Experiment 1 : Create Table with Constraints

A. NOT NULL

Ensures a column cannot have NULL (empty) values.

B. UNIQUE

Ensures all values in a column are different.

C. PRIMARY KEY

Uniquely identifies each record in a table (NOT NULL + UNIQUE)

D. FOREIGN KEY

Links one table to another using a referenced key.

E. CHECK

Ensures that all values in a column satisfy a specific condition.

F. DEFAULT

Assigns a default value to a column if no value is provided.

G. CREATE INDEX

Improves the speed of data retrieval from a table.

Experiments:

A. NOT NULL

Code:

create table student(id int not null,name varchar2(50) not null);

```
SQL> create table student(id int not null,name varchar2(50) not null);

Table created.
```

Output:

```
SQL> desc student
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ID                                        NOT NULL NUMBER(38)
 NAME                                      NOT NULL VARCHAR2(50)
```

B. UNIQUE

Code:

create table student_uni(roll_no int unique,email varchar2(100) unique);

```
SQL> create table student_uni(roll_no int unique,email varchar2(100) unique);

Table created.
```

Output:

```
SQL> desc student_uni
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ROLL_NO                                            NUMBER(38)
 EMAIL                                              VARCHAR2(100)

SQL> create table student_pri(roll_no int primary key,name varchar2(100));
```

C. PRIMARY KEY

Code:

create table student_pri(roll_no int primary key,name varchar2(100));

```
SQL> create table student_pri(roll_no int primary key,name varchar2(100));

Table created.
```

Output:

```
SQL> desc student_pri
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ROLL_NO                                   NOT NULL NUMBER(38)
 NAME                                               VARCHAR2(100)
```

D. FOREIGN KEY

Code:

create table dept(dept_id int primary key,dept_name varchar2(100));
create table student_fore(roll_no int primary key,dept_id int,foreign key (dept_id) references dept(dept_id));

```
SQL> create table dept(dept_id int primary key,dept_name varchar2(100));

Table created.

SQL> create table student_fore(roll_no int primary key,dept_id int,foreign key (dept_id) references dept(dept_id));

Table created.
```

Output:

```
SQL> desc student_fore
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ROLL_NO                                   NOT NULL NUMBER(38)
 DEPT_ID                                            NUMBER(38)
```

E. CHECK

Code:

create table student_check(id int primary key,age int check(age>=18));

```
SQL> create table student_check(id int primary key,age int check(age>=18));

Table created.
```

Output:

```
SQL> desc student_check
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ID                                        NOT NULL NUMBER(38)
 AGE                                                NUMBER(38)
```

F. DEFAULT

Code:

create table student_default(id int primary key,city varchar2(50) default 'kadiri');

```
SQL> create table student_default(id int primary key,city varchar2(50) default 'kadiri');

Table created.
```

Output:1

G. CREATE INDEX

Code:

create index idx_name on student_pri(name);

```
SQL> create index idx_name on student_pri(name);

Index created.
```

Output:1

Experiment 2 : INSERT Command

1. Insert values with single entry
2. Insert values with multiple entires
3. ALTER Table Structure
4. VIEW Table structure
5. UPDATE table
6. DELETE Rows in table

Source Code:

```
-- ========================================
-- EXPERIMENT 2: INSERT COMMAND
-- ========================================

-- Step 1: Create and use database
CREATE DATABASE IF NOT EXISTS DBMS_Experiments;
USE DBMS_Experiments;

-- Step 2: Create necessary tables (so INSERT has targets)
CREATE TABLE IF NOT EXISTS Students (
    StudentID INT PRIMARY KEY,
    FirstName VARCHAR(50) NOT NULL,
    LastName VARCHAR(50),
    Email VARCHAR(100) UNIQUE,
    Age INT CHECK (Age >= 18),
    City VARCHAR(50) DEFAULT 'Unknown'
);

CREATE TABLE IF NOT EXISTS Courses (
    CourseID INT PRIMARY KEY,
    CourseName VARCHAR(100) NOT NULL
);

CREATE TABLE IF NOT EXISTS Enrollments (
    EnrollmentID INT PRIMARY KEY,
    StudentID INT,
    CourseID INT,
    FOREIGN KEY (StudentID) REFERENCES Students(StudentID),
    FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)
);

-- ========================================
-- INSERT COMMANDS
-- ========================================

-- 1  Insert values with single entry
INSERT INTO Students (StudentID, FirstName, LastName, Email, Age, City)
VALUES (1, 'John', 'Doe', 'john.doe@example.com', 20, 'New York');

-- 2  Insert values with multiple entries
INSERT INTO Students (StudentID, FirstName, LastName, Email, Age, City)
VALUES
(2, 'Alice', 'Smith', 'alice.smith@example.com', 22, 'Boston'),
(3, 'Bob', 'Brown', 'bob.brown@example.com', 21, 'Chicago'),
(4, 'Mary', 'Johnson', 'mary.johnson@example.com', 19, DEFAULT);

-- 3  Insert into Courses table
INSERT INTO Courses (CourseID, CourseName)
VALUES
(101, 'Database Systems'),
(102, 'Operating Systems'),
```

```
(103, 'Computer Networks');

-- 4   Insert into Enrollments table
INSERT INTO Enrollments (EnrollmentID, StudentID, CourseID)
VALUES
(1, 1, 101),
(2, 2, 102),
(3, 3, 103),
(4, 4, 101);

-- ========================================
-- VIEW INSERTED DATA
-- ========================================
SELECT * FROM Students;
SELECT * FROM Courses;
SELECT * FROM Enrollments;
```

