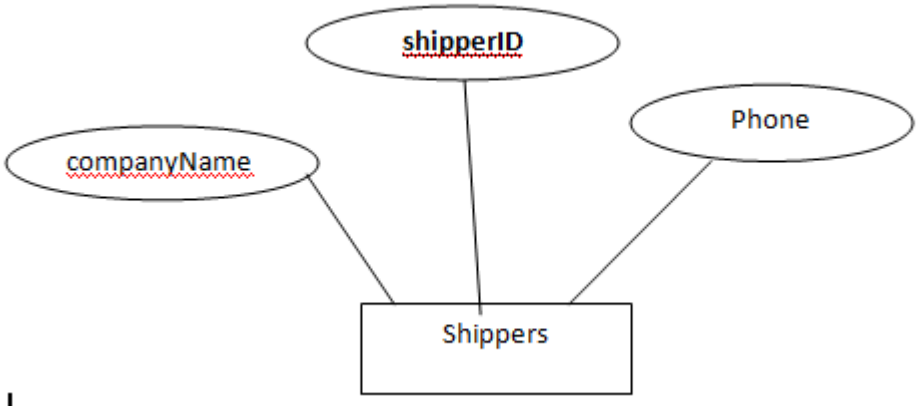


Entity Diagram of Invoices

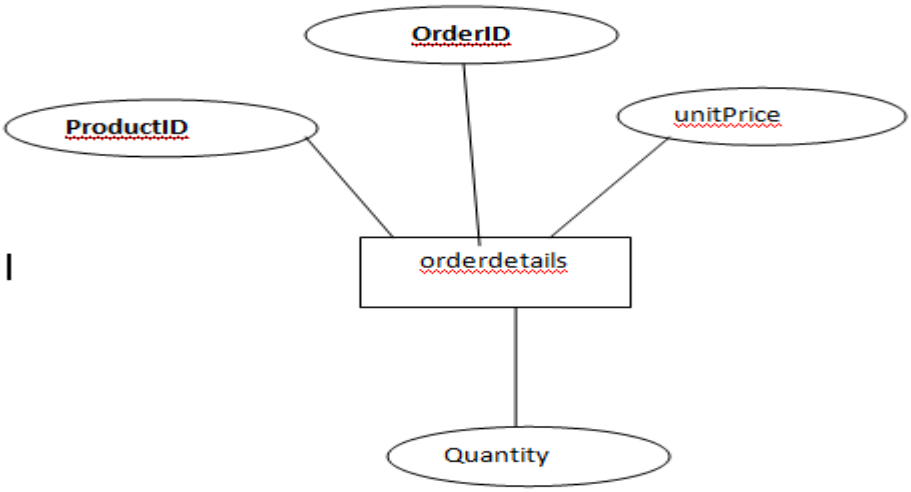


Entity

Diagram of Shippers



Entity Diagram of orderdetails



Normalization

Database normalization is a technique for designing relational database tables to minimize duplication of information and, in doing so , to safeguard the database against certain types of logical or structural problems namely data anomalies.

MODEL INPUT

The normalization forms are:

1. **First Normal Form**: 1NF requires that the values in each column of a table are atomic. By atomic we mean that there are no sets of values within a column.
2. **Second Normal Form**: where the 1NF deals with atomicity of data, the 2NF deals with relationships between composite key columns and non-key columns. To achieve 2NF the tables should be in 1NF. The 2NF any non-key columns must depend on the entire primary key. In case of a composite primary key, this means that non-key column can't depend on only part of the composite key.
3. **Third Normal Form**: 3NF requires that all columns depend directly on the primary key. Tables violate the third normal form when one column depends an another column, which in turn depends on the primary key(transitive dependency). One way to identify transitive dependency is to look at your tables and see if any columns would require updating if another column in the table was updated. If such a column exists, it probably violates 3NF.

Experiment 2

Installation & DDL

Installation of Mysql and practicing DDL commands.

Creating databases, How to create tables, altering the database or tables, dropping tables anddatabases if not required. You will also try truncate, rename commands etc.

Data Definition Language (DDL) : create , alter, drop.

Installation of Mysql and Practicing DDL commands:

Installation of Mysql. In this week you will learn creating databases, how to create tables, altering the tables, dropping tables and databases if not required. You will also try truncate, rename commands etc.

MODEL INPUT

Step: 1 download mysql essential from the website www.mysql.com/downloads and save the .exe file.

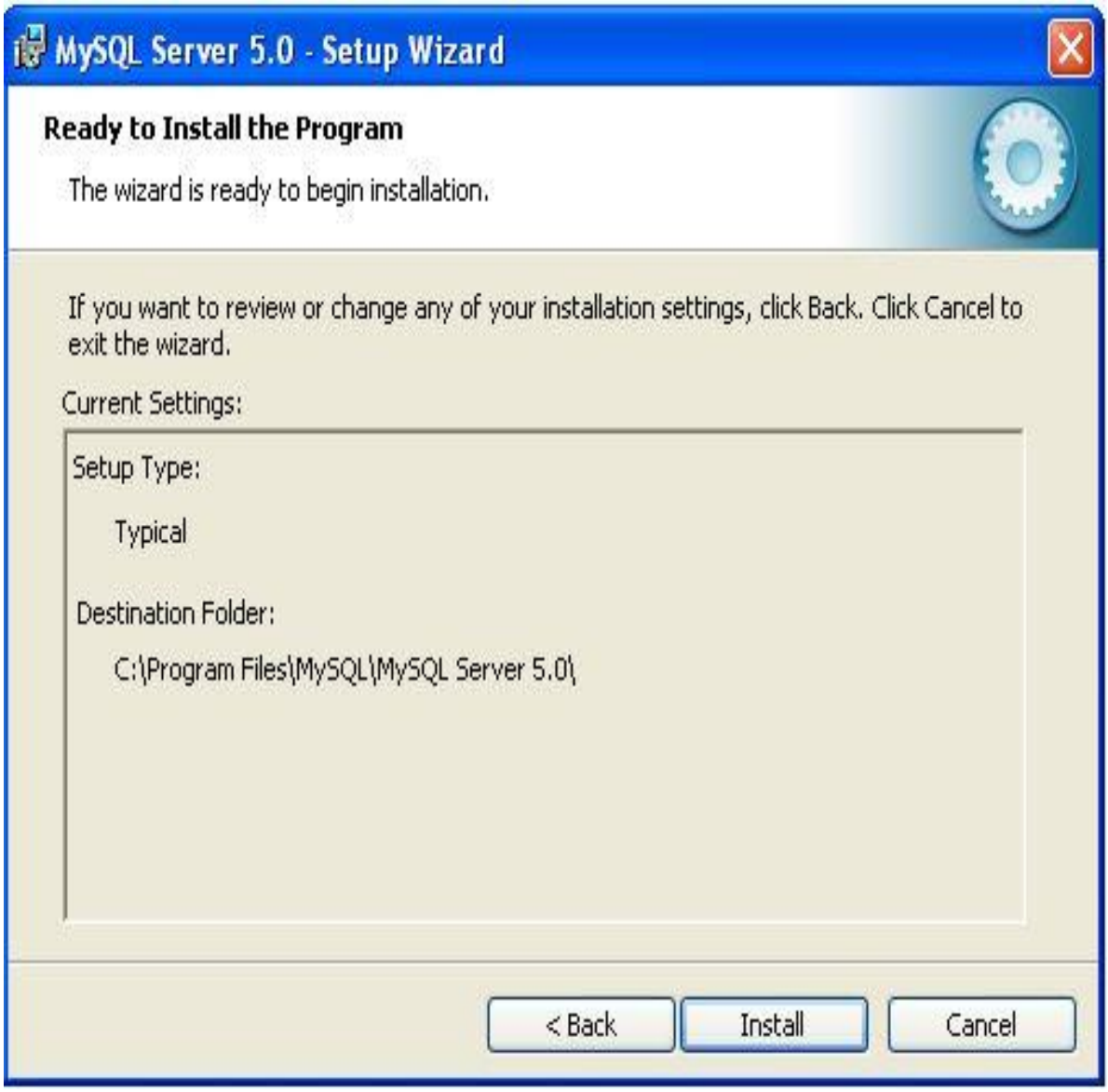
Step: 2 Double click on the mysql.exe file to start installation.

