MIT ART DESIGN & TECHNOLOGY UNIVERSITY

MIT College of Management (MITCOM), Pune

Sub:- Advanced Java

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Sr No.	Name Of The Practical	Page	Date	Record Sign
1	Write a Java program to connect to a specific database (e.g., MySQL, workbench etc.) using JDBC. Create a table in the database using JDBC and insert some sample data. and retrieve all data from a specific table and display it on the console			
2	Implement a program to update a specific record in a table based on a given condition. and delete a record from a table based on a specific criteria.			
3	Write a program to utilize transactions in JDBC, demonstrating both commit and rollback functionalities.			
4	Implement a program to handle different types of JDBC exceptions effectively. Write JDBC Program to calculate Employee salary and print the salary statement in tabular form by selecting the details from database table (Emp_Sal) using Prepared Statement			
5	Write a program to perform aggregation functions (e.g., COUNT, SUM,AVERAGE) on data retrieved from a database.			
6	Write a program to create a simple Java application that interacts with a database to perform CRUD operations (Create, Read, Update, Delete) on a specific table.			
7	Design a simple servlet that displays a welcome message with the user's name retrieved from request parameters.			
8	Design a simple servlet that displays a welcome message with the user's name retrieved from request parameters.			

9	Create a servlet that utilizes session management to maintain a shopping cart for an online store			
10	Write a servlet Program to calculate the addition of two numbers and print the result.(Eg:Addition of two numbers=50)			
11	Write a Servlet Program to create a registration form using in html and CSS and print the message Registration is successful			
12	Write a servlet Program for student information and display the information in tabular form by selecting the details from student database table			
13	Write a Java Servlet program to read employee details including employee number (empno), name, designation, basic pay, deductions, and allowances, and then calculate and display the net salary. display the information in tabular form by selecting the details from Emp_sal database table			
14	Write a JSP program calculates factorial of an integer number, while the input is taken from an HTML form.			
15	Write a JSP program to generate the Fibonacci series up to a particular term, while the input is taken from an HTML form			
16	Write a JSP program to display the System date and time.			
17	Write a JSP program to display a Sample shopping Order calculation Form and display output in tabular form.			
18	Write a JSP program to perform Arithmetic operations such as Addition, Subtraction, Multiplication and Division. Design a HTML to accept two numbers in text box and radio buttons to display operations. On submit			

	display result as per the selected operation on next page using JSP			
19	Define and illustrate the concept of entity mapping in JPA.Explain how JPA maps Java classes (entities) to database tables.Provide an example of an entity class with annotations and its corresponding database table schema			
20	Describe the different types of relationships between entities (one-to-one, one-to-many, many-to-one, many-to-many).Explain how JPA represents these relationships using annotations.Provide code examples for each type of relationship			
21	Create a JPA application to perform CRUD operations on a simple entity (e.g., Product). Include methods for creating, retrieving, updating, and deleting Product entities. Demonstrate the use of EntityManager for persistence operations.			
22	Configure a Spring Boot application to connect to a specific MySQL database without explicitly defining beans for connection pool, DataSource, etc. Use only the necessary dependencies and demonstrate how auto-configuration sets up the connection. Explore using application.properties to customize connection details (URL, username, password).			
23	Create a Spring Boot application that utilizes JPA repositories. Persist and retrieve data from an in-memory database (e.g., H2) without manual configuration. Focus on the simplicity achieved through auto-configuration for JPA and repositories. Implement basic CRUD operations using JPA repositories. Develop a Spring Boot application with a RESTful API that exposes an endpoint to retrieve a list of products. Utilize Spring MVC annotations like @RestController and @GetMapping. Implement a service layer to interact with a product repository (in-memory or database).			

	Return the list of products in JSON format using @ResponseBody.			
25	Write a Hibernate program to create the product table (product id,product name,product category,product price) and delete the specific product record.(using through the product id)			
26	Write a Hibernate program to update the product price data from product table.(Using HQL)			
27	Write a Hibernate Program for product information and display the information by selecting the details from product database table			

Assignment 1: Programs On JAVA JDBC

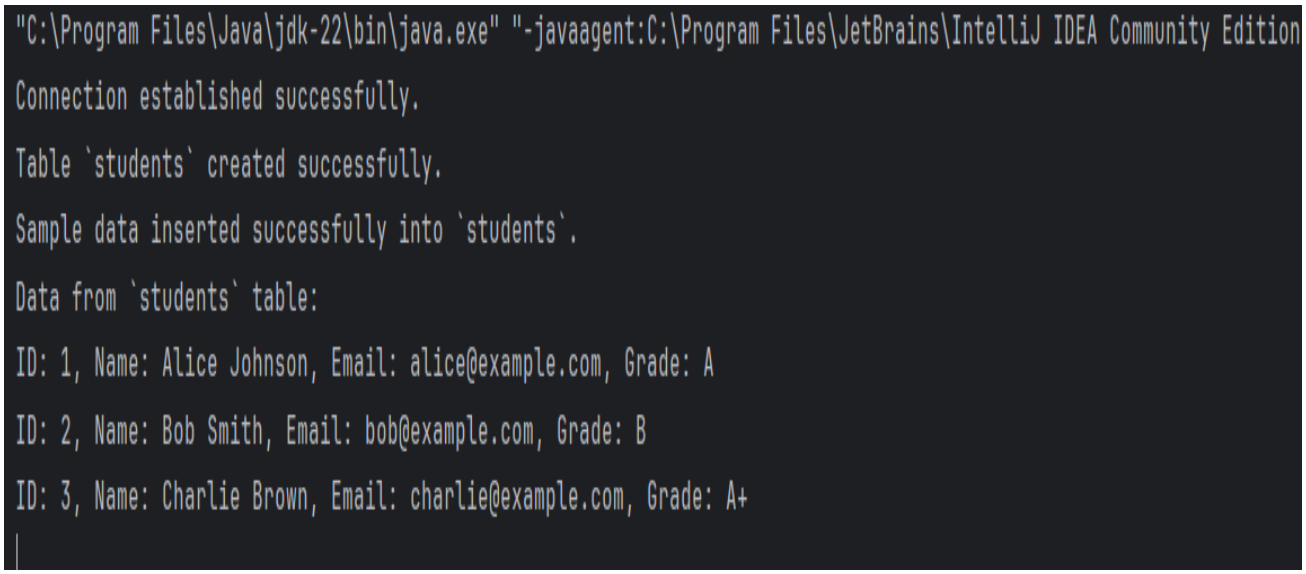
1.1 Write a Java program to connect to a specific database (e.g., MySQL, workbench etc.) using JDBC. Create a table in the database using JDBC and insert some sample data. and retrieve all data from a specific table and display it on the console.