Program:

```sql
-- Step 1: Create and use database
CREATE DATABASE IF NOT EXISTS DBMS_Experiments;
USE DBMS_Experiments;

-- Step 2: Create necessary tables (so INSERT has targets)
CREATE TABLE IF NOT EXISTS Students (
    StudentID INT PRIMARY KEY,
    FirstName VARCHAR(50) NOT NULL,
    LastName VARCHAR(50),
    Email VARCHAR(100) UNIQUE,
    Age INT CHECK (Age >= 18),
    City VARCHAR(50) DEFAULT 'Unknown'
);

CREATE TABLE IF NOT EXISTS Courses (
    CourseID INT PRIMARY KEY,
    CourseName VARCHAR(100) NOT NULL
);

CREATE TABLE IF NOT EXISTS Enrollments (
    EnrollmentID INT PRIMARY KEY,
    StudentID INT,
    CourseID INT,
    FOREIGN KEY (StudentID) REFERENCES Students(StudentID),
    FOREIGN KEY (CourseID) REFERENCES Courses(CourseID)
);

-- ========================================
-- INSERT COMMANDS
-- ========================================

-- 1. Insert values with single entry
INSERT INTO Students (StudentID, FirstName, LastName, Email, Age, City)
VALUES (1, 'John', 'Doe', 'john.doe@example.com', 20, 'New York');

-- 2. Insert values with multiple entries
INSERT INTO Students (StudentID, FirstName, LastName, Email, Age, City)
VALUES
(2, 'Alice', 'Smith', 'alice.smith@example.com', 22, 'Boston'),
(3, 'Bob', 'Brown', 'bob.brown@example.com', 21, 'Chicago'),
(4, 'Mary', 'Johnson', 'mary.johnson@example.com', 19, DEFAULT);
```

```sql
-- 3 Insert into Courses table
INSERT INTO Courses (CourseID, CourseName)
VALUES
(101, 'Database Systems'),
(102, 'Operating Systems'),
(103, 'Computer Networks');
-- 4 Insert into Enrollments table
INSERT INTO Enrollments (EnrollmentID, StudentID, CourseID)
VALUES
(1, 1, 101),
(2, 2, 102),
(3, 3, 103),
(4, 4, 101);
-- ========================================
-- VIEW INSERTED DATA
-- ========================================
SELECT * FROM Students;
SELECT * FROM Courses;
SELECT * FROM Enrollments;
```

Output:

Result Grid | Filter Rows: | Edit: | Export/Import:

StudentID	FirstName	LastName	Email	Age	City
1	John	Doe	john.doe@example.com	20	New York
2	Alice	Smith	alice.smith@example.com	22	Boston
3	Bob	Brown	bob.brown@example.com	21	Chicago
4	Mary	Johnson	mary.johnson@example.com	19	Unknown
NULL	NULL	NULL	NULL	NULL	NULL

Result Grid | Filter Rows:

EnrollmentID	StudentID	CourseID
1	1	101
2	2	102
3	3	103
4	4	101
NULL	NULL	NULL

Result Grid | Filter Rows:

CourseID	CourseName
101	Database Systems
102	Operating Systems
103	Computer Networks
NULL	NULL

Experiment 3 :Aggregate Functions

Source Code:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;

-- Create table
CREATE TABLE marks (
   student_name VARCHAR(50),
   subject VARCHAR(50),
   score INT
);

-- Insert sample data
INSERT INTO marks VALUES
('Manasa', 'DBMS', 90),
('Ravi', 'DBMS', 80),
('Priya', 'Math', 95),
('Kiran', 'Math', 65),
('Meena', 'Math', 60);

-- Display all records
SELECT * FROM marks;

-- Aggregate functions demonstration
SELECT
   MIN(score) AS min_score,
   MAX(score) AS max_score,
   COUNT(*) AS total_students,
   SUM(score) AS total_score,
   AVG(score) AS avg_score
FROM marks;
```

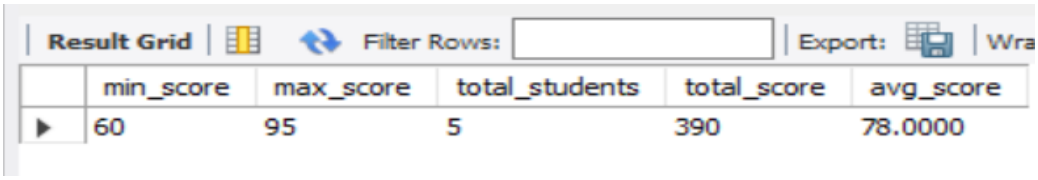
Program:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;
-- Create table
CREATE TABLE marks (
    student_name VARCHAR(50),
    subject VARCHAR(50),
    score INT
);
-- Insert sample data
INSERT INTO marks VALUES
('Manasa', 'DBMS', 90),
('Ravi', 'DBMS', 80),
('Priya', 'Math', 95),
('Kiran', 'Math', 65),
('Meena', 'Math', 60);
-- Display all records
SELECT * FROM marks;
-- Aggregate functions demonstration
SELECT
    MIN(score) AS min_score,
    MAX(score) AS max_score,
    COUNT(*) AS total_students,
    SUM(score) AS total_score,
    AVG(score) AS avg_score
FROM marks;
```

Output:

Result Grid | Filter Rows:

student_name	subject	score
Manasa	DBMS	90
Ravi	DBMS	80
Priya	Math	95
Kiran	Math	65
Meena	Math	60