Step: 3

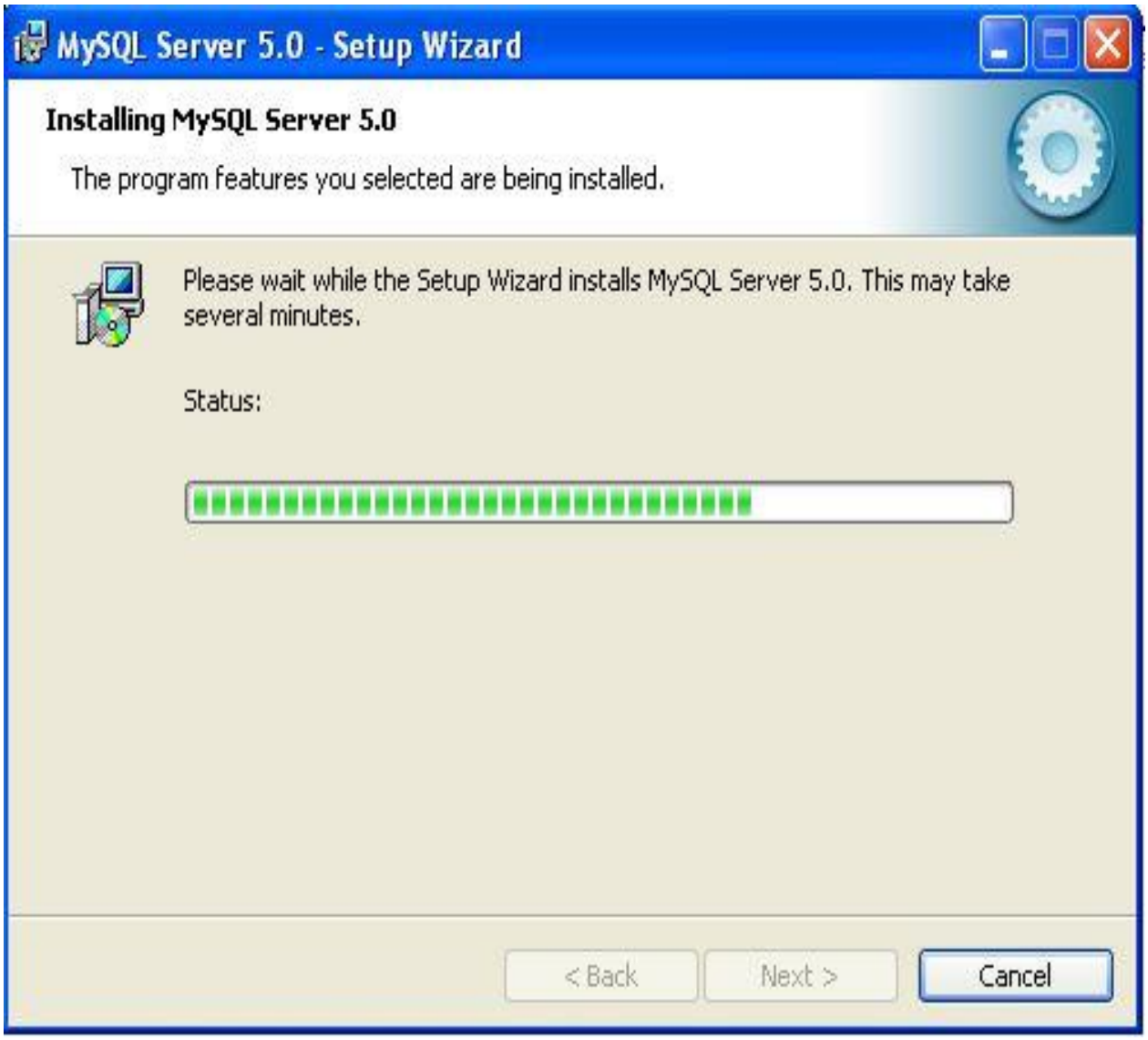
Step : 4


MySQL Server 5.0 - Setup Wizard
Setup Type
Choose the setup type that best suits your needs.
Please select a setup type.
Typical
Common program features will be installed. Recommended for general use.
Complete
All program features will be installed. (Requires the most disk space.)
Custom
Choose which program features you want installed and where they will be installed. Recommended for advanced users.
< Back
Next >
Cancel

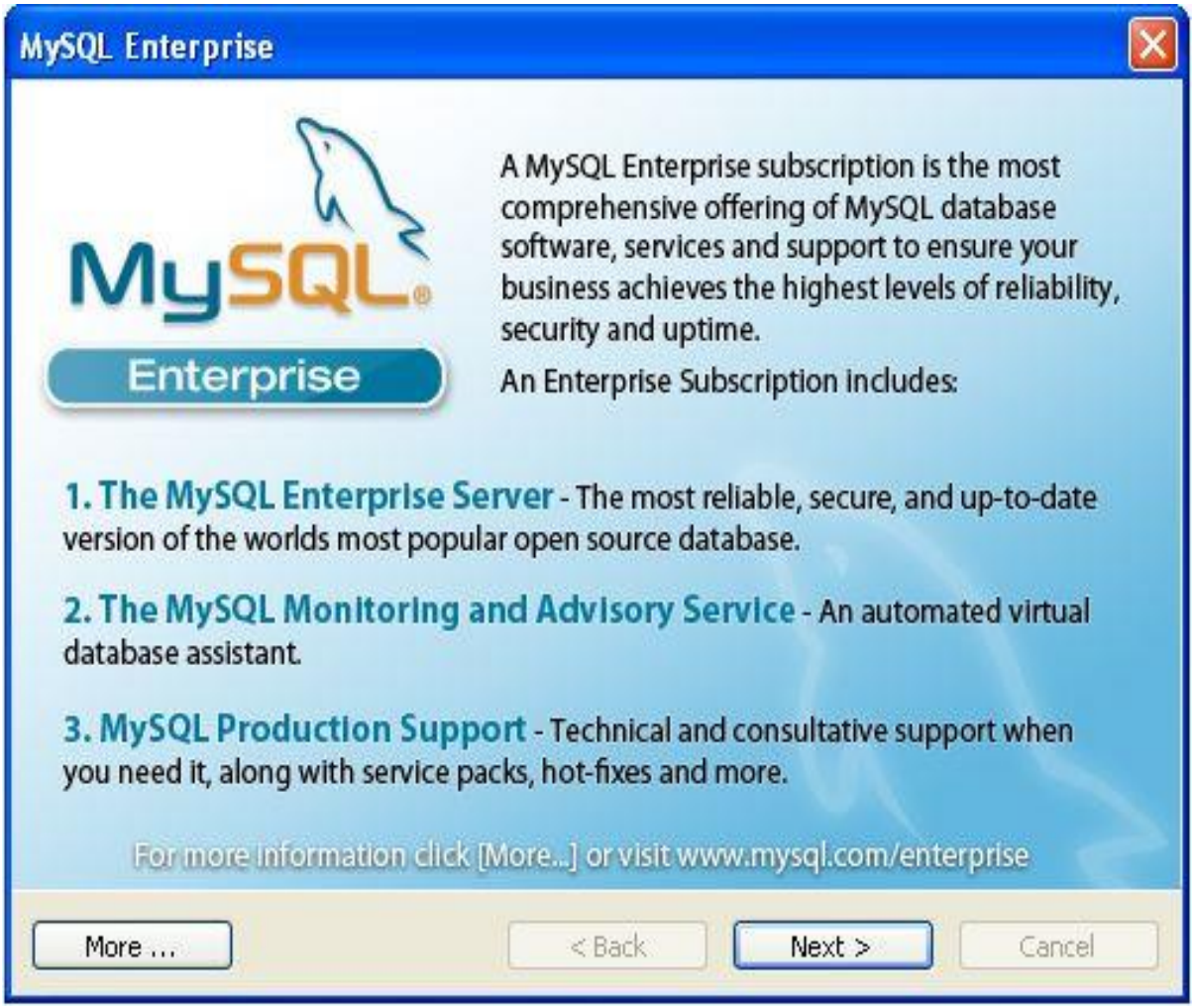
Step: 5


MySQL Server 5.0 - Setup Wizard
Ready to Install the Program
The wizard is ready to begin installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
Current Settings:
Setup Type:
Typical
Destination Folder:
C:\Program Files\MySQL\MySQL Server 5.0\
< Back
Install
Cancel

Step: 6


MySQL Server 5.0 - Setup Wizard
Installing MySQL Server 5.0
The program features you selected are being installed.
Please wait while the Setup Wizard installs MySQL Server 5.0. This may take several minutes.
Status:
< Back
Next >
Cancel

Step: 7

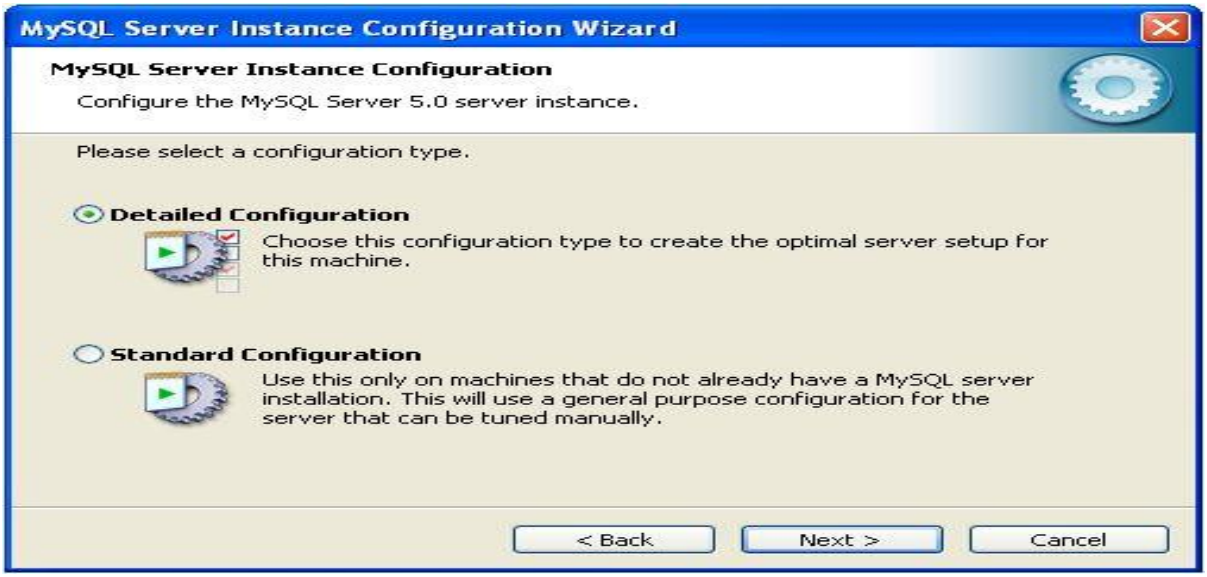

MySQL Enterprise
MySQL
Enterprise
A MySQL Enterprise subscription is the most comprehensive offering of MySQL database software, services and support to ensure your business achieves the highest levels of reliability, security and uptime.
An Enterprise Subscription includes:
1. The MySQL Enterprise Server - The most reliable, secure, and up-to-date version of the worlds most popular open source database.
2. The MySQL Monitoring and Advisory Service - An automated virtual database assistant.
3. MySQL Production Support - Technical and consultative support when you need it, along with service packs, hot-fixes and more.
For more information click [More...] or visit www.mysql.com/enterprise
More ...
< Back
Next >
Cancel

Step 8

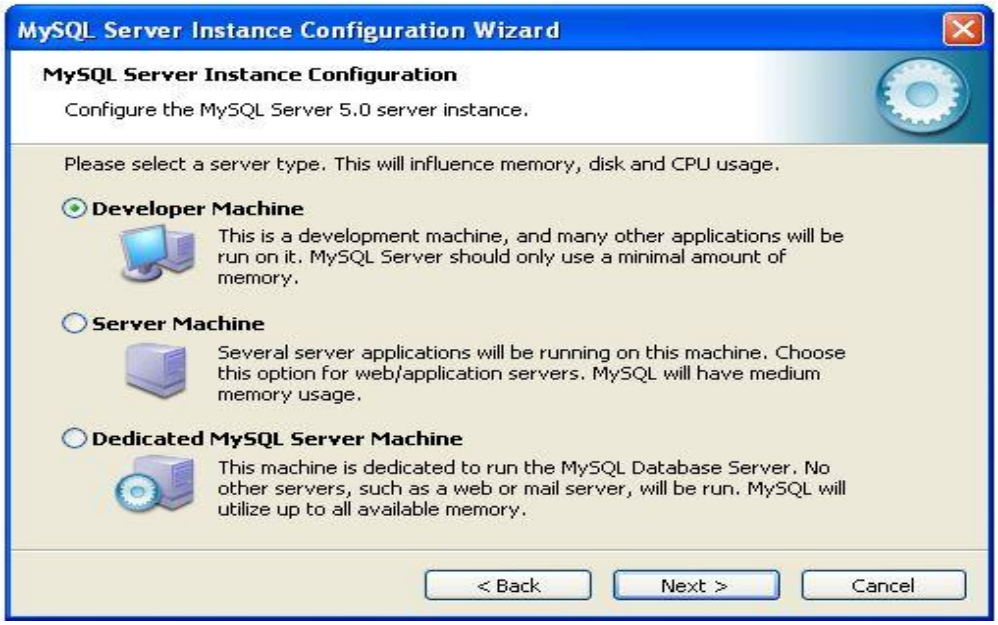

MySQL Server 5.0 - Setup Wizard
Wizard Completed
Setup has finished installing MySQL Server 5.0. Click Finish to exit the wizard.
Configure the MySQL Server now
Use this option to generate an optimized MySQL config file, setup a Windows service running on a dedicated port and to set the password for the root account.
MySQL
< Back
Finish
Cancel