Ans:-

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.Statement;
import java.sql.ResultSet;

public class Practical {
    public static void main(String[] args) {
        // Database credentials
        String url = "jdbc:mysql://localhost:3306/college"; // Replace with your
database name
        String username = "root"; // Replace with your MySQL username
        String password = "1234567890"; // Replace with your MySQL password

        // JDBC objects
        Connection conn = null;
        Statement stmt = null;

        try {
            // 1. Register JDBC Driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // 2. Open Connection
            conn = DriverManager.getConnection(url, username, password);
            System.out.println("Connection established successfully.");

            // 3. Create Statement
            stmt = conn.createStatement();

            // 4. Create Table
            String createTableSQL = "CREATE TABLE IF NOT EXISTS students ("
+
                    "id INT AUTO_INCREMENT PRIMARY KEY, " +
                    "name VARCHAR(50), " +
                    "email VARCHAR(50), " +
                    "grade VARCHAR(10))";
            stmt.executeUpdate(createTableSQL);
            System.out.println("Table `students` created successfully.");
```

```
            // 5. Insert Sample Data
            String insertSQL = "INSERT INTO students (name, email, grade)
VALUES " +
                    "('Alice Johnson', 'alice@example.com', 'A'), " +
                    "('Bob Smith', 'bob@example.com', 'B'), " +
                    "('Charlie Brown', 'charlie@example.com', 'A+')";
            stmt.executeUpdate(insertSQL);
            System.out.println("Sample data inserted successfully into `students`.");

            // 6. Retrieve and Display Data
            String selectSQL = "SELECT * FROM students";
            ResultSet rs = stmt.executeQuery(selectSQL);

            System.out.println("Data from `students` table:");
            while (rs.next()) {
                int id = rs.getInt("id");
                String name = rs.getString("name");
                String email = rs.getString("email");
                String grade = rs.getString("grade");
                System.out.printf("ID: %d, Name: %s, Email: %s, Grade: %s%n", id,
name, email, grade);
            }

            // Close the ResultSet
            rs.close();
        } catch (Exception e) {
            e.printStackTrace();
        } finally {
            try {
                // Close the Statement and Connection
                if (stmt != null) stmt.close();
                if (conn != null) conn.close();
            } catch (Exception ex) {
                ex.printStackTrace();
            }
        }
    }
}
```

OUTPUT:



1.2 Implement a program to update a specific record in a table based on a given condition and delete a record from a table based on a specific criteria.

Ans:-

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;

public class Practical2 {
    public static void main(String[] args) {
        // Database credentials
        String url = "jdbc:mysql://localhost:3306/college"; // Replace with your
database name
        String username = "root"; // Replace with your MySQL username
        String password = "1234567890"; // Replace with your MySQL password

        // JDBC objects
        Connection conn = null;

        try {
            // 1. Register JDBC Driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // 2. Open Connection
            conn = DriverManager.getConnection(url, username, password);
            System.out.println("Connection established successfully.");
```

```
            // 3. Update Record
            String updateSQL = "UPDATE students SET grade = ? WHERE id = ?";
            PreparedStatement updateStmt = conn.prepareStatement(updateSQL);
            updateStmt.setString(1, "A+"); // New grade
            updateStmt.setInt(2, 2); // ID of the student to update
            int updateCount = updateStmt.executeUpdate();
            if (updateCount > 0) {
                System.out.println("Record updated successfully.");
            } else {
                System.out.println("No record found to update.");
            }

            // 4. Delete Record
            String deleteSQL = "DELETE FROM students WHERE id = ?";
            PreparedStatement deleteStmt = conn.prepareStatement(deleteSQL);
            deleteStmt.setInt(1, 3); // ID of the student to delete
            int deleteCount = deleteStmt.executeUpdate();
            if (deleteCount > 0) {
                System.out.println("Record deleted successfully.");
            } else {
                System.out.println("No record found to delete.");
            }

            // Close statements
            updateStmt.close();
            deleteStmt.close();
        } catch (Exception e) {
            e.printStackTrace();
        } finally {
            try {
                // Close Connection
                if (conn != null) conn.close();
            } catch (Exception ex) {
                ex.printStackTrace();
            }
        }
    }
}
```

Output:-

```
"C:\Program Files\Java\jdk-22\bin\java.exe" "-javaagent:C:\Program Files\JetB
Connection established successfully.
Record updated successfully.
Record deleted successfully.

Process finished with exit code 0
```