Result Grid | Filter Rows: | Export: | Wra

	min_score	max_score	total_students	total_score	avg_score
▶	60	95	5	390	78.0000

Experiment 4 :Group By and Order By

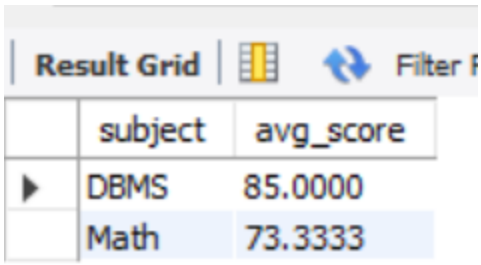
Source Code:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;
CREATE TABLE marks (
   student_name VARCHAR(50),
   subject VARCHAR(50),
   score INT
);
INSERT INTO marks VALUES
('Manasa', 'DBMS', 90),
('Ravi', 'DBMS', 80),
('Priya', 'Math', 95),
('Kiran', 'Math', 65),
('Meena', 'Math', 60);
-- Average score per subject
SELECT subject, AVG(score) AS avg_score
FROM marks
GROUP BY subject;
-- Order students by score descending
SELECT student_name, score
FROM marks
ORDER BY score DESC;
```

Program:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;
CREATE TABLE marks (
    student_name VARCHAR(50),
    subject VARCHAR(50),
    score INT
);
INSERT INTO marks VALUES
('Manasa', 'DBMS', 90),
('Ravi', 'DBMS', 80),
('Priya', 'Math', 95),
('Kiran', 'Math', 65),
('Meena', 'Math', 60);
-- Average score per subject
SELECT subject, AVG(score) AS avg_score
FROM marks
GROUP BY subject;
-- Order students by score descending
SELECT student_name, score
FROM marks
ORDER BY score DESC;
```

Output:1



subject	avg_score
DBMS	85.0000
Math	73.3333

Experiment 5 : Ascending, Descending

Source Code:

```
-- Create database
CREATE DATABASE IF NOT EXISTS college;
USE college;

-- Create table
DROP TABLE IF EXISTS student;
CREATE TABLE student (
   id INT PRIMARY KEY,
   name VARCHAR(30),
   age INT,
   branch VARCHAR(10)
);

-- Insert sample data
INSERT INTO student VALUES
(1, 'Manasa', 20, 'CSE'),
(2, 'Ravi', 22, 'ECE'),
(3, 'Kiran', 21, 'CSE'),
(4, 'Priya', 19, 'EEE'),
(5, 'Arjun', 23, 'MECH');

-- View all records
SELECT * FROM student;

-- Ascending order by name
SELECT * FROM student
ORDER BY name ASC;

-- Descending order by age
SELECT * FROM student
ORDER BY age DESC;
```

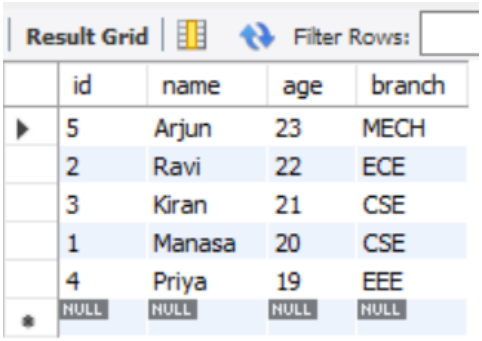
Program:

```sql
-- Create database
CREATE DATABASE IF NOT EXISTS college;
USE college;
-- Create table
DROP TABLE IF EXISTS student;
CREATE TABLE student (
    id INT PRIMARY KEY,
    name VARCHAR(30),
    age INT,
    branch VARCHAR(10)
);
-- Insert sample data
INSERT INTO student VALUES
(1, 'Manasa', 20, 'CSE'),
(2, 'Ravi', 22, 'ECE'),
(3, 'Kiran', 21, 'CSE'),
(4, 'Priya', 19, 'EEE'),
(5, 'Arjun', 23, 'MECH');
-- View all records
SELECT * FROM student;
-- Ascending order by name
SELECT * FROM student
ORDER BY name ASC;
-- Descending order by age
SELECT * FROM student
ORDER BY age DESC;
```

Output:1

Result Grid | Filter Rows:

id	name	age	branch
1	Manasa	20	CSE
2	Ravi	22	ECE
3	Kiran	21	CSE
4	Priya	19	EEE
5	Arjun	23	MECH
NULL	NULL	NULL	NULL



Result Grid | Filter Rows:

id	name	age	branch
5	Arjun	23	MECH
2	Ravi	22	ECE
3	Kiran	21	CSE
1	Manasa	20	CSE
4	Priya	19	EEE
NULL	NULL	NULL	NULL

Experiment 6 :SQL Operators

1. Like operator (%,-)
2. Between & or

Source Code:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;
CREATE TABLE student (
   student_id INT PRIMARY KEY,
   name VARCHAR(50),
   age INT,
   dept_id INT
);
INSERT INTO student VALUES
(101, 'Manasa', 20, 1),
(102, 'Ravi', 21, 2),
(103, 'Priya', 19, 1),
(104, 'Kiran', 22, 1),
(105, 'Meena', 20, 3);
-- LIKE operator
SELECT * FROM student WHERE name LIKE 'M%';
SELECT * FROM student WHERE name LIKE '%an%';
-- BETWEEN operator
```

SELECT * FROM student WHERE age BETWEEN 19 AND 21;
-- IN operator
SELECT * FROM student WHERE dept_id IN (1, 3);

Program:

```
DROP DATABASE IF EXISTS college;
CREATE DATABASE college;
USE college;
CREATE TABLE student (
    student_id INT PRIMARY KEY,
    name VARCHAR(50),
    age INT,
    dept_id INT
);
INSERT INTO student VALUES
(101, 'Manasa', 20, 1),
(102, 'Ravi', 21, 2),
(103, 'Priya', 19, 1),
(104, 'Kiran', 22, 1),
(105, 'Meena', 20, 3);
-- LIKE operator
SELECT * FROM student WHERE name LIKE 'M%';
SELECT * FROM student WHERE name LIKE '%an%';
-- BETWEEN operator
SELECT * FROM student WHERE age BETWEEN 19 AND 21;
-- IN operator
SELECT * FROM student WHERE dept_id IN (1, 3);
```

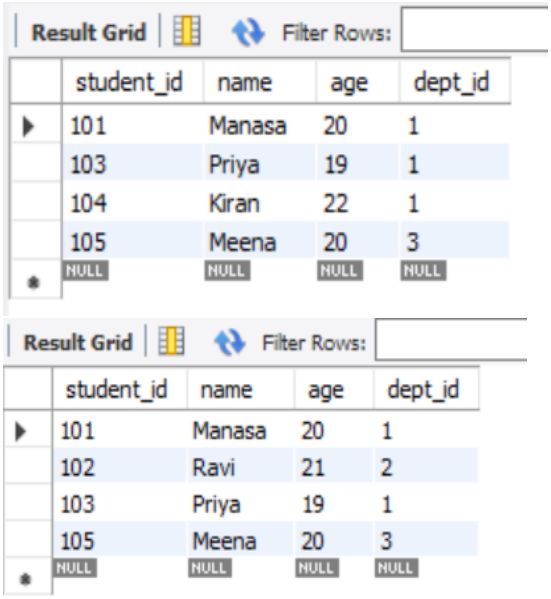
Output:

Result Grid | Filter Rows:

student_id	name	age	dept_id
101	Manasa	20	1
104	Kiran	22	1
NULL	NULL	NULL	NULL

Result Grid | Filter Rows:

student_id	name	age	dept_id
101	Manasa	20	1
105	Meena	20	3
NULL	NULL	NULL	NULL



Result Grid | Filter Rows:

student_id	name	age	dept_id
101	Manasa	20	1
103	Priya	19	1
104	Kiran	22	1
105	Meena	20	3
NULL	NULL	NULL	NULL

Result Grid | Filter Rows:

student_id	name	age	dept_id
101	Manasa	20	1
102	Ravi	21	2
103	Priya	19	1
105	Meena	20	3
NULL	NULL	NULL	NULL

Experiment 7 : SQL Joins

1. Inner Join
2. Left Join
3. Right Join
4. Outer Join
5. Left Join exclude Inner Join
6. Right Join exclude Inner Join
7. Outer Join exclude Inner Jain

Source Code:

```
-- Create tables
DROP TABLE IF EXISTS Students;
DROP TABLE IF EXISTS Courses;
CREATE TABLE Students (
    StudentID INT,
    Name VARCHAR(50),
    CourseID INT
```

```
);

CREATE TABLE Courses (
    CourseID INT,
    CourseName VARCHAR(50)
);

-- Insert data
INSERT INTO Students VALUES
(1, 'John', 101),
(2, 'Emma', 102),
(3, 'Raj', 103),
(4, 'Sara', NULL);

INSERT INTO Courses VALUES
(101, 'Math'),
(102, 'Science'),
(104, 'History');

-- 1. INNER JOIN
SELECT s.Name, c.CourseName
FROM Students s
INNER JOIN Courses c ON s.CourseID = c.CourseID;

-- 2. LEFT JOIN
SELECT s.Name, c.CourseName
FROM Students s
LEFT JOIN Courses c ON s.CourseID = c.CourseID;

-- 3. RIGHT JOIN
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID;

-- 4. FULL OUTER JOIN (some databases: use UNION of LEFT + RIGHT)
SELECT s.Name, c.CourseName
FROM Students s
LEFT JOIN Courses c ON s.CourseID = c.CourseID
UNION
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID;

-- 5. LEFT JOIN EXCLUDING INNER JOIN
SELECT s.Name, c.CourseName
FROM Students s
```

LEFT JOIN Courses c ON s.CourseID = c.CourseID
WHERE c.CourseID IS NULL;

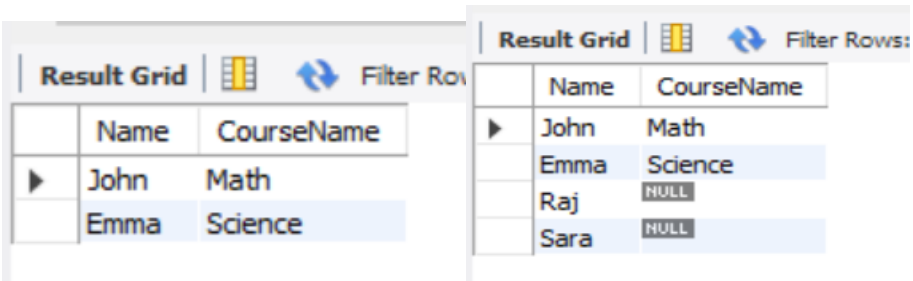
-- 6. RIGHT JOIN EXCLUDING INNER JOIN
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID
WHERE s.CourseID IS NULL;

Program:

```sql
-- Create tables
DROP TABLE IF EXISTS Students;
DROP TABLE IF EXISTS Courses;
CREATE TABLE Students (
    StudentID INT,
    Name VARCHAR(50),
    CourseID INT
);
CREATE TABLE Courses (
    CourseID INT,
    CourseName VARCHAR(50)
);
-- Insert data
INSERT INTO Students VALUES
(1, 'John', 101),
(2, 'Emma', 102),
(3, 'Raj', 103),
(4, 'Sara', NULL);
INSERT INTO Courses VALUES
(101, 'Math'),
(102, 'Science'),
(104, 'History');
-- 1. INNER JOIN
SELECT s.Name, c.CourseName
FROM Students s
INNER JOIN Courses c ON s.CourseID = c.CourseID;
-- 2. LEFT JOIN
SELECT s.Name, c.CourseName
FROM Students s
LEFT JOIN Courses c ON s.CourseID = c.CourseID;
-- 3. RIGHT JOIN
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID;
-- 4. FULL OUTER JOIN (some databases: use UNION of LEFT + RIGHT)
SELECT s.Name, c.CourseName
FROM Students s
LEFT JOIN Courses c ON s.CourseID = c.CourseID
UNION
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID;
-- 5. LEFT JOIN EXCLUDING INNER JOIN
```

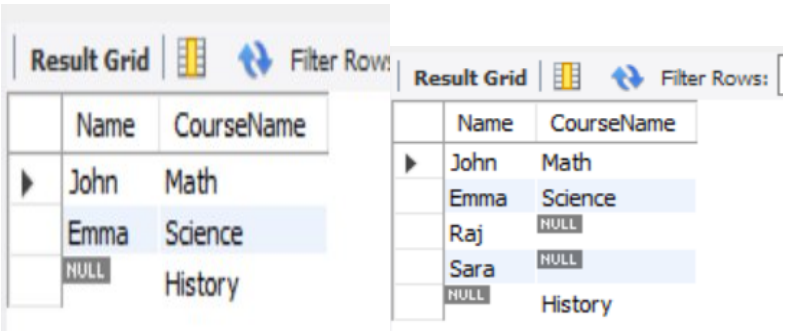
```sql
SELECT s.Name, c.CourseName
FROM Students s
LEFT JOIN Courses c ON s.CourseID = c.CourseID
WHERE c.CourseID IS NULL;
-- 6. RIGHT JOIN EXCLUDING INNER JOIN
SELECT s.Name, c.CourseName
FROM Students s
RIGHT JOIN Courses c ON s.CourseID = c.CourseID
WHERE s.CourseID IS NULL;
```

Output:



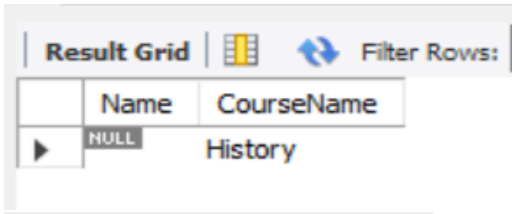
Name	CourseName
John	Math
Emma	Science

Name	CourseName
John	Math
Emma	Science
Raj	NULL
Sara	NULL

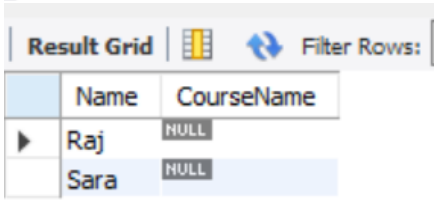


Name	CourseName
John	Math
Emma	Science
NULL	History

Name	CourseName
John	Math
Emma	Science
Raj	NULL
Sara	NULL
NULL	History



Name	CourseName
NULL	History



Name	CourseName
Raj	NULL
Sara	NULL

Experiment 8 : Normal Forms

1. INF

Source Code:

```
DROP DATABASE IF EXISTS normalforms;

CREATE DATABASE normalforms;

USE normalforms;


CREATE TABLE orders_1nf (
   order_id INT,
   customer_name VARCHAR(30),
   product VARCHAR(30),
   quantity INT
);
```

INSERT INTO orders_1nf VALUES

(1, 'Manasa', 'Pen', 10),

(1, 'Manasa', 'Book', 2),

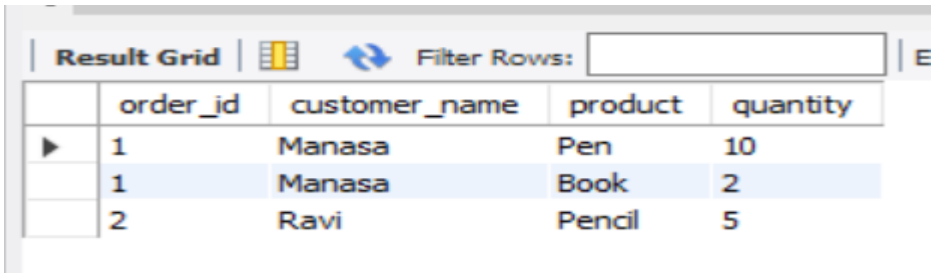
(2, 'Ravi', 'Pencil', 5);

SELECT * FROM orders_1nf;

Program:

```
DROP DATABASE IF EXISTS normalforms;
CREATE DATABASE normalforms;
USE normalforms;

CREATE TABLE orders_1nf (
    order_id INT,
    customer_name VARCHAR(30),
    product VARCHAR(30),
    quantity INT
);

INSERT INTO orders_1nf VALUES
(1, 'Manasa', 'Pen', 10),
(1, 'Manasa', 'Book', 2),
(2, 'Ravi', 'Pencil', 5);
SELECT * FROM orders_1nf;
```

Output:



order_id	customer_name	product	quantity
1	Manasa	Pen	10
1	Manasa	Book	2
2	Ravi	Pencil	5

2. 2NF

Source Code:

```
-- Clean safely (drop children first)
DROP TABLE IF EXISTS items;
DROP TABLE IF EXISTS orders_2nf;
DROP TABLE IF EXISTS customer;
-- Recreate tables
CREATE TABLE customer (
  cust_id INT PRIMARY KEY,
  cust_name VARCHAR(30)
);
CREATE TABLE orders_2nf (
  order_id INT PRIMARY KEY,
  cust_id INT,
  FOREIGN KEY (cust_id) REFERENCES customer(cust_id)
);
CREATE TABLE items (
  item_id INT PRIMARY KEY,
  order_id INT,
  product VARCHAR(30),
  quantity INT,
  FOREIGN KEY (order_id) REFERENCES orders_2nf(order_id)
);
-- Insert data
INSERT INTO customer VALUES (1, 'Manasa'), (2, 'Ravi');
INSERT INTO orders_2nf VALUES (101, 1), (102, 2);
INSERT INTO items VALUES
```

(1, 101, 'Pen', 10),

(2, 101, 'Book', 2),

(3, 102, 'Pencil', 5);

-- Verify

SELECT o.order_id, c.cust_name, i.product, i.quantity

FROM orders_2nf o

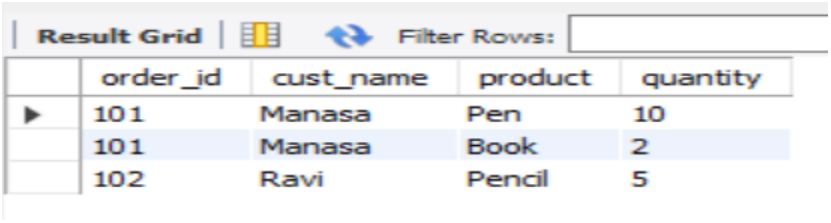
JOIN customer c ON o.cust_id = c.cust_id

JOIN items i ON o.order_id = i.order_id;

Program:

```
-- Clean safely (drop children first)
DROP TABLE IF EXISTS items;
DROP TABLE IF EXISTS orders_2nf;
DROP TABLE IF EXISTS customer;
-- Recreate tables
CREATE TABLE customer (
  cust_id INT PRIMARY KEY,
  cust_name VARCHAR(30)
);
CREATE TABLE orders_2nf (
  order_id INT PRIMARY KEY,
  cust_id INT,
  FOREIGN KEY (cust_id) REFERENCES customer(cust_id)
);
CREATE TABLE items (
  item_id INT PRIMARY KEY,
  order_id INT,
  product VARCHAR(30),
  quantity INT,
  FOREIGN KEY (order_id) REFERENCES orders_2nf(order_id)
);
-- Insert data
INSERT INTO customer VALUES (1, 'Manasa'), (2, 'Ravi');
INSERT INTO orders_2nf VALUES (101, 1), (102, 2);
INSERT INTO items VALUES
  (1, 101, 'Pen', 10),
  (2, 101, 'Book', 2),
  (3, 102, 'Pencil', 5);
-- Verify
SELECT o.order_id, c.cust_name, i.product, i.quantity
FROM orders_2nf o
JOIN customer c ON o.cust_id = c.cust_id
JOIN items i ON o.order_id = i.order_id;
```

Output:



Result Grid | Filter Rows:

order_id	cust_name	product	quantity
101	Manasa	Pen	10
101	Manasa	Book	2
102	Ravi	Pencil	5

3. 3NF

Source Code:

```
    -- Create database
CREATE DATABASE normalforms3;
USE normalforms3;
-- Tables for 3NF
CREATE TABLE city (
  city_name VARCHAR(30) PRIMARY KEY,
  state VARCHAR(30)
);
CREATE TABLE customer (
  cust_id INT PRIMARY KEY,
  cust_name VARCHAR(30),
  city_name VARCHAR(30),
  FOREIGN KEY (city_name) REFERENCES city(city_name)
);
CREATE TABLE orders (
  order_id INT PRIMARY KEY,
  cust_id INT,
  product VARCHAR(30),
  quantity INT,
  FOREIGN KEY (cust_id) REFERENCES customer(cust_id)
);
-- Insert data
INSERT INTO city VALUES
('Vijayawada', 'Andhra Pradesh'),
('Hyderabad', 'Telangana');
INSERT INTO customer VALUES
(1, 'Manasa', 'Vijayawada'),
(2, 'Ravi', 'Hyderabad');
INSERT INTO orders VALUES
(101, 1, 'Pen', 10),
(102, 1, 'Book', 5),
(103, 2, 'Pencil', 6);
-- Display result
SELECT o.order_id, c.cust_name, c.city_name, ci.state, o.product, o.quantity
FROM orders o
JOIN customer c ON o.cust_id = c.cust_id
JOIN city ci ON c.city_name = ci.city_name;
```

Program:

```sql
-- Create database
CREATE DATABASE normalforms3;
USE normalforms3;
-- Tables for 3NF
CREATE TABLE city (
  city_name VARCHAR(30) PRIMARY KEY,
  state VARCHAR(30)
);
CREATE TABLE customer (
  cust_id INT PRIMARY KEY,
  cust_name VARCHAR(30),
  city_name VARCHAR(30),
  FOREIGN KEY (city_name) REFERENCES city(city_name)
);
CREATE TABLE orders (
  order_id INT PRIMARY KEY,
  cust_id INT,
  product VARCHAR(30),
  quantity INT,
  FOREIGN KEY (cust_id) REFERENCES customer(cust_id)
);
-- Insert data
INSERT INTO city VALUES
('Vijayawada', 'Andhra Pradesh'),
('Hyderabad', 'Telangana');
INSERT INTO customer VALUES
(1, 'Manasa', 'Vijayawada'),
(2, 'Ravi', 'Hyderabad');
INSERT INTO orders VALUES
(101, 1, 'Pen', 10),
(102, 1, 'Book', 5),
(103, 2, 'Pencil', 6);
-- Display result
SELECT o.order_id, c.cust_name, c.city_name, ci.state, o.product, o.quantity
FROM orders o
JOIN customer c ON o.cust_id = c.cust_id
JOIN city ci ON c.city_name = ci.city_name;
```

Output:

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

order_id	cust_name	city_name	state	product	quantity
103	Ravi	Hyderabad	Telangana	Pencil	6
101	Manasa	Vijayawada	Andhra Pradesh	Pen	10
102	Manasa	Vijayawada	Andhra Pradesh	Book	5

Experiment 9 :Nested Queries Using select across two tables

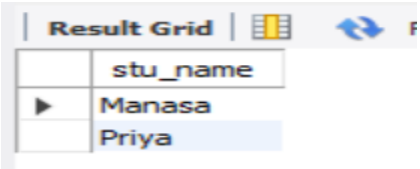
Source Code:

```
CREATE TABLE department (
  dept_id INT PRIMARY KEY,
  dept_name VARCHAR(20)
);
CREATE TABLE student (
  stu_id INT PRIMARY KEY,
  stu_name VARCHAR(20),
  dept_id INT,
  FOREIGN KEY (dept_id) REFERENCES department(dept_id)
);
INSERT INTO department VALUES (1, 'CSE'), (2, 'ECE');
INSERT INTO student VALUES
(101, 'Manasa', 1),
(102, 'Ravi', 2),
(103, 'Priya', 1);
SELECT stu_name
FROM student
WHERE dept_id = (SELECT dept_id FROM department WHERE dept_name = 'CSE');
```

Program:

```
CREATE TABLE department (
  dept_id INT PRIMARY KEY,
  dept_name VARCHAR(20)
);
CREATE TABLE student (
  stu_id INT PRIMARY KEY,
  stu_name VARCHAR(20),
  dept_id INT,
  FOREIGN KEY (dept_id) REFERENCES department(dept_id)
);
INSERT INTO department VALUES (1, 'CSE'), (2, 'ECE');
INSERT INTO student VALUES
(101, 'Manasa', 1),
(102, 'Ravi', 2),
(103, 'Priya', 1);
SELECT stu_name
FROM student
WHERE dept_id = (SELECT dept_id FROM department WHERE dept_name = 'CSE');
```

Output:



Experiment 10 :SQL wild card characters

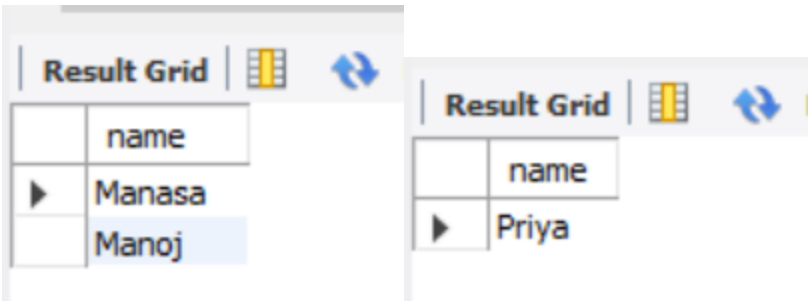
Source Code:

```
 DROP TABLE IF EXISTS student;

CREATE TABLE student (

  id INT,

  name VARCHAR(30)

);

INSERT INTO student (id, name) VALUES

(1, 'Manasa'),

(2, 'Ravi'),

(3, 'Manoj'),

(4, 'Priya'),

(5, 'Kiran');

-- Names starting with 'Ma'

SELECT name

FROM student

WHERE name LIKE 'Ma%';

-- Names containing 'ri' (case-insensitive)

SELECT name

FROM student

WHERE LOWER(name) LIKE '%ri%';
```

Program:

```
 DROP TABLE IF EXISTS student;
CREATE TABLE student (
  id INT,
  name VARCHAR(30)
);
INSERT INTO student (id, name) VALUES
(1, 'Manasa'),
(2, 'Ravi'),
(3, 'Manoj'),
(4, 'Priya'),
(5, 'Kiran');
-- Names starting with 'Ma'
SELECT name
FROM student
WHERE name LIKE 'Ma%';
-- Names containing 'ri' (case-insensitive)
SELECT name
FROM student
WHERE LOWER(name) LIKE '%ri%';
```

Output:



Experiment 11 :Retrieve Database using SELECT with Comparison operator (= , > . <. >= , <=)

Source Code:

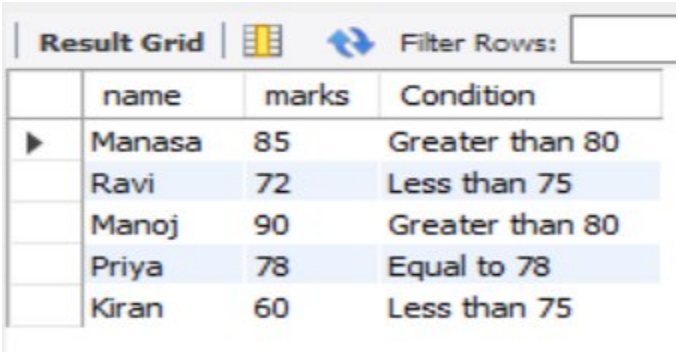
```
 DROP TABLE IF EXISTS student;
CREATE TABLE student (
  id INT,
  name VARCHAR(30),
  marks INT
);
INSERT INTO student (id, name, marks) VALUES
(1, 'Manasa', 85),
(2, 'Ravi', 72),
(3, 'Manoj', 90),
(4, 'Priya', 78),
(5, 'Kiran', 60);
-- Single query showing all comparison operators
SELECT
    name,
    marks,
    CASE
        WHEN marks = 78 THEN 'Equal to 78'
        WHEN marks > 80 THEN 'Greater than 80'
```