Step: 9

Step: 10

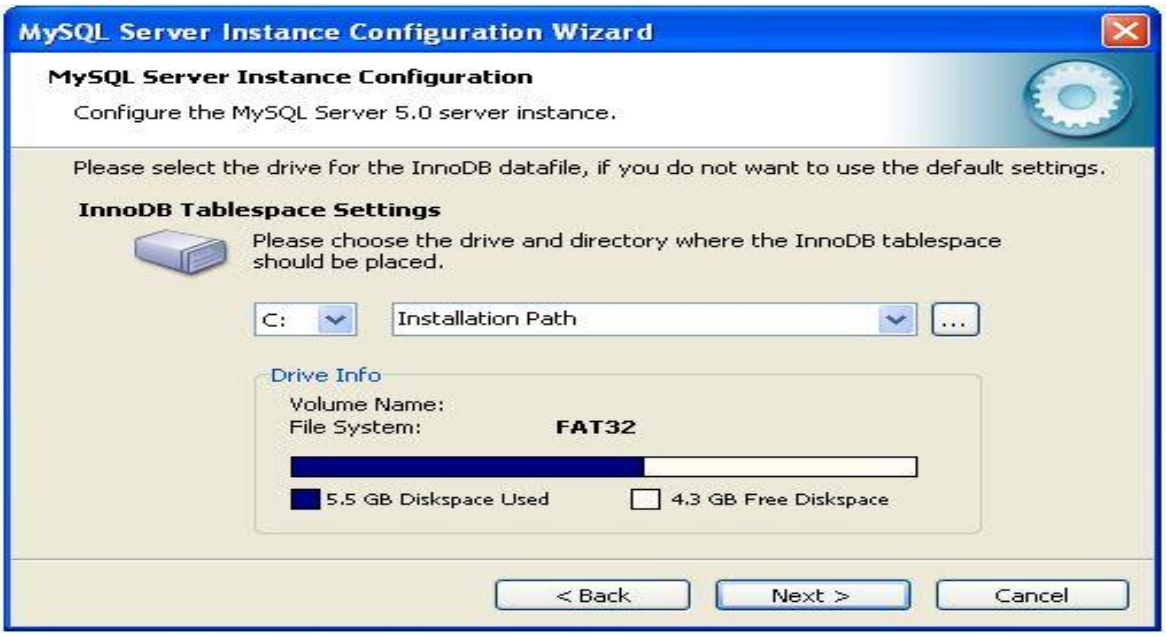


Step: 11

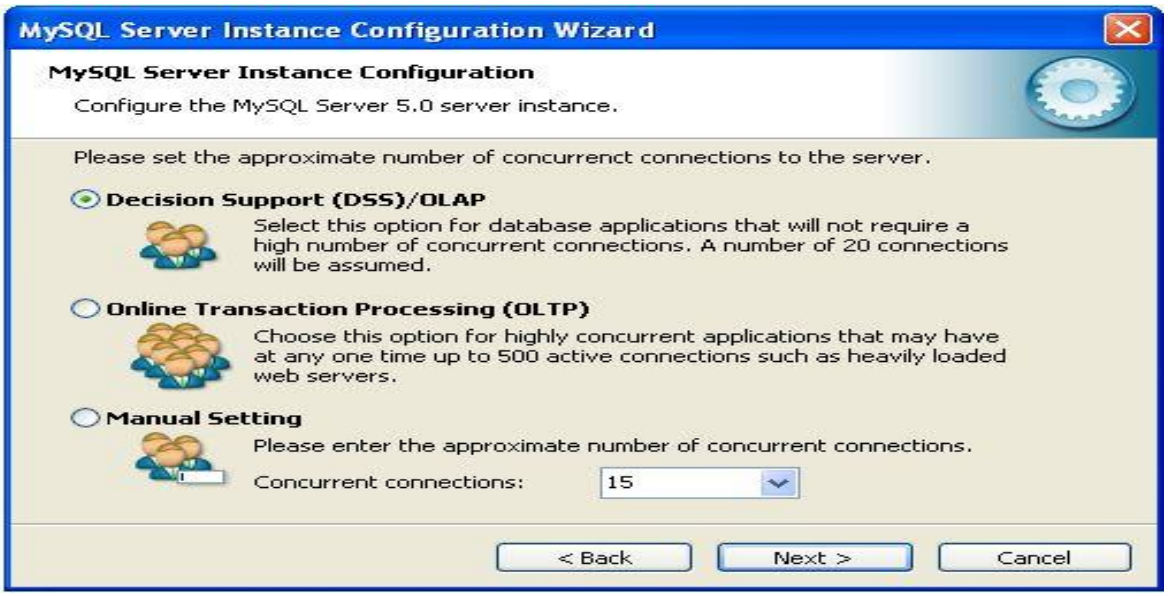


Step: 12

Step: 13



Step: 14



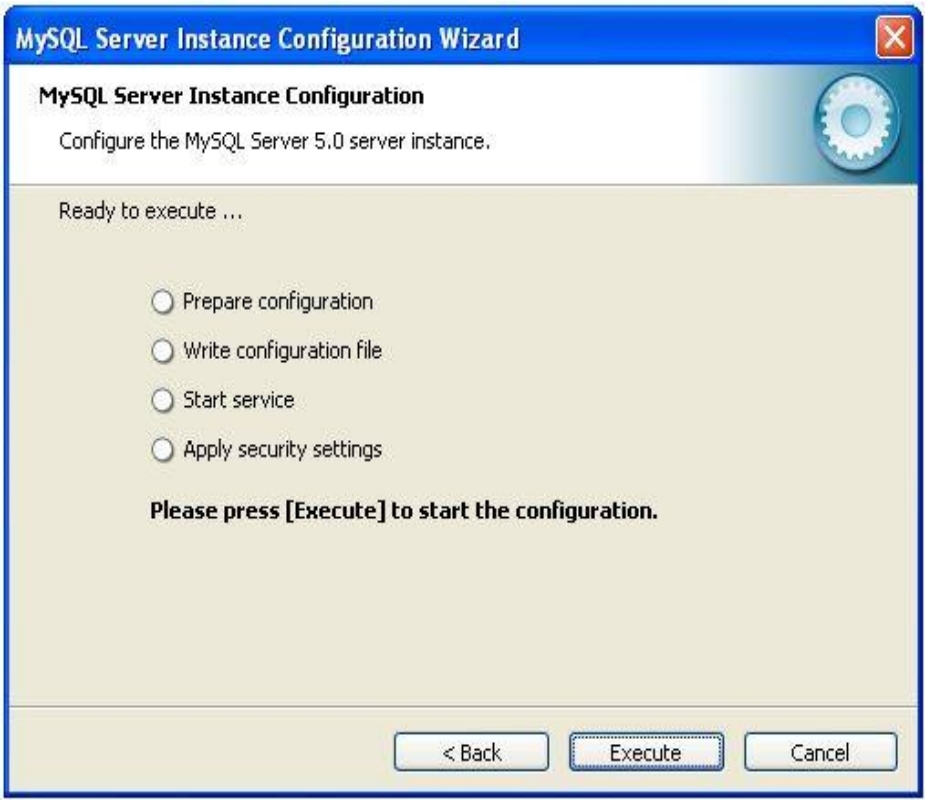
Step: 15

Step: 16

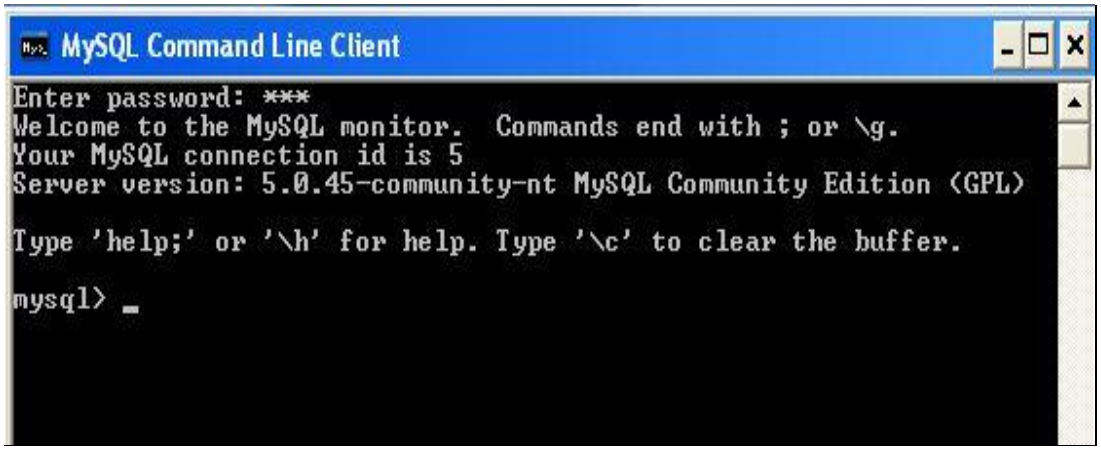
Step: 17

Step: 18

Step: 19



Step: 20



```
mysql> create database southwind;
Query OK, 1 row affected (0.00 sec)


mysql> create database southwind;
Query OK, 1 row affected (0.00 sec)

mysql> use southwind;
Database changed

mysql> show tables;
Empty set (0.00 sec)
```

Creating Tables:-

Syntax: Create table tablename (columnname 1 datatype 1,

Columnname 2 datatype 2,

: :

: :

Columnname n datatype n ...);

Example:

mysql> create table student1(rollno int, name varchar(10),dob date, city varchar(10), state varchar(10));

Query OK, 0 rows affected (0.07 sec)

Table Created

Observing Table Information:-

The easiest way to get description about a table is with the DESC command:

Syntax: DESC table name*;*

Altering Tables:-

To alter a table use the alter table command:

Syntax1:

Alter table tablename add (columnname datatype*,* ...);

Syntax2:

Alter table tablename drop column columnname;