1.3 Write a program to utilize transactions in JDBC, demonstrating both commit and rollback functionalities.

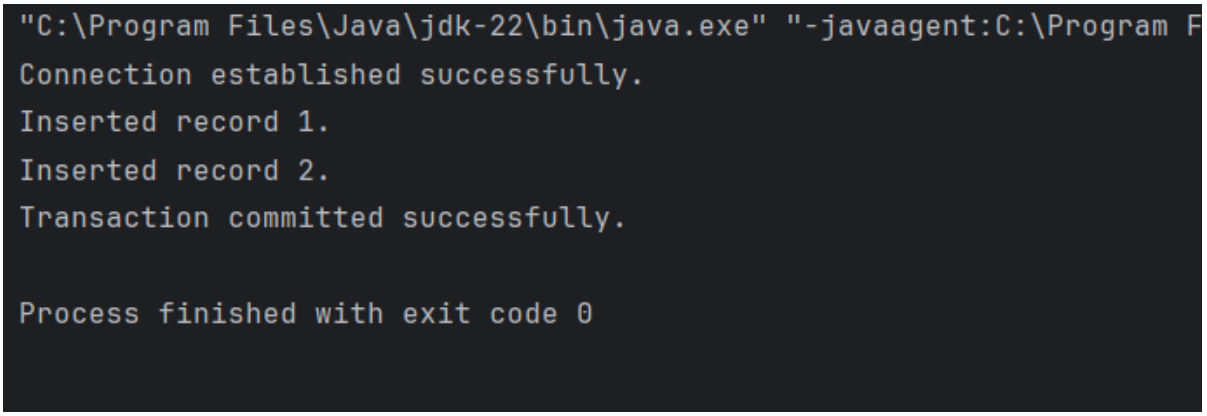
Ans:-

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.SQLException;

public class Practical3_TransactionExample {
    public static void main(String[] args) {
        // Database credentials
        String url = "jdbc:mysql://localhost:3306/college"; // Replace with your
database name
        String username = "root"; // Replace with your MySQL username
        String password = "1234567890"; // Replace with your MySQL password

        Connection conn = null;

        try {
            // 1. Register JDBC Driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // 2. Open Connection
            conn = DriverManager.getConnection(url, username, password);
            System.out.println("Connection established successfully.");

            // 3. Disable Auto-commit Mode
            conn.setAutoCommit(false);

            // 4. Insert Record 1
            String insertSQL1 = "INSERT INTO students (id, name, email, grade)
VALUES (?, ?, ?, ?)";
            PreparedStatement stmt1 = conn.prepareStatement(insertSQL1);
```

```
            stmt1.setString(2, "David Adams"); // Name
            stmt1.setString(3, "david@example.com"); // Email
            stmt1.setString(4, "B+"); // Grade
            stmt1.executeUpdate();
            System.out.println("Inserted record 1.");

            // 5. Insert Record 2
            String insertSQL2 = "INSERT INTO students (id, name, email, grade)
VALUES (?, ?, ?, ?)";
            PreparedStatement stmt2 = conn.prepareStatement(insertSQL2);
            stmt2.setInt(1, 5); // ID
            stmt2.setString(2, "Eva Green"); // Name
            stmt2.setString(3, "eva@example.com"); // Email
            stmt2.setString(4, "A"); // Grade
            stmt2.executeUpdate();
            System.out.println("Inserted record 2.");

            // Commit transaction if no error
            conn.commit();
            System.out.println("Transaction committed successfully.");

        } catch (SQLException e) {
            System.err.println("Error occurred, rolling back transaction.");
            e.printStackTrace();
            try {
                if (conn != null) {
                    conn.rollback(); // Rollback transaction
                    System.out.println("Transaction rolled back successfully.");
                }
            } catch (SQLException rollbackEx) {
                rollbackEx.printStackTrace();
            }
        } catch (ClassNotFoundException e) {
            e.printStackTrace();
        } finally {
            try {
                if (conn != null) {
                    conn.setAutoCommit(true); // Restore default auto-commit
behavior
                    conn.close();
                }

            } catch (SQLException closeEx) {
                closeEx.printStackTrace();
            }
```

```
    }
}
```

OUTPUT :



1.4 Implement a program to handle different types of JDBC exceptions effectively. Write JDBC Program to calculate Employee salary and print the salary statement in tabular form by selecting the details from database table (Emp_Sal) using Prepared Statement

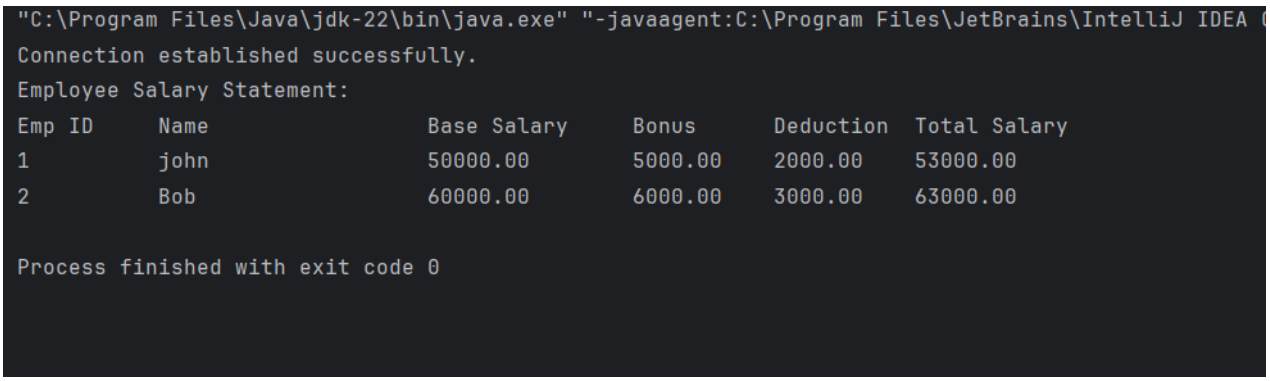
Ans:-

```
import  java.sql.*;
public class practical4 {
    public static void main(String[] args) {
        String url = "jdbc:mysql://localhost:3306/company_db"; // Replace with your
database name
        String username = "root"; // Replace with your MySQL username
        String password = "1234567890"; // Replace with your MySQL password