```
    WHEN marks < 75 THEN 'Less than 75'
    WHEN marks >= 78 THEN 'Greater than or equal to 78'
    WHEN marks <= 72 THEN 'Less than or equal to 72'
    ELSE 'Other'
  END AS `Condition`
FROM student;
```

Program:

```
DROP TABLE IF EXISTS student;
CREATE TABLE student (
  id INT,
  name VARCHAR(30),
  marks INT
);
INSERT INTO student (id, name, marks) VALUES
(1, 'Manasa', 85),
(2, 'Ravi', 72),
(3, 'Manoj', 90),
(4, 'Priya', 78),
(5, 'Kiran', 60);
-- Single query showing all comparison operators
SELECT
    name,
    marks,
    CASE
        WHEN marks = 78 THEN 'Equal to 78'
        WHEN marks > 80 THEN 'Greater than 80'
        WHEN marks < 75 THEN 'Less than 75'
        WHEN marks >= 78 THEN 'Greater than or equal to 78'
        WHEN marks <= 72 THEN 'Less than or equal to 72'
        ELSE 'Other'
    END AS `Condition`
FROM student;
```

Output:



Result Grid | Filter Rows:

	name	marks	Condition
▶	Manasa	85	Greater than 80
	Ravi	72	Less than 75
	Manoj	90	Greater than 80
	Priya	78	Equal to 78
	Kiran	60	Less than 75

Experiment 12 : Working on Local Host XAMPP Server

1. Exploring Server Variables.(Servername. User, pwd, DBname)

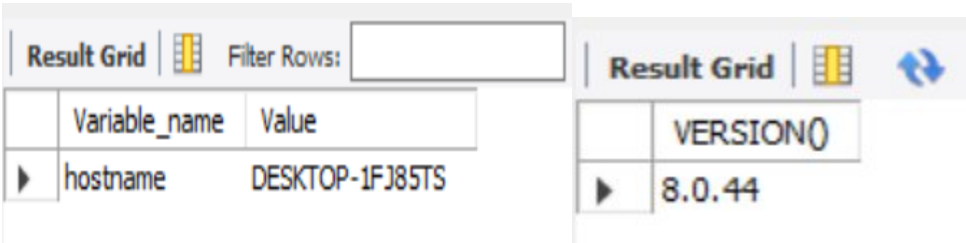
Source Code:

```
-- Get the current MySQL user

SELECT USER();


-- Get the current selected database

SELECT DATABASE();


-- Get the hostname (server name)

SHOW VARIABLES LIKE 'hostname';


-- Get the MySQL version

SELECT VERSION();
```

Program:

```sql
-- Get the current MySQL user
SELECT USER();

-- Get the current selected database
SELECT DATABASE();

-- Get the hostname (server name)
SHOW VARIABLES LIKE 'hostname';

-- Get the MySQL version
SELECT VERSION();
```

Output:11



2. Exploring Create hierarchical user access with privileges

Source Code:

-- Check if the database exists and then drop it

DROP DATABASE IF EXISTS testdb;

CREATE DATABASE testdb;

USE testdb;

CREATE TABLE students (id INT PRIMARY KEY, name VARCHAR(50), age INT);

Program:

```sql
-- Check if the database exists and then drop it
DROP DATABASE IF EXISTS testdb;
CREATE DATABASE testdb;
USE testdb;
CREATE TABLE students (id INT PRIMARY KEY, name VARCHAR(50), age INT);
-- Experiment: Create Users and Grant Privileges in MySQL

-- Step 1: Drop database if it already exists and create a new one
DROP DATABASE IF EXISTS companydb;
CREATE DATABASE companydb;
USE companydb;

-- Step 2: Create users (admin and staff)
CREATE USER IF NOT EXISTS 'admin'@'localhost' IDENTIFIED BY 'admin123';
CREATE USER IF NOT EXISTS 'staff'@'localhost' IDENTIFIED BY 'staff123';

-- Step 3: Grant privileges
-- Admin has full access to companydb
GRANT ALL PRIVILEGES ON companydb.* TO 'admin'@'localhost';

-- Staff has limited access (can only SELECT and INSERT)
GRANT SELECT, INSERT ON companydb.* TO 'staff'@'localhost';

-- Step 4: Apply privilege changes
FLUSH PRIVILEGES;

-- Step 5: Verify the privileges for each user
SHOW GRANTS FOR 'admin'@'localhost';
SHOW GRANTS FOR 'staff'@'localhost';
```

Output:1

Result Grid | Filter Rows: | Export:

Grants for admin@localhost
GRANT SELECT, INSERT, UPDATE, DELETE, CR...
GRANT APPLICATION_PASSWORD_ADMIN,AU...
GRANT ALL PRIVILEGES ON `companydb`.* TO...