Example 1:

mysql> alter table student1 add(pin int);

Query OK, 0 rows affected (0.31 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> alter table student1 drop column pin;

Query OK, 0 rows affected (0.23 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> alter table student1 add pin int;

Query OK, 0 rows affected (0.21 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> alter table student1 drop column dob;

Query OK, 0 rows affected (0.20 sec)

Records: 0 Duplicates: 0 Warnings: 0

Dropping Tables:-

To delete a table use the following:

Syntax Drop table tablename;

Example:

mysql> drop table student1;

Query OK, 0 rows affected (0.08 sec)

Table dropped.

mysql> desc student1;

ERROR 1146 (42S02): Table 'southwind.student1' doesn't exist

Object student does not exist

```
mysql> create table products (
productID    INT UNSIGNED  NOT NULL AUTO_INCREMENT,
productCode  CHAR(3)       NOT NULL DEFAULT '',
name         VARCHAR(30)   NOT NULL DEFAULT '',
quantity     INT UNSIGNED  NOT NULL DEFAULT 0,
  price      DECIMAL(7,2)  NOT NULL DEFAULT 99999.99,
  PRIMARY KEY  (productID)
    );
Query OK, 0 rows affected (0.24 sec)

mysql> INSERT INTO products VALUES (1001, 'PEN', 'Pen Red', 5000, 1.23);
Query OK, 1 row affected (0.04 sec)

mysql> INSERT INTO products VALUES (NULL, 'PEN', 'Pen Blue',  8000, 1.25),
  (NULL, 'PEN', 'Pen Black', 2000, 1.25);
Query OK, 2 rows affected (0.04 sec)
Records: 2  Duplicates: 0  Warnings: 0

mysql> INSERT INTO products (productCode, name, quantity, price) VALUES
 ('PEC', 'Pencil 2B', 10000, 0.48), ('PEC', 'Pencil 2H', 8000, 0.49);
Query OK, 2 rows affected (0.04 sec)
Records: 2  Duplicates: 0  Warnings: 0

mysql> INSERT INTO products (productCode, name) VALUES ('PEC', 'Pencil HB');
Query OK, 1 row affected (0.06 sec)

mysql> select * from products;
```

Comparison Operators

For numbers (INT, DECIMAL, FLOAT), you could use comparison operators: '=' (equal to), '<>' or '!=' (not equal to), '>' (greater than), '<' (less than), '>=' (greater than or equal to), '<=' (less than or equal to), to compare two numbers. For example, price > 1.0, quantity <= 500.

```
mysql> SELECT name, price FROM products WHERE price < 1.0;

mysql> SELECT name, quantity FROM products WHERE quantity <= 2000;
```

CAUTION: Do not compare FLOATs (real numbers) for equality ('=' or '<>'), as they are not precise. On the other hand, DECIMAL are precise.

For strings, you could also use '=', '<>', '>', '<', '>=', '<=' to compare two strings (e.g., productCode = 'PEC'). The ordering of string depends on the so-called *collation* chosen. For example,

```
mysql> SELECT name, price FROM products WHERE productCode = 'PEN';
```

String Pattern Matching - LIKE and NOT LIKE

For strings, in addition to full matching using operators like '=' and '<>', we can perform *pattern matching* using operator LIKE (or NOT LIKE) with wildcard characters. The wildcard '_' matches any single character; '%' matches any number of characters (including zero). For example,

- 'abc%' matches strings beginning with 'abc';
- '%xyz' matches strings ending with 'xyz';
- '%aaa%' matches strings containing 'aaa';
- '___' matches strings containing exactly three characters; and
- 'a_b%' matches strings beginning with 'a', followed by any single character, followed by 'b', followed by zero or more characters.

mysql> SELECT name, price FROM products WHERE name LIKE 'PENCIL%';

mysql> SELECT name, price FROM products WHERE name LIKE 'P__ %';

Arithmetic Operators

```
mysql> select (20+30);

+---------+

| (20+30) |

+---------+

|     50 |

+---------+

1 row in set (0.00 sec)

mysql> select (30-20);

+---------+

| (30-20) |

+---------+

|     10 |

+---------+

1 row in set (0.12 sec)
```

```
mysql> select (20*5);
+--------+
| (20*5) |
+--------+
|    100 |
+--------+
1 row in set (0.00 sec)
mysql> select (20/5);
+--------+
| (20/5) |
+--------+
| 4.0000 |
+--------+
1 row in set (0.02 sec)
mysql> select (20%5);
+--------+
| (20%5) |
+--------+
|      0 |
+--------+
1 row in set (0.00 sec)
mysql> select (20 div 5);
+------------+
| (20 div 5) |
+------------+
|          4 |
+------------+
```

Logical Operators - AND, OR, NOT, XOR

You can combine multiple conditions with boolean operators AND, OR, XOR. You can also invert a condition using operator NOT. For examples,

```
mysql> SELECT * FROM products WHERE quantity >= 5000 AND name LIKE 'Pen %';

mysql> SELECT * FROM products WHERE quantity >= 5000 AND price < 1.24 AND name LIKE 'Pen %';

mysql> SELECT * FROM products WHERE NOT (quantity >= 5000 AND name LIKE 'Pen %');
```

IN, NOT IN

You can select from members of a set with IN (or NOT IN) operator. This is easier and clearer than the equivalent AND-OR expression.

```
mysql> SELECT * FROM products WHERE name IN ('Pen Red', 'Pen Black');
```

BETWEEN, NOT BETWEEN

To check if the value is within a range, you could use BETWEEN ... AND ... operator. Again, this is easier and clearer than the equivalent AND-OR expression.

```
mysql> SELECT * FROM products WHERE (price BETWEEN 1.0 AND 2.0) AND (quantity BETWEEN 1000 AND 2000);
```

IS NULL, IS NOT NULL

NULL is a special value, which represent "no value", "missing value" or "unknown value". You can checking if a column contins NULL by IS NULL or IS NOT NULL. For example,

```
mysql> SELECT * FROM products WHERE productCode IS NULL;
Empty set (0.00 sec)

mysql> SELECT * FROM products WHERE productCode IS NOT NULL;
```

ORDER BY Clause

You can order the rows selected using ORDER BY clause, with the following syntax:

SELECT ... FROM *tableName* WHERE *criteria* ORDER BY *columnA* ASC|DESC, *columnB* ASC|DESC, ...
The selected row will be ordered according to the values in *columnA*, in either ascending (ASC) (default) or descending (DESC) order. If several rows have the same value in *columnA*, it will be ordered according to *columnB*, and so on. For strings, the ordering could be case-sensitive or case-insensitive, depending on the so-called character collating sequence used. For examples,

```
mysql> SELECT * FROM products WHERE name LIKE 'Pen %' ORDER BY price DESC;
```

You can randomize the returned records via function RAND(), e.g.,

Experiment 3

DML

Data Manipulation Language Commands (DML) commands are used to for managing datawithin schema objects.

Exercising the commands using **DML :** insert, delete, update on the following tables : products, customers, suppliers, orders, , employees, order details, categories.

- INSERT – insert data into a table.
- UPDATE – updates existing data within a table.
- DELETE – deletes single or all records from a table.