        Connection conn = null;
        PreparedStatement pstmt = null;
        ResultSet rs = null;

        try {
            // 1. Register JDBC Driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // 2. Open Connection
            conn = DriverManager.getConnection(url, username, password);
            System.out.println("Connection established successfully.");

            // 3. Prepare SQL Query with PreparedStatement
            String selectSQL = "SELECT emp_id, emp_name, base_salary, bonus,
deduction FROM Emp_Sal";
            pstmt = conn.prepareStatement(selectSQL);
```

```
            // 4. Execute the query
            rs = pstmt.executeQuery();

            // 5. Display salary statement in tabular form
            System.out.println("Employee Salary Statement:");
            System.out.printf("%-10s %-20s %-15s %-10s %-10s %-10s%n",
                    "Emp ID", "Name", "Base Salary", "Bonus", "Deduction", "Total
Salary");

            // 6. Process the ResultSet
            while (rs.next()) {
                int empId = rs.getInt("emp_id");
                String empName = rs.getString("emp_name");
                double baseSalary = rs.getDouble("base_salary");
                double bonus = rs.getDouble("bonus");
                double deduction = rs.getDouble("deduction");

                // Calculate the total salary
                double totalSalary = baseSalary + bonus - deduction;

                // Print the salary statement
                System.out.printf("%-10d %-20s %-15.2f %-10.2f %-10.2f %-10.2f%n",
                        empId, empName, baseSalary, bonus, deduction, totalSalary);
            }
        } catch (SQLException e) {
            // Handle SQL exceptions
            System.err.println("SQL Error: " + e.getMessage());
            e.printStackTrace();
        } catch (ClassNotFoundException e) {
            // Handle ClassNotFound exception (for JDBC Driver)
            System.err.println("JDBC Driver not found: " + e.getMessage());
            e.printStackTrace();
        } catch (Exception e) {
            // Catch any other exceptions
            System.err.println("Unexpected error: " + e.getMessage());
            e.printStackTrace();
        } finally {
            try {
                // 7. Close resources
                if (rs != null) rs.close();
                if (pstmt != null) pstmt.close();
                if (conn != null) conn.close();
            } catch (SQLException e) {
                System.err.println("Error closing resources: " + e.getMessage());
                e.printStackTrace();}
```

```
    }
  }
}
```

OUTPUT:



1.5. Write a program to perform aggregation functions (e.g., COUNT, SUM,AVERAGE) on data retrieved from a database.

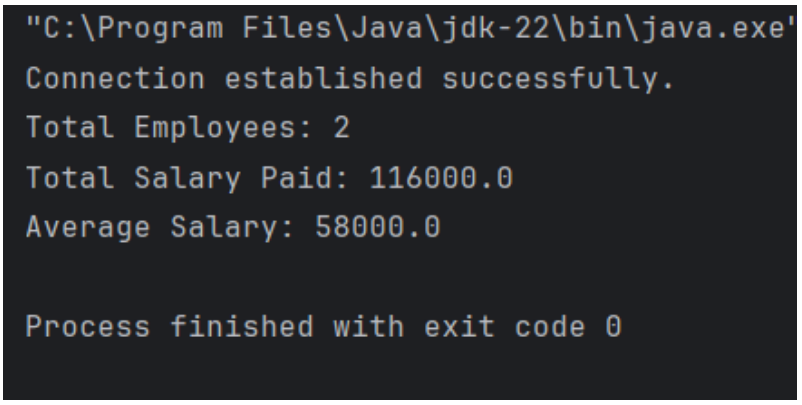
Ans:-

```
import  java.sql.*;

public class practical5 {

    public static void main(String[] args) {
        String url = "jdbc:mysql://localhost:3306/company_db"; // Replace with
your database name
        String username = "root"; // Replace with your MySQL username
        String password = "1234567890"; // Replace with your MySQL password

        Connection conn = null;
        Statement stmt = null;
        ResultSet rs = null;

        try {
            // 1. Register JDBC Driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // 2. Open Connection
            conn = DriverManager.getConnection(url, username, password);
            System.out.println("Connection established successfully.");

            // 3. Create Statement
            stmt = conn.createStatement();
```

```
            // 4. Perform Aggregation Queries
            // Count the number of employees
            String countSQL = "SELECT COUNT(*) AS total_employees FROM
Emp_Sal";
            rs = stmt.executeQuery(countSQL);
            if (rs.next()) {
                int totalEmployees = rs.getInt("total_employees");
                System.out.println("Total Employees: " + totalEmployees);
            }

            // Sum of all salaries (Base salary + Bonus - Deduction)
            String sumSQL = "SELECT SUM(base_salary + bonus - deduction) AS
total_salary FROM Emp_Sal";
            rs = stmt.executeQuery(sumSQL);
            if (rs.next()) {
                double totalSalary = rs.getDouble("total_salary");
                System.out.println("Total Salary Paid: " + totalSalary);
            }

            // Average Salary (Base salary + Bonus - Deduction)
            String avgSQL = "SELECT AVG(base_salary + bonus - deduction) AS
avg_salary FROM Emp_Sal";
            rs = stmt.executeQuery(avgSQL);
            if (rs.next()) {
                double avgSalary = rs.getDouble("avg_salary");
                System.out.println("Average Salary: " + avgSalary);
            }
        } catch (SQLException e) {
            // Handle SQL exceptions
            System.err.println("SQL Error: " + e.getMessage());
            e.printStackTrace();
        } catch (ClassNotFoundException e) {
            // Handle ClassNotFoundException (for JDBC Driver)
            System.err.println("JDBC Driver not found: " + e.getMessage());
            e.printStackTrace();
        } catch (Exception e) {
            // Catch any other exceptions
            System.err.println("Unexpected error: " + e.getMessage());
            e.printStackTrace();
        } finally {
            try {
                // 5. Close resources
                if (rs != null) rs.close();
                if (stmt != null) stmt.close();
                if (conn != null) conn.close();
```

```
            } catch (SQLException e) {
                System.err.println("Error closing resources: " + e.getMessage());
                e.printStackTrace();
            }
        }
    }
}
```

OUTPUT:-



` `

1.6. Write a program to create a simple Java application that interacts with a database to perform CRUD operations (Create, Read, Update, Delete) on a specific table.

Ans:-

```
import  java.sql.*;
import java.util.Scanner;

public class practical6 {

    // Database connection details
    private static final String URL = "jdbc:mysql://localhost:3306/company_db"; // Replace with your database URL
    private static final String USER = "root"; // Replace with your MySQL username
    private static final String PASSWORD = "1234567890"; // Replace with your MySQL password
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        Connection conn = null;
        PreparedStatement pstmt = null;
        Statement stmt = null;
        ResultSet rs = null;

        try {
```

```
            // Establish connection
            conn = DriverManager.getConnection(URL, USER, PASSWORD);
            stmt = conn.createStatement();

            // Show menu for CRUD operations
            while (true) {
                System.out.println("Choose an operation:");
                System.out.println("1. Create (Insert) Employee");
                System.out.println("2. Read (Select) Employees");
                System.out.println("3. Update Employee Salary");
                System.out.println("4. Delete Employee");
                System.out.println("5. Exit");
                int choice = scanner.nextInt();

                switch (choice) {
                    case 1: // Create (Insert)
                        insertEmployee(conn, scanner);
                        break;
                    case 2: // Read (Select)
                        readEmployees(stmt);
                        break;
                    case 3: // Update
                        updateEmployee(conn, scanner);
                        break;
                    case 4: // Delete
                        deleteEmployee(conn, scanner);
                        break;
                    case 5: // Exit
                        System.out.println("Exiting...");
                        return;
                    default:
                        System.out.println("Invalid choice! Try again.");
                }
            }

        } catch (SQLException e) {
            System.err.println("SQL Exception: " + e.getMessage());
        } finally {
            try {
                if (rs != null) rs.close();
                if (pstmt != null) pstmt.close();
                if (stmt != null) stmt.close();
                if (conn != null) conn.close();
            } catch (SQLException e) {
                System.err.println("Error closing resources: " + e.getMessage());
```

```
        }
    }

    // Create (Insert)
    private static void insertEmployee(Connection conn, Scanner scanner) {
        try {
            System.out.print("Enter Employee Name: ");
            String name = scanner.next();
            System.out.print("Enter Base Salary: ");
            double baseSalary = scanner.nextDouble();
            System.out.print("Enter Bonus: ");
            double bonus = scanner.nextDouble();
            System.out.print("Enter Deduction: ");
            double deduction = scanner.nextDouble();

            String insertSQL = "INSERT INTO Emp_Sal (emp_name, base_salary,
bonus, deduction) VALUES (?, ?, ?, ?)";
            PreparedStatement pstmt = conn.prepareStatement(insertSQL);
            pstmt.setString(1, name);
            pstmt.setDouble(2, baseSalary);
            pstmt.setDouble(3, bonus);
            pstmt.setDouble(4, deduction);
            pstmt.executeUpdate();
            System.out.println("Employee added successfully!");
        } catch (SQLException e) {
            System.err.println("Error while inserting: " + e.getMessage());
        }
    }
    // Read (Select)
    private static void readEmployees(Statement stmt) {
        try {
            String selectSQL = "SELECT * FROM Emp_Sal";
            ResultSet rs = stmt.executeQuery(selectSQL);
            System.out.printf("%-10s %-20s %-15s %-10s %-10s%n", "Emp ID",
"Name", "Base Salary", "Bonus", "Deduction");
            while (rs.next()) {
                int empId = rs.getInt("emp_id");
                String name = rs.getString("emp_name");
                double baseSalary = rs.getDouble("base_salary");
                double bonus = rs.getDouble("bonus");
                double deduction = rs.getDouble("deduction");
                System.out.printf("%-10d %-20s %-15.2f %-10.2f %-10.2f%n", empId,
name, baseSalary, bonus, deduction);
            }
        } catch (SQLException e) {
```

```
            System.err.println("Error while reading: " + e.getMessage());
        }
    }
    private static void updateEmployee(Connection conn, Scanner scanner) {
        try {
            System.out.print("Enter Employee ID to Update: ");
            int empId = scanner.nextInt();
            System.out.print("Enter New Base Salary: ");
            double baseSalary = scanner.nextDouble();
            System.out.print("Enter New Bonus: ");
            double bonus = scanner.nextDouble();
            System.out.print("Enter New Deduction: ");
            double deduction = scanner.nextDouble();
            String updateSQL = "UPDATE Emp_Sal SET base_salary = ?, bonus = ?,
deduction = ? WHERE emp_id = ?";
            PreparedStatement pstmt = conn.prepareStatement(updateSQL);
            pstmt.setDouble(1, baseSalary);
            pstmt.setDouble(2, bonus);
            pstmt.setDouble(3, deduction);
            pstmt.setInt(4, empId);
            int rowsUpdated = pstmt.executeUpdate();
            if (rowsUpdated > 0) {
                System.out.println("Employee salary updated successfully!");
            } else {
                System.out.println("No employee found with that ID.");
            }
        } catch (SQLException e) {
            System.err.println("Error while updating: " + e.getMessage());
        }
    }
    private static void deleteEmployee(Connection conn, Scanner scanner) {
        try {
            System.out.print("Enter Employee ID to Delete: ");
            int empId = scanner.nextInt();
            String deleteSQL = "DELETE FROM Emp_Sal WHERE emp_id = ?";
            PreparedStatement pstmt = conn.prepareStatement(deleteSQL);
            pstmt.setInt(1, empId);
            int rowsDeleted = pstmt.executeUpdate();
            if (rowsDeleted > 0) {
                System.out.println("Employee deleted successfully!");
            } else {
                System.out.println("No employee found with that ID.");
            }
        } catch (SQLException e) {
            System.err.println("Error while deleting: " + e.getMessage());
```