Data Query Language – Select

```
mysql> CREATE TABLE Customers( CustomerID VARCHAR(5) NOT NULL, CompanyName VARCHAR(40) NOT NULL, ContactName VARCHAR(30), ContactTitle VARCHAR(30), Address VARCHAR(60), City VARCHAR(15), Region VARCHAR(15), PostalCode VARCHAR(10), Country VARCHAR(15), Phone VARCHAR(24), Fax VARCHAR(24), CONSTRAINT `PK_Customers` PRIMARY KEY (`CustomerID`));
Query OK, 0 rows affected (0.09 sec)

mysql> insert into Customers( CustomerID, CompanyName, ContactName, ContactTitle, Address, City, Region, PostalCode, Country, Phone, Fax) values('1001', 'tcs', 'maria', 'sales representative', 'Obere Str. 57', 'Berlin', NULL, '12209', 'Germany', '030-0074321', '030-0076545'),( '1002', 'wipro', 'Ana ', 'Owner', 'Avda. de la Constitucin 2222', 'Mxico D.F.', NULL, '05021', 'Mexico', '(5) 555-4729', '(5) 555-3745'), ('1003', 'polaris', 'Antonio ', 'Owner', 'Mataderos  2312', 'Mxico D.F.', NULL, '05023', 'Mexico', '(5) 555-3932', '(5) 565-3532'), ('1004', 'virtuasa', 'Thomas Hardy', 'Sales Representative', '120 Hanover Sq.', 'London', NULL, 'WA1 1DP', 'UK', '(171) 555-7788', '(171) 555-6750'), ('1005', 'genpact', 'Frdrique Citeaux', 'Marketing Manager', '24, place Klber', 'Strasbourg', NULL, '67000', 'France', '88.60.15.31', '88.60.15.32');
Query OK, 5 rows affected (0.07 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> select * from Customers;

mysql> CREATE TABLE Employees ( EmployeeID INTEGER NOT NULL AUTO_INCREMENT, LastName VARCHAR(20) NOT NULL, FirstName VARCHAR(10) NOT NULL, JobTitle VARCHAR(30), BirthDate DATETIME, HireDate DATETIME, Address VARCHAR(60), City VARCHAR(15), PostalCode VARCHAR(10), Country VARCHAR(15), Phone VARCHAR(24), ReportsTo INTEGER, Salary FLOAT, CONSTRAINT `PK_Employees` PRIMARY KEY (`EmployeeID`));
Query OK, 0 rows affected (0.16 sec)
```

```
mysql> insert into Employees(EmployeeID, LastName, FirstName, JobTitle, BirthDate, HireDate,
Address,City  ,PostalCode, Country,Phone, ReportsTo, Salary ) values (5001, 'rao', 'krishna',
'Sales Representative', '1948-12-08','1992-05-01', '507 - 20th Ave. E.Apt. 2A','Seattle',
'98122','USA', '22255556',1234,30000.00);
Query OK, 1 row affected (0.16 sec)

mysql> insert into Employees(EmployeeID, LastName, FirstName, JobTitle, BirthDate, HireDate,
Address,City  ,PostalCode, Country,Phone, ReportsTo, Salary ) values (5002, 'krishna', 'ram',
'Manager', '1950-10-06','1995-06-02', '307 - 15th Ave. E.Apt','Hyderabad', '500031','India',
'9849789648',1315,35000.00);
Query OK, 1 row affected (0.12 sec)

mysql> insert into Employees(EmployeeID, LastName, FirstName, JobTitle, BirthDate, HireDate,
Address,City  ,PostalCode, Country,Phone, ReportsTo, Salary ) values (5003, 'hare', 'ram',
'Accountant', '1975-10-05','1997-09-01', '107 Apt', 'Secunderabad', '500031','India',
'9849755648',1415,45000.00);
Query OK, 1 row affected (0.05 sec)

mysql> insert into Employees(EmployeeID, LastName, FirstName, JobTitle, BirthDate, HireDate,
Address,City  ,PostalCode, Country,Phone, ReportsTo, Salary ) values (5004, 'hare', 'krishna',
'Assistant Manager', '1980-08-06','2002-10-05', '407 Apt', 'Vijayawada', '520031','India',
'9888755648',2415,40000.00);

Query OK, 1 row affected (0.12 sec)

mysql> insert into Employees(EmployeeID, LastName, FirstName, JobTitle, BirthDate, HireDate,
Address,City  ,PostalCode, Country,Phone, ReportsTo, Salary ) values (5005, 'murali', 'mohan', '
Manager', '1982-08-07','2007-06-01', '237 Apt', 'Hyderabad', '500031','India',
'9888695648',2695,45000.00);
Query OK, 1 row affected (0.05 sec)

mysql> select * from Employees;

mysql> CREATE TABLE Orders (    OrderID INTEGER NOT NULL AUTO_INCREMENT,    CustomerID
VARCHAR(5),    EmployeeID INTEGER,    OrderDate DATETIME,    RequiredDate DATETIME,
ShippedDate DATETIME,    ShipId INTEGER,    ShipName VARCHAR(40),    ShipAddress
VARCHAR(60),     CONSTRAINT `PK_Orders` PRIMARY KEY (`OrderID`));
Query OK, 0 rows affected (0.17 sec)

mysql> insert into Orders (OrderID,  CustomerID, EmployeeID,OrderDate,RequiredDate,
   ShippedDate,ShipId,ShipName,ShipAddress) values(9001, '1001',5001, '1996-07-04
00:00:00.000','1996-08-01 00:00:00.000','1996-07-16 00:00:00.000',3,'Reims','France');
Query OK, 1 row affected (0.07 sec)

mysql> insert into Orders  values (9002, '1002',5002, '1996-07-05 00:00:00.000','1996-08-16
00:00:00.000','1996-07-10 00:00:00.000',1,'Mnster','Germany');
Query OK, 1 row affected (0.05 sec)
```

```
mysql> insert into Orders  values (9003, '1003',5003, '1998-11-06 00:00:00.000','1998-12-04
00:00:00.000','1998-11-08 00:00:00.000',3,'SP','Brazil');

Query OK, 1 row affected (0.03 sec)

mysql> insert into Orders  values (9004, '1004',5004, '2002-11-12 00:00:00.000','2002-11-26
00:00:00.000','2002-11-18 00:00:00.000',2,'Lisboa','Portugal');

Query OK, 1 row affected (0.12 sec)

mysql> insert into Orders  values (9005, '1005',5005, '2008-11-25 00:00:00.000','2008-12-23
00:00:00.000','2008-11-28 00:00:00.000',4, 'Marseille','France');

Query OK, 1 row affected (0.03 sec)

mysql> select * from Orders;

mysql> CREATE TABLE Categories (    CategoryID INTEGER NOT NULL AUTO_INCREMENT,
CategoryName VARCHAR(15) NOT NULL,    CONSTRAINT `PK_Categories` PRIMARY KEY
(`CategoryID`));

Query OK, 0 rows affected (0.09 sec)

mysql> insert into Categories(CategoryID,CategoryName) values
(7001,'electronics'),(7002,'groceries'),(7003,'clothing'),(7004,'utensils'),(7005,'bags');
Query OK, 5 rows affected (0.06 sec)
Records: 5  Duplicates: 0  Warnings: 0
mysql> select * from Categories;

mysql> CREATE TABLE Products (    ProductID INTEGER NOT NULL AUTO_INCREMENT,
ProductName VARCHAR(40) NOT NULL,    SupplierID INTEGER,    CategoryID INTEGER,
QuantityPerUnit VARCHAR(20),    UnitPrice DECIMAL(10,4) DEFAULT 0,    UnitsInStock
SMALLINT(2) DEFAULT 0,    UnitsOnOrder SMALLINT(2) DEFAULT 0,    ReorderLevel SMALLINT(2)
DEFAULT 0,    Discontinued BIT NOT NULL DEFAULT 0,    CONSTRAINT `PK_Products` PRIMARY
KEY (`ProductID`));
Query OK, 0 rows affected (0.05 sec)
mysql> insert into  Products (    ProductID,   ProductName ,  SupplierID ,    CategoryID,
QuantityPerUnit ,UnitPrice,    UnitsInStock ,    UnitsOnOrder,    ReorderLevel ,    Discontinued)
values (6001,'computer',2001,7001,'25 computers',25000.00,20,10,5,1),
(6002,'laptop',2002,7002,'20 laptops',45000.00,10,5,3,0), (6003,'pendrive',2003,7003,'35
pendrives',1000.00,30,10,5,0), (6004,'memory card',2004,7004,'45 memory
cards',500.00,50,20,10,1), (6005,'headphones',2005,7005,'20
headphones',1000.00,30,15,10,0);
Query OK, 5 rows affected (0.07 sec)
Records: 5  Duplicates: 0  Warnings: 0
```

```
mysql> select * from products;

mysql> CREATE TABLE Shippers(    ShipperID INTEGER NOT NULL AUTO_INCREMENT,
CompanyName VARCHAR(40) NOT NULL,    Phone VARCHAR(24),    CONSTRAINT `PK_Shippers`
PRIMARY KEY (`ShipperID`));
Query OK, 0 rows affected (0.18 sec)

mysql> insert into Shippers(ShipperID, CompanyName, Phone) values
(1,'samsung','90000001'),(2,'lg','6258215545'),(3,'redme','6454545454'),(4,'nokia','895633552'
),(5,'oppo','789658258');
Query OK, 5 rows affected (0.08 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> select * from Shippers;

mysql> CREATE TABLE Suppliers(    SupplierID INTEGER NOT NULL AUTO_INCREMENT,
CompanyName VARCHAR(40) NOT NULL,    ContactName VARCHAR(30),    ContactJobTitle
VARCHAR(30),    Address VARCHAR(60),    Phone VARCHAR(24),    CONSTRAINT `PK_Suppliers`
PRIMARY KEY (`SupplierID`));
Query OK, 0 rows affected (0.42 sec)


mysql> insert into Suppliers (SupplierID,CompanyName,ContactName,ContactJobTitle,Address,
Phone ) values (2001,'samsung','abc','Salesman','hyderabad','987456321'),
(2002,'lg','xyz','manager','delhi','879654123'),(2003,'redme','pqr','accountant','agra','6587492
34'),(2004,'nokia','uvw','assistant manager','vijayawada','896547213'),
(2005,'oppo','abcd','executive','secunderabad','985462317');

Query OK, 5 rows affected (0.05 sec)

Records: 5  Duplicates: 0  Warnings: 0


mysql> CREATE TABLE OrderDetails (    OrderID INTEGER NOT NULL,    ProductID INTEGER NOT
NULL,    UnitPrice DECIMAL(10,4) NOT NULL DEFAULT 0,    Quantity SMALLINT(2) NOT NULL
DEFAULT 1,    CONSTRAINT `PK_Order Details` PRIMARY KEY (`OrderID`, `ProductID`));
Query OK, 0 rows affected (0.07 sec)

mysql> insert into OrderDetails(OrderID ,ProductID,UnitPrice,Quantity)
values(9001,6001,20000.00,10),(9002,6002,25000.00,5),(9003,6003,30000.00,10),(9004,6004,2
3000.00,5),(9005,6005,25000.00,10);
Query OK, 5 rows affected (0.07 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> select * from orderDetails;

mysql> select * from products;
```

Altering Tables:-

To alter a table use the alter table command:

Syntax1:

Alter table tablename add (columnname datatype, ...);

Syntax2:

Alter table tablename drop column columnname;

```
mysql> alter table products add(productno int);
Query OK, 5 rows affected (0.25 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> select * from products;

mysql> alter table products drop column productno;
Query OK, 5 rows affected (0.35 sec)
Records: 5  Duplicates: 0  Warnings: 0

mysql> select * from products;

mysql> select ProductID,ProductName from Products;

mysql> select ProductID,ProductName from Products where unitprice<=20000;
```

Experiment 4

Querying

Practice queries on **Aggregate functions** like count, max , min ,avg ,sum Practice queries like nested queries/co-related queries using ANY, ALL, IN,Exists, NOT EXISTS, UNION, INTERSECT, groupby ,having etc.

Joins: Join , Left Outer Join, Right Outer Join, Self Join

The SQL ANY and ALL Operators

The `ANY` and `ALL` operators allow you to perform a comparison between a single column value and a range of other values.

The SQL ANY Operator

The `ANY` operator:

- returns a boolean value as a result
- returns TRUE if ANY of the subquery values meet the condition

`ANY` means that the condition will be true if the operation is true for any of the values in the range.

ANY Syntax

```
SELECT column_name(s) FROM table_name  WHERE column_name operator ANY
 (SELECT column_name     FROM table_name    WHERE condition);
```

```
mysql> SELECT   ProductName  FROM Products    WHERE ProductID = ANY (SELECT ProductID
FROM   OrderDetails   WHERE   Quantity = 10);
```

The SQL ALL Operator

The ALL operator:

- returns a boolean value as a result
- returns TRUE if ALL of the subquery values meet the condition
- is used with SELECT, WHERE and HAVING statements

ALL means that the condition will be true only if the operation is true for all values in the range.

ALL Syntax With SELECT

SELECT ALL *column_name(s)* FROM *table_name* WHERE *condition*;

ALL Syntax With WHERE or HAVING

SELECT *column_name(s)* FROM *table_name* WHERE *column_name operator* ALL
(SELECT *column_name* FROM *table_name* WHERE *condition*);

Exists:

The EXISTS condition in SQL is used to check whether the result of a correlated nested query is empty (contains no tuples) or not. The result of EXISTS is a boolean value True or False. It can be used in a SELECT, UPDATE, INSERT or DELETE statement.

Syntax:

SELECT column_name(s)**FROM** table_name **WHERE EXISTS** (**SELECT** column_name(s) **FROM** table_name **WHERE** condition);

Using NOT with EXISTS

mysql> SELECT CompanyName FROM Customers WHERE NOT EXISTS (SELECT * FROM Orders WHERE Customers.CustomerID = Orders. CustomerID);
Empty set (0.00 sec)

Differences between UNION and INTERSECT Operators:

1. The SET operators are mainly used to combine the result of more than 1 select statement and return a single result set to the user.
2. The set operators work on complete rows of the queries, so the results of the queries must have the same column name, same column order and the types of columns must be compatible.