```
        }
    }
}
```

OUTPUT:-

```
"C:\Program Files\Java\jdk-22\bin\
Choose an operation:
1. Create (Insert) Employee
2. Read (Select) Employees
3. Update Employee Salary
4. Delete Employee
5. Exit
1
Enter Employee Name: Vaishnavi
Enter Base Salary: 60000.00
Enter Bonus: 20000.00
Enter Deduction: 1000.00
Employee added successfully!
Choose an operation:
1. Create (Insert) Employee
```

```
Employee added successfully!
Choose an operation:
1. Create (Insert) Employee
2. Read (Select) Employees
3. Update Employee Salary
4. Delete Employee
5. Exit
2
Emp ID     Name                Base Salary     Bonus      Deduction
1          john                50000.00        5000.00    2000.00
2          Bob                 60000.00        6000.00    3000.00
3          Vaishnavi           6000.00         2000.00    500.00
4          Vaishnavi           60000.00        20000.00   1000.00
Choose an operation:
```

```
3
Enter Employee ID to Update: 3
Enter New Base Salary: 65000.00
Enter New Bonus: 4000.00
Enter New Deduction: 2000.00
Employee salary updated successfully!
```

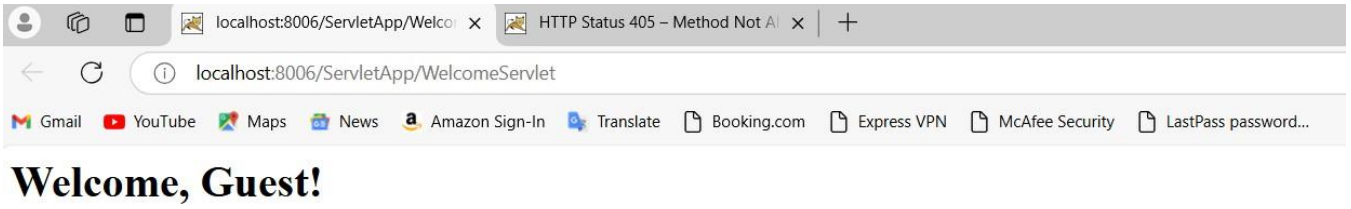
Assignment 2 : Programs On JAVA Servlet

1.Design a simple servlet that displays a welcome message with the user's name retrieved from request parameters

Ans:-

```
package com.example.servlet;
import jakarta.servlet.ServletException;
import jakarta.servlet.annotation.WebServlet;
import jakarta.servlet.http.HttpServlet;
import jakarta.servlet.http.HttpServletRequest;
import jakarta.servlet.http.HttpServletResponse;
import java.io.IOException;

/**
 * Servlet implementation class WelcomeServlet
 */
@WebServlet("/welcome") // Maps this servlet to the /welcome URL
public class WelcomeServlet extends HttpServlet {
    private static final long serialVersionUID = 1L;

    /**
     * @see HttpServlet#HttpServlet()
     */
    public WelcomeServlet() {
        super();
    }

    /**
     * @see HttpServlet#doGet(HttpServletRequest request,
HttpServletResponse response)
     */
    protected void doGet(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        // Set response content type
        response.setContentType("text/html");

        // Retrieve the user's name from request parameters
        String name = request.getParameter("name");
        if (name == null || name.trim().isEmpty()) {
            name = "Guest"; // Default to "Guest" if no name is provided
        }

        // Generate a welcome message
        response.getWriter().append("<html><body>");
```

```
        response.getWriter().append("<h1>Welcome, " + name + "!</h1>");
        response.getWriter().append("</body></html>");
    }

    /**
     * @see HttpServlet#doPost(HttpServletRequest request,
HttpServletResponse response)
     */
    protected void doPost(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        doGet(request, response); // Reuse doGet for POST requests
    }
}
```



2 Implement a servlet that handles a login form and validates user credentials against a database.

Ans:-

LoginServlet.java

```
package com.loginapp;

import jakarta.servlet.ServletException;
import jakarta.servlet.annotation.WebServlet;
import jakarta.servlet.http.HttpServlet;
import jakarta.servlet.http.HttpServletRequest;
import jakarta.servlet.http.HttpServletResponse;
import java.io.IOException;
import java.io.PrintWriter;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;

//@WebServlet("/login")
public class LoginServlet extends HttpServlet {

    protected void doPost(HttpServletRequest request, HttpServletResponse
```

```
response) throws ServletException, IOException {
        String username = request.getParameter("username");
        String password = request.getParameter("password");

        // Database credentials and connection details
        String dbURL = "jdbc:mysql://localhost:3306/yourdb";
        String dbUser = "yourusername";
        String dbPass = "yourpassword";

        // SQL query to check the credentials
        String sql = "SELECT * FROM users WHERE username = ? AND
password = ?";

        // Initialize response writer
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        // Database connection and validation
        try {
            // Connect to the database
            Connection connection = DriverManager.getConnection(dbURL,
dbUser, dbPass);
            PreparedStatement stmt = connection.prepareStatement(sql);
            stmt.setString(1, username);
            stmt.setString(2, password);

            // Execute query
            ResultSet rs = stmt.executeQuery();

            // Check if user exists
            if (rs.next()) {
                // Successful login
                out.println("<h2>Login Successful</h2>");
            } else {
                // Invalid credentials
                out.println("<h2>Invalid Username or Password</h2>");
            }

            // Close the connection
            rs.close();
            stmt.close();
            connection.close();
        } catch (Exception e) {
            out.println("<h2>Error: " + e.getMessage() + "</h2>");
        }
```

```
    }
}
```

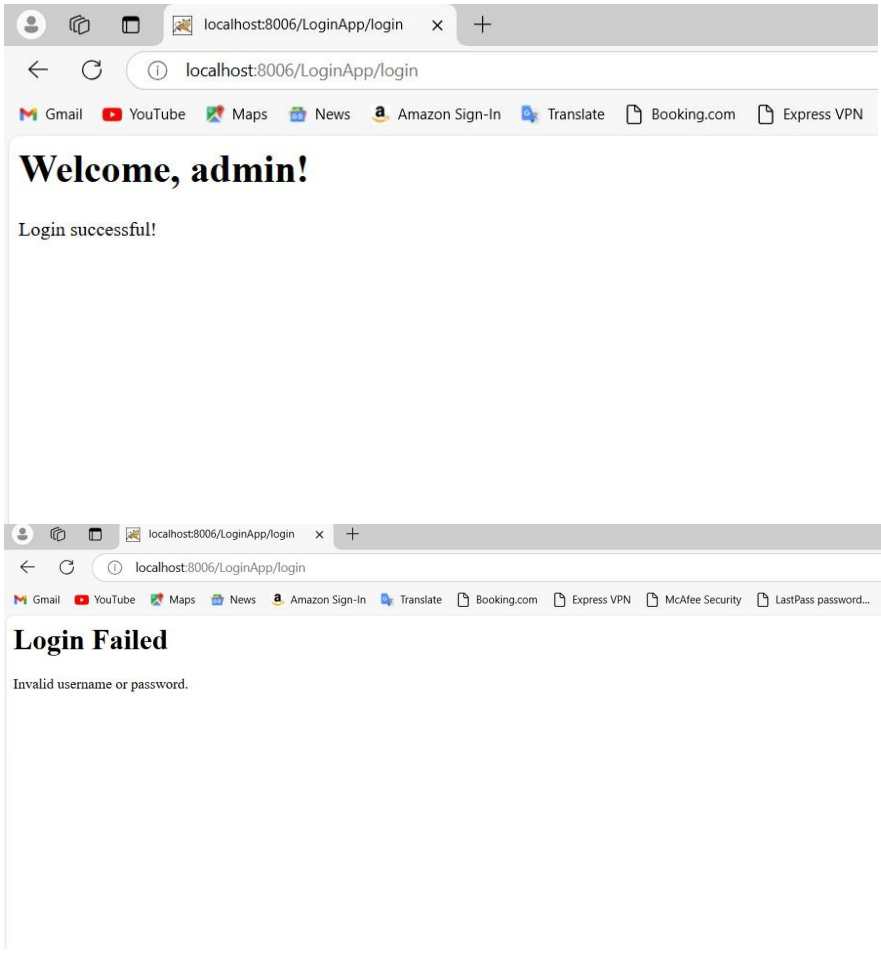
Login.html

```
<!DOCTYPE html>
<html lang="en">

<body>
    <h2>Login</h2>
    <form action="/LoginApp/login" method="POST">
        <label for="username">Username:</label><br>
        <input type="text" id="username" name="username" required><br><br>

        <label for="password">Password:</label><br>
        <input type="password" id="password" name="password"
required><br><br>

        <input type="submit" value="Login">
    </form>
</body>
</html>
```

Web.xml

```
<element>
<web-app>

    <servlet>
        <servlet-name>LoginServlet</servlet-name>
        <servlet-class>com.loginapp.LoginServlet</servlet-class>
    </servlet>
    <servlet-mapping>
        <servlet-name>LoginServlet</servlet-name>
        <url-pattern>/login</url-pattern>
    </servlet-mapping>
</web-app>
</element>
```

Outputs:-



3 Create a servlet that utilizes session management to maintain a shopping cart for an online store.
Ans:-
Loginservlet.java

```
package com.shoppingcart;

import jakarta.servlet.*;
import jakarta.servlet.http.*;
import java.io.*;

public class LoginServlet extends HttpServlet {
   protected void doPost(HttpServletRequest request, HttpServletResponse response)
throws ServletException, IOException {
        String username = request.getParameter("username");
        String password = request.getParameter("password");
        // Simple validation (use database for production)
        if ("admin".equals(username) && "password123".equals(password)) {
            HttpSession session = request.getSession();
            session.setAttribute("user", username);
            response.sendRedirect("cart"); // Redirect to the shopping cart page
```

```
        } else {
            response.sendRedirect("login.html"); // Redirect to login page if
authentication fails
        }
    }
}
```

Cartservleyt.java

```
package com.shoppingcart;
import jakarta.servlet.*;
import jakarta.servlet.http.*;
import java.io.*;
import java.util.*;

public class CartServlet extends HttpServlet {
    @SuppressWarnings("unchecked")
        protected void doGet(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        HttpSession session = request.getSession(false);
        if (session == null || session.getAttribute("user") == null) {
            response.sendRedirect("login.html");
            return;
        }