There are the following 4 set operators in SQL Server:

1. **UNION**: Combine two or more result sets into a single set, without duplicates.
2. **UNION ALL**: Combine two or more result sets into a single set, including all duplicates.
3. **INTERSECT**: Takes the data from both result sets which are in common.

Rules on Set Operations:

1. The result sets of all queries must have the same number of columns.
2. In every result set the data type of each column must be compatible (well matched) to the data type of its corresponding column in other result sets.
3. In order to sort the result, an ORDER BY clause should be part of the last select statement. The column names or aliases must be found out by the first select statement.

Understand the differences between these operators with examples.

Use below SQL Script to create and populate the two tables that we are going to use in our examples.

```
mysql> create table colors_a(color_name varchar(20));

Query OK, 0 rows affected (0.17 sec)

mysql> create table colors_b(color_name varchar(20));

Query OK, 0 rows affected (0.11 sec)

mysql> insert into colors_a(color_name)values('red'),('green'),('orange'),('yellow'),('violet');

Query OK, 5 rows affected (0.09 sec)

Records: 5  Duplicates: 0  Warnings: 0

mysql> insert into colors_b(color_name)values('white'),('red'),('peach'),('orange');

Query OK, 4 rows affected (0.08 sec)

Records: 4  Duplicates: 0  Warnings: 0

mysql> select * from colors_a;

mysql> select * from colors_b;
```

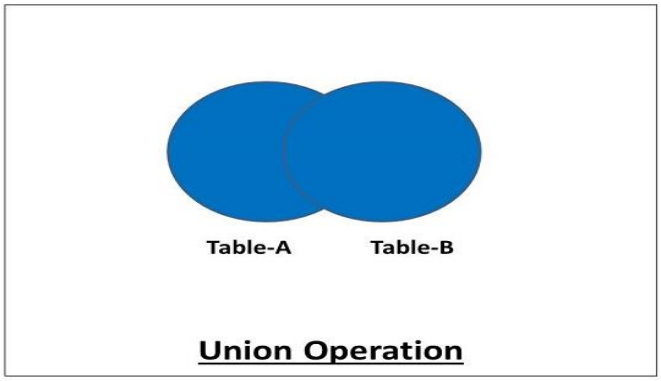
UNION

The Union is a binary set operator in DBMS. It is used to combine the result set of two select queries. Thus, It combines two result sets into one. In other words, the result set obtained after union operation is the collection of the result set of both the tables.

But two necessary conditions need to be fulfilled when we use the union command. These are:

1. Both SELECT statements should have an equal number of fields in the same order.
2. The data types of these fields should either be the same or compatible with each other.

The Union operation can be demonstrated as follows:



The syntax for the union operation is as follows:

SELECT (coloumn_names) from table1 [WHERE condition] UNION SELECT (coloumn_names) from table2 [WHERE condition];

The MySQL query for the union operation can be as follows:

mysql> select color_name from colors_a union select color_name from colors_b;

The returned values for the above query is as follows:

The Union operation gives us distinct values. If we want to allow the duplicates in our result set, we'll have to use the **'Union-All'** operation.

Union All operation is also similar to the union operation. The only difference is that it allows duplicate values in the result set.

The syntax for the union all operation is as follows:

SELECT (coloumn_names) from table1 [WHERE condition] UNION ALL SELECT (coloumn_names) from table2 [WHERE condition];

The MySQL query for the union all operation can be as follows:

mysql> select color_name from colors_a union all select color_name from colors_b;

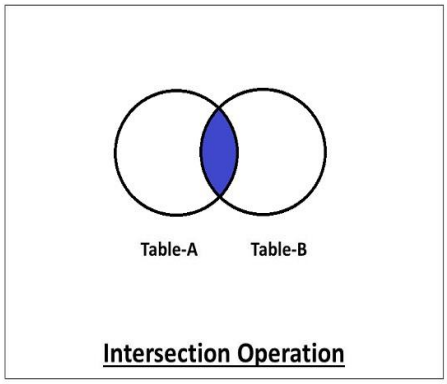
The returned values for the above query is as follows:

INTERSECT

Intersect is a binary set operator in DBMS. The intersection operation between two selections returns only the common data sets or rows between them. It should be noted that the intersection operation always returns the distinct rows. The duplicate rows will not be returned by the intersect operator.

Here also, the above conditions of the union and minus are followed, i.e., the number of fields in both the SELECT statements should be the same, with the same data type, and in the same order for the intersection.

The intersection operation can be demonstrated as follows:



The syntax for the intersection operation is as follows:

```
SELECT (coloumn_names) from table1[WHERE condition] INTERSECT SELECT (coloumn_names) from table2 [WHERE condition];
```

Note: *It is to be noted that the intersect operator is not present in MySQL. But we can make use of 'IN' operator for performing an intersection operation in MySQL.*

Here, we are using the 'IN' clause for demonstrating the examples.

The MySQL query for the intersection operation using the 'IN' operator can be as follows:

```
mysql> select color_name from colors_a where color_name in(select color_name from colors_b);
```

The returned values for the above query is as follows:

GROUP BY Clause

The GROUP BY clause allows you to *collapse* multiple records with a common value into groups. For example,

```
mysql> select * from Products group by ProductID;
```

GROUP BY Aggregate Functions: COUNT, MAX, MIN, AVG, SUM:

```
mysql> select count(*), max(UnitPrice),min(UnitPrice),
sum(UnitPrice),avg(UnitPrice),STD(UnitPrice) from Products;
```

Join Operations:

In DBMS, a join statement is mainly used to combine two tables based on a specified common field between them. If we talk in terms of Relational algebra, it is the cartesian product of two tables followed by the selection operation. Thus, we can execute the product and selection process on two tables using a single join statement. We can use either 'on' or 'using' clause in MySQL to apply predicates to the join queries.

A Join can be broadly divided into two types:

1. **Inner Join**
2. **Outer Join**

For all the examples, we will consider the below-mentioned employee and department table.

```
mysql> create table employee (empId int,empName varchar(20),deptId int);
Query OK, 0 rows affected (0.16 sec)

mysql> insert into employee (empId,empName,deptId) values
(1,'Harry',2),(2,'Tom',3),(3,'Joy',5),(4,'Roy',8);
Query OK, 4 rows affected (0.06 sec)
Records: 4  Duplicates: 0  Warnings: 0

mysql> create table department(deptId int, deptName varchar(20));
Query OK, 0 rows affected (0.14 sec)
```

mysql> insert into department(deptId,deptName) values (1,'CSE'),(2,'Mech'),(3,'IT');

Query OK, 3 rows affected (0.07 sec)

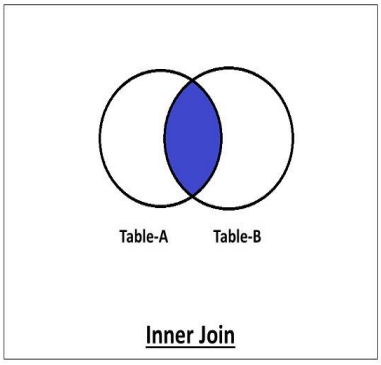
Records: 3 Duplicates: 0 Warnings: 0

mysql> select * from employee;

mysql> select * from department;

Inner Join

Inner Join is a join that can be used to return all the values that have matching values in both the tables. Inner Join can be depicted using the below diagram.



The inner join can be further divided into the following types:

1. **Equi Join**
2. **Natural Join**

1. Equi Join

Equi Join is an inner join that uses the equivalence condition for fetching the values of two tables.

Query:

mysql> Select employee.empId, employee.empName, department.deptName from employee inner join department on employee.deptId = department.deptId;

The returned values for the above query is as follows:

2. Natural Join

Natural Join is an inner join that returns the values of the two tables on the basis of a common attribute that has the same name and domain. It does not use any comparison operator. It also removes the duplicate attribute from the results.

Query:

mysql> select * from employee **natural join** department;

The above query will return the values of tables removing the duplicates.
If we want to specify the attribute names, the query will be as follows:
Query:

mysql> Select employee.empId, employee.empName, department.deptId, department.deptName from employee natural join department;

Outer Join

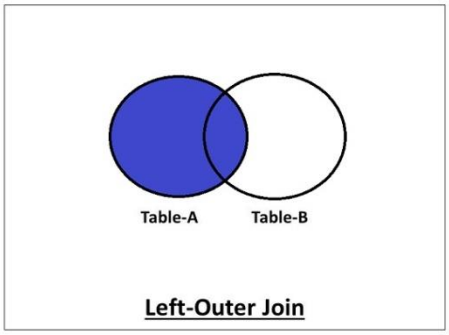
Outer Join is a join that can be used to return the records in both the tables whether it has matching records in both the tables or not.

The outer join can be further divided into three types:

1. **Left-Outer Join**
2. **Right-Outer Join**
3. **Full-Outer Join**

Left-Outer Join:

The Left-Outer Join is an outer join that returns all the values of the left table, and the values of the right table that has matching values in the left table.
If there is no matching result in the right table, it will return null values in that field. The Left-Outer Join can be depicted using the below diagram.



Left-Outer Join

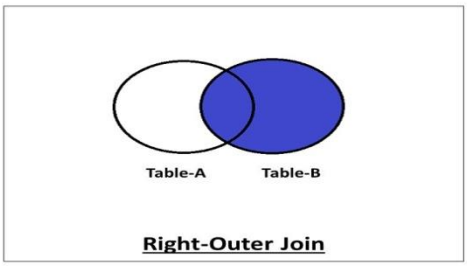
Query:

mysql> select employee.empId, employee.empName, department.deptName from employee **left outer join** department on employee.deptId = department.deptId;

2. Right-Outer Join:

The Right-Outer Join is an outer join that returns all the values of the right table, and the values of the left table that has matching values in the right table.

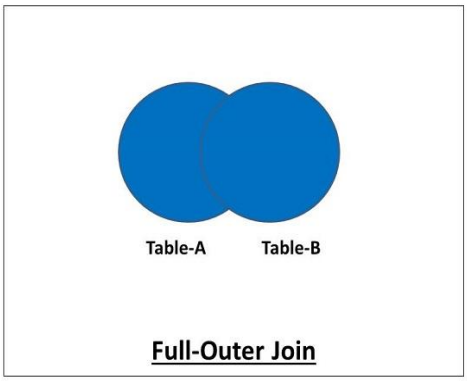
The Right-Outer Join can be depicted using the below diagram.



3. Full-Outer Join:

The Full-Outer join contains all the values of both the tables whether they have matching values in them or not.

The Full-Outer Join can be depicted using the below diagram.



Query:

mysql> select * from employee full join department;

Experiment 5

Querying(continued…)

Practice the following Queries :

- **Display all the order details of given a customer.**

```
mysql> select * from  Customers,Orders;
```

- **Display all the products:**

```
mysql> select * from Products;
```

- **Get the highest sold product from given supplierID**

```
mysql> select max(UnitsInStock) from Products;
+------------------+
```

- **List all products grouped by category**

```
mysql> select * from Products group by ProductID;
```

- **List the products , whose products unit price is greater then all the products of average.**

```
mysql> SELECT PRODUCTID, ProductName,UnitPrice FROM Products WHERE
UnitPrice IN (SELECT UnitPrice > AVG(UnitPrice) FROM Products);
Empty set (0.00 sec)
```

- **List Details of order and customer of each order**

```
mysql> SELECT *  FROM Customers  JOIN Orders ON Customers.CustomerID = Orders.CustomerID;
```

List the products which were sold in year 1997 Display categoryNamd and productname

```
mysql> SELECT   Categories.CategoryName,
Products.ProductName,
Sum(ROUND(OrderDetails.UnitPrice*Quantity)) AS ProductSales
FROM Categories
JOIN Products On Categories.CategoryID = Products.CategoryID
JOIN OrderDetails on Products.ProductID = OrderDetails.ProductID
JOIN `Orders` on Orders.OrderID = OrderDetails.OrderID
WHERE Orders.ShippedDate BETWEEN '1997-01-01' And '1997-12-31'
GROUP BY Categories.CategoryName, Products.ProductName;

Empty set (0.00 sec)

mysql> SELECT    Categories.CategoryName,    Products.ProductName,
Sum(ROUND(OrderDetails.UnitPrice*Quantity)) AS ProductSales  FROM Categories
JOIN Products On Categories.CategoryID = Products.CategoryID
JOIN OrderDetails on Products.ProductID = OrderDetails.ProductID
JOIN `Orders` on Orders.OrderID = OrderDetails.OrderID
WHERE Orders.ShippedDate BETWEEN '1997-01-01' And '2000-12-31'
GROUP BY Categories.CategoryName, Products.ProductName;
```

- **Display the total amount for each order**

```
mysql> SELECT   OrderDetails.OrderID, Sum(ROUND(OrderDetails.UnitPrice*Quantity)) AS Subtotal
FROM OrderDetails  GROUP BY OrderDetails.OrderID;
```

- **Display Order Details for given an orderID**

Order Detials: productname and unitprice for given orderID

```
mysql> select a.ProductName,b.UnitPrice from Products a,OrderDetails b where b.ProductID=a.ProductID and
b.OrderID=9003;
```

Experiment 6

Stored Procedures

Create a Procedure to display order details of given customerID like ordered, orderDate , RequiredDate, ShippedDate

```
mysql> DELIMITER ;
mysql> DELIMITER $$
mysql> CREATE PROCEDURE CustOrders(IN AtCustomerID VARCHAR(5))
BEGIN
SELECT
OrderID,
OrderDate,
RequiredDate,
ShippedDate
FROM Orders
WHERE CustomerID = AtCustomerID
ORDER BY OrderID;
END $$
Query OK, 0 rows affected (0.00 sec)

mysql> DELIMITER ;

mysql> call CustOrders(1003);
```

Create a procedure to accept a customerID and display the customer order history(productname and how much quantity ordered for that particular product)
Ex: productname , Total_quantity he/she ordered.

```
mysql> DELIMITER $$
mysql> CREATE PROCEDURE CustOrderHist(IN AtCustomerID VARCHAR(5))
  BEGIN
SELECT
ProductName,
SUM(Quantity) as TOTAL
FROM Products
INNER JOIN OrderDetails USING(ProductID)
INNER JOIN Orders USING (OrderID)
INNER JOIN Customers USING (CustomerID)
WHERE Customers.CustomerID = AtCustomerID
GROUP BY ProductName;
END $$
Query OK, 0 rows affected (0.04 sec)

mysql> DELIMITER ;

mysql> call CustOrderHist(1003);

mysql> call CustOrderHist(1002);
```

- **Create a procedure to display Ten Most Expensive Products**
  Columns should be displayed Productname & Unit price

```
mysql> DROP PROCEDURE IF EXISTS  TenMostExpensiveProducts;
Query OK, 0 rows affected, 1 warning (0.05 sec)

mysql> DELIMITER $$
mysql> CREATE PROCEDURE  TenMostExpensiveProducts()
BEGIN
SELECT
 Products.ProductName AS TenMostExpensiveProducts, Products.UnitPrice FROM Products
ORDER BY Products.UnitPrice DESC  LIMIT 10;
END $$
Query OK, 0 rows affected (0.02 sec)

mysql> DELIMITER ;

mysql> CALL TenMostExpensiveProducts ();
```

Experiment 7

Views

Create a view to display the current product list which are available(not discontinued)

```
mysql> CREATE VIEW  CurrentProductList   AS SELECT     ProductID,   ProductName  FROM Products
WHERE Discontinued = 0;
Query OK, 0 rows affected (0.05 sec)

mysql> select * from CurrentProductList;
```

Create a view to display the products by category
Display productname, quantityPerUnit,unitsInStock,Discontinued

```
mysql> CREATE VIEW ProductsbyCategory AS  SELECT    Categories.CategoryName,
Products.ProductName,  Products.QuantityPerUnit,  Products.UnitsInStock,    Products.Discontinued
FROM Categories   INNER JOIN Products ON Categories.CategoryID = Products.CategoryID
    WHERE Products.Discontinued = 0;
Query OK, 0 rows affected (0.05 sec)

mysql> select * from ProductsbyCategory;
```

Create a view as "Invoices" to display all the information from order, customer, shipper for each OrderDetails

```
-- All information (order, customer, shipper)
-- for each `Order Details` line.
-- An invoice is supposed to be per order?!

mysql> CREATE VIEW   Invoices   AS    SELECT  Orders.OrderID,
Orders.CustomerID, Orders.EmployeeID, Orders.OrderDate, Orders.RequiredDate,
Orders.ShippedDate, Orders.ShipId, Orders.ShipName,
Orders.ShipAddress,Customers.CompanyName, Customers.Address, Customers.City,
Customers.Region, Customers.PostalCode, Customers.Country  FROM Customers
INNER JOIN Orders     ON Customers.CustomerID = Orders.CustomerID;

Query OK, 0 rows affected (0.07 sec)

mysql> select * from Invoices;
```

Experiment 8

Triggers

Demonstrate Create Trigger, Alter Trigger, Drop Trigger, Row Level , Table Level triggers, Before Insert ,AfterInsert, Before Update, After Update, Before Delete, After Delete

Trigger in DBMS

Triggers are the SQL statements that are **automatically executed** when there is any change in the database. The triggers are executed **in response to certain events**(INSERT, UPDATE or DELETE) in a particular table. These triggers help in maintaining the integrity of the data by changing the data of the database in a systematic fashion.

A trigger is called a special procedure because it cannot be called directly like a stored procedure. The main difference between the trigger and procedure is that a trigger is called automatically when a data modification event is made against a table. In contrast, a stored procedure must be called explicitly.

Generally, **triggers are of two types** according to the SQL standard: row-level triggers and statement-level triggers.

Row-Level Trigger: It is a trigger, which is activated for each row by a triggering statement such as insert, update, or delete. For example, if a table has inserted, updated, or deleted multiple rows, the row trigger is fired automatically for each row affected by the insert, update, or delete statement.

Statement-Level Trigger: It is a trigger, which is fired once for each event that occurs on a table regardless of how many rows are inserted, updated, or deleted.

Types of Triggers in MySQL:

We can define the maximum six types of actions or events in the form of triggers:

1. **Before Insert:** It is activated before the insertion of data into the table.
2. **After Insert:** It is activated after the insertion of data into the table.
3. **Before Update:** It is activated before the update of data in the table.
4. **After Update:** It is activated after the update of the data in the table.
5. **Before Delete:** It is activated before the data is removed from the table.
6. **After Delete:** It is activated after the deletion of data from the table.

When we use a statement that does not use INSERT, UPDATE or DELETE query to change the data in a table, the triggers associated with the trigger will not be invoked.

Create Trigger:

Syntax

create trigger **Trigger_name** (before | after) [insert | update | delete] on [table_name] [**for** each row] [trigger_body];

1. **CREATE TRIGGER:** These two keywords specify that a triggered block is going to be declared.
2. **TRIGGER_NAME:** It creates or replaces an existing trigger with the Trigger_name. The trigger name should be unique.
3. **BEFORE | AFTER:** It specifies when the trigger will be initiated i.e. before the ongoing event or after the ongoing event.
4. **INSERT | UPDATE | DELETE**: These are the DML operations and we can use either of them in a given trigger.
5. **ON[TABLE_NAME]:** It specifies the name of the table on which the trigger is going to be applied.
6. **FOR EACH ROW:** Row-level trigger gets executed when any row value of any column changes.
7. **TRIGGER BODY:** It consists of queries that need to be executed when the trigger is called.

CREATE [OR REPLACE]

CREATE [OR REPLACE] TRIGGER trigger_name {BEFORE | AFTER | INSTEAD OF }

{INSERT [OR] | UPDATE [OR] | DELETE} [OF col_name] ON table_name

[REFERENCING OLD AS o NEW AS n] [FOR EACH ROW] WHEN (condition)

DECLARE Declaration-statements BEGIN Executable-statements

EXCEPTION Exception-handling-statements END;

Drop Trigger:

To drop trigger, use DROP command.

The syntax is as follows −

```
DROP TRIGGER IF EXISTS TriggerName;
```

To understand the above syntax, you need to have a trigger in your current database.

To check the trigger is present or not, you can use below query. We have a trigger in our database –

```
mysql> create table student(student_id int,name varchar(20), address varchar(20),marks int);
Query OK, 0 rows affected (0.12 sec)

mysql> insert into student(student_id,name,address,marks) values
(1,'billie','ny',220),(2,'eilish','london',190),(3,'ariana','miami',180);
Query OK, 3 rows affected (0.05 sec)
Records: 3  Duplicates: 0  Warnings: 0

mysql> select * from student;

mysql> create or replace  trigger add_marks before insert on student for each row set
new.marks=new.marks+100;
Query OK, 0 rows affected (0.20 sec)

mysql> select * from student;

mysql> show triggers;
```

The following is the output −

```
mysql> show triggers;
+-----------+--------+---------+----------------------------+--------+---------+----------------------------------------------------------------+-
---------------+----------------------+----------------------+--------------------+
| Trigger   | Event  | Table   | Statement                  | Timing | Created | sql_mode                                                       |
Definer       | character_set_client | collation_connection | Database Collation |
+-----------+--------+---------+----------------------------+--------+---------+----------------------------------------------------------------+-
---------------+----------------------+----------------------+--------------------+
| add_marks | INSERT | student | set new.marks=new.marks+100 | BEFORE | NULL    |
STRICT_TRANS_TABLES,NO_AUTO_CREATE_USER,NO_ENGINE_SUBSTITUTION | root@localhost | latin1            |
latin1_swedish_ci    | latin1_swedish_ci  |
+-----------+--------+---------+----------------------------+--------+---------+----------------------------------------------------------------+-
---------------+----------------------+----------------------+--------------------+
1 row in set (0.01 sec)

mysql> drop trigger if exists add_marks;

Query OK, 0 rows affected (0.01 sec)
```

Use the show triggers command to check whether the trigger is present or not. The query is as follows −

```
mysql> show triggers;
Empty set (0.00 sec)
```

Look at the above result now, the trigger is not present the database. We removed it by using drop.

Types of Triggers in MySQL:

Examples:

mysql> create table Students (sid CHAR(20) , name char (30) , login char(20) , age int,

gpa REAL, UNIQUE (name, age), UNIQUE(login), CONSTRAINT StudentsKey PRIMARY KEY (sid));

Query OK, 0 rows affected (0.19 sec)

mysql> create table Enrolled (sid CHAR(20), cid CHAR(20), grade CHAR(2), PRIMARY KEY (sid,cid), FOREIGN KEY (sid) REFERENCES Students(sid));

Query OK, 0 rows affected (0.10 sec)

mysql> INSERT INTO Students (sid, name,login,age,gpa) VALUES (53666,'Jones','jones@cs',18,3.4);

Query OK, 1 row affected (0.10 sec)

mysql> INSERT INTO Students (sid, name,login,age,gpa) VALUES (53688,'Smith','Smith@ee',18,3.2);

Query OK, 1 row affected (0.02 sec)

mysql> INSERT INTO Students (sid, name,login,age,gpa) VALUES (53667,'Raj','Raj@cs',20,4.4);

Query OK, 1 row affected (0.05 sec)

mysql> INSERT INTO Students (sid, name,login,age,gpa) VALUES (53650, 'Smith', 'smith@math',19,3.8);

Query OK, 1 row affected (0.03 sec)

```
mysql> select * from students;

mysql> INSERT INTO Enrolled(sid, cid,grade) VALUES (53666, 'History105', 'B');

Query OK, 1 row affected (0.05 sec)


mysql> INSERT INTO Enrolled(sid, cid,grade) VALUES (53650, 'Topology112', 'A');

Query OK, 1 row affected (0.04 sec)


mysql> INSERT INTO Enrolled(sid, cid,grade) VALUES (53688, 'Reggae203', 'B');

Query OK, 1 row affected (0.04 sec)


mysql> INSERT INTO Enrolled(sid, cid,grade) VALUES (53688, 'Carnatic101', 'C');

Query OK, 1 row affected (0.05 sec)


mysql> select * from Enrolled;
```

Before insert triggers

```
mysql> delimiter //

mysql> Create Trigger before_insert_students BEFORE INSERT ON Students FOR EACH
ROW

    begin

if new.age<18 then set new.age=18;

end if;

end//
```

```
Query OK, 0 rows affected (0.08 sec)

mysql> insert into Students values(55555,'xq','xq@we',15,3.5);

Query OK, 1 row affected (0.10 sec)

mysql> select * from Students;
```

After insert triggers

```
/*
```

Write a query to invoke trigger after inserting a row in students table such that the newly inserted sid in students table should even reflect in enrolled table as shown in output.

```
*/

mysql> drop trigger if exists after_insert_details;

Query OK, 0 rows affected (1.42 sec)

mysql> DELIMITER //

mysql> Create Trigger after_insert_details

    AFTER INSERT ON Students FOR EACH ROW

    BEGIN

   INSERT INTO Enrolled VALUES (new.sid, 'History', 'A');

    END //

Query OK, 0 rows affected (0.25 sec)

mysql> insert into Students values(55556, 'xq1', 'xq1@we',15,3.5);

Query OK, 1 row affected (0.40 sec)

mysql> select * from Students;

mysql> select * from Enrolled;
```

Before update trigger

/* Write a query to invoke trigger before updating a row in students table such that the newly updated gpa in students table if exceeds 10 then make it 10.

*/

```
mysql>drop trigger if exists before_update_students;

Query OK, 0 rows affected (1.42 sec)


mysql> DELIMITER //

mysql> CREATE TRIGGER before_update_students

    BEFORE UPDATE

    ON Students FOR EACH ROW

    BEGIN

       IF new.gpa > 10 THEN

       set new.gpa=10;

      END IF;

   END //

Query OK, 0 rows affected (0.10 sec)

mysql> update Students set gpa=20 where sid=55555;

Query OK, 1 row affected (0.07 sec)

Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from Students;
```

After update trigger

/* Write a query to invoke trigger after updating a row in students table such that the newly updated sid in students table should even reflect in enrolled table as shown in output.

```
mysql>drop trigger if exists after_update_students;

Query OK, 0 rows affected (1.42 sec)

mysql> DELIMITER //
mysql> SET FOREIGN_KEY_CHECKS = 0; //
Query OK, 0 rows affected (0.00 sec)

mysql> Create Trigger after_update_students
   AFTER UPDATE ON Students FOR EACH ROW
    BEGIN
   UPDATE Enrolled SET sid=new.sid where sid=old.sid;
   END //
Query OK, 0 rows affected (0.15 sec)

mysql> update Students set sid=66666 where sid=55556;

Query OK, 1 rows affected (0.15 sec)

Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from Students;

mysql> select * from Enrolled;
```

Trigger Before Deleting:

/* Write a query to invoke trigger before deleting a row in students table such that the newly deleted row in students table should be added to new table called studentsdeleted.

```
mysql> delete from Enrolled where sid=55555;

Query OK, 0 rows affected (0.00 sec)

mysql> drop table if exists studentsdeleted;

Query OK, 0 rows affected, 1 warning (0.00 sec)
```

```
mysql> CREATE TABLE studentsdeleted(sid CHAR(20),name CHAR (30),login
CHAR(20),age INTEGER,gpa REAL, UNIQUE (name, age), UNIQUE(login),CONSTRAINT
StudentsKey PRIMARY KEY (sid));

Query OK, 0 rows affected (0.11 sec)

mysql> drop trigger if exists before_delete_students;

Query OK, 0 rows affected, 1 warning (0.00 sec)

mysql> DELIMITER //

mysql> CREATE TRIGGER before_delete_students

BEFORE DELETE

ON Students FOR EACH ROW

BEGIN

INSERT INTO studentsdeleted values(old.sid,old.name,old.login,old.age,old.gpa);

END //

Query OK, 0 rows affected (0.10 sec)

mysql> delete from Students where sid=55555;

Query OK, 1 row affected (0.06 sec)

mysql> select * from Students;

mysql> select * from studentsdeleted;
```

Trigger after delete

/* Write a query to invoke trigger after deleting a row in students table such that the deleted sid in students table should even be deleted in enrolled table.

```
mysql> drop trigger if exists after_delete_students;

Query OK, 0 rows affected, 1 warning (0.00 sec)
```

```
mysql> DELIMITER //
mysql> SET FOREIGN_KEY_CHECKS = 0;
    Create Trigger after_delete_students
    AFTER DELETE ON Students FOR EACH ROW
    BEGIN
    DELETE FROM Enrolled where sid=old.sid;
    END //
Query OK, 0 rows affected (0.00 sec)
mysql> DELETE FROM Students where sid=66666;
Query OK, 0 rows affected (0.00 sec)
mysql> select * from Students;
mysql> select * from Enrolled;
```

Experiment 9

Demonstrate the role of DBA using DCL commands

The *Data Control Language* is a subset of the Structured Query Language. Database administrators use DCL to configure security access to relational databases. It complements the *Data Definition Language*, which adds and deletes database objects, and the *Data Manipulation Language*, which retrieves, inserts, and modifies the contents of a database.

DCL is the simplest of the SQL subsets, as it consists of only three commands: GRANT, REVOKE, and DENY. Combined, these three commands provide administrators with the flexibility to set and remove database permissions in granular fashion.

Adding Permissions With the GRANT Command

The GRANT command adds new permissions to a database user. It has a very simple syntax, defined as follows:

```
GRANT [privilege]   ON [object]   TO [user]      [WITH GRANT OPTION]
```

Here's the rundown on each of the parameters you can supply with this command:

- **Privilege** — can be either the keyword ALL (to grant a wide variety of permissions) or a specific database permission or set of permissions. Examples include CREATE DATABASE, SELECT, INSERT, UPDATE, DELETE, EXECUTE and CREATE VIEW.
- **Object** — can be any database object. The valid privilege options vary based on the type of database object you include in this clause. Typically, the object will be either a database, function, stored procedure, table or view.
- **User** — can be any database user. You can also substitute a role for the user in this clause if you wish to make use of role-based database security.
- If you include the optional **WITH GRANT OPTION** clause at the end of the GRANT command, you not only grant the specified user the permissions defined in the SQL statement but also give the user permission to further grant those same permissions to *other* database users. For this reason, use this clause with care.

For example, assume you wish to grant the user *Joe* the ability to retrieve information from the *employee* table in a database called *HR*. Use the following SQL command:

```
GRANT    SELECT   ON    HR.employees   TO   Joe
```

Joe can retrieve information from the employees' table. He will not, however, be able to grant other users permission to retrieve information from that table because the DCL script did not include the WITH GRANT OPTION clause.

Revoking Database Access

The REVOKE command removes database access from a user previously granted such access. The syntax for this command is defined as follows:

```
REVOKE [GRANT OPTION FOR] [permission]  ON [object]  FROM [user]
                    [CASCADE]
```

Here's the rundown on the parameters for the REVOKE command:

- **Permission** — specifies the database permissions to remove from the identified user. The command revokes both GRANT and DENY assertions previously made for the identified permission.
- **Object** — can be any database object. The valid privilege options vary based on the type of database object you include in this clause. Typically, the object will be either a database, function, stored procedure, table, or view.
- **User** — can be any database user. You can also substitute a role for the user in this clause if you wish to make use of role-based database security.
- The **GRANT OPTION FOR** clause removes the specified user's ability to grant the specified permission to other users. If you include the **GRANT OPTION FOR** clause in a REVOKE statement, the primary permission is not revoked. This clause revokes only the granting ability.
- The **CASCADE** option also revokes the specified permission from any users that the specified user granted the permission.

The following command revokes the permission granted to Joe in the previous example:

```
REVOKE    SELECT  ON   HR.employees  FROM    Joe
```