        // Fetch the shopping cart from the session
        List<String> cart = (List<String>) session.getAttribute("cart");
        if (cart == null) {
            cart = new ArrayList<>();
            session.setAttribute("cart", cart);
        }
        // Display the shopping cart
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();
        out.println("<html><body>");
        out.println("<h1>Welcome, " + session.getAttribute("user") + "</h1>");
        out.println("<h3>Your Shopping Cart</h3>");
        out.println("<table border='1'><tr><th>Product</th><th>Action</th></tr>");
        for (String product : cart) {
            out.println("<tr><td>" + product + "</td><td><a href='cart?remove=" +
product + "'>Remove</a></td></tr>");
        }
        out.println("</table>");
        out.println("<br><a href='index.html'>Continue Shopping</a>");
        out.println("</body></html>");
```

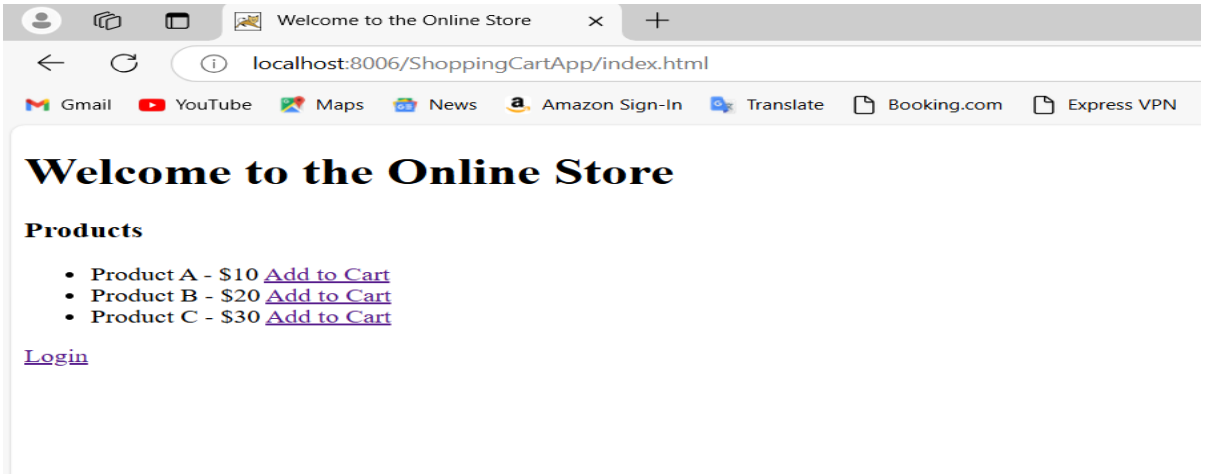
```
    }

    @SuppressWarnings("unchecked")
        protected void doPost(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        // Adding item to cart
        String product = request.getParameter("product");
        HttpSession session = request.getSession();
        List<String> cart = (List<String>) session.getAttribute("cart");
        if (cart == null) {
            cart = new ArrayList<>();
            session.setAttribute("cart", cart);
        }

        if (product != null) {
            cart.add(product);  // Add selected product to the cart
        }

        response.sendRedirect("cart"); // Redirect to the cart page to view updated cart
    }
}
```

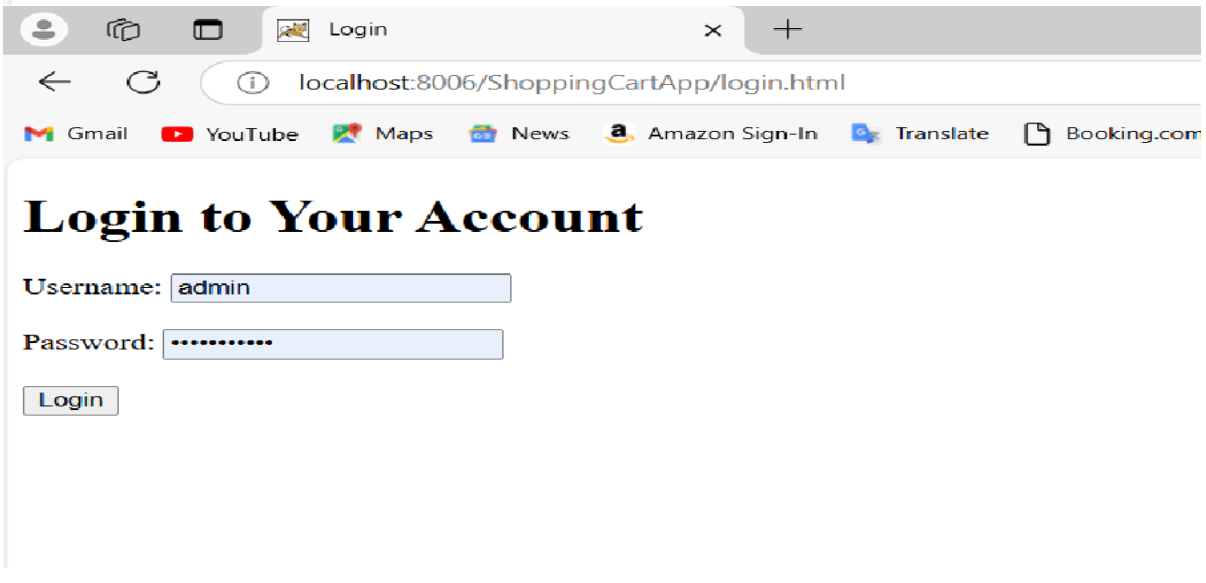
Index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Welcome to the Online Store</title>
</head>
<body>
    <h1>Welcome to the Online Store</h1>
    <h3>Products</h3>
    <ul>
        <li>Product A - $10 <a href="cart?product=Product A">Add to
Cart</a></li>
        <li>Product B - $20 <a href="cart?product=Product B">Add to
Cart</a></li>
        <li>Product C - $30 <a href="cart?product=Product C">Add to
Cart</a></li>
    </ul>
    <a href="login.html">Login</a>
</body>
</html>
```

Login.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Login</title>
</head>
<body>
    <h1>Login to Your Account</h1>
    <form action="login" method="POST">
        <label for="username">Username:</label>
        <input type="text" id="username" name="username" required><br><br>
        <label for="password">Password:</label>
        <input type="password" id="password" name="password"
required><br><br>
        <button type="submit">Login</button>
    </form>
</body>
</html>
```





4 Write a servlet Program to calculate the addition of two numbers and print the result.(Eg:Addition of two numbers=50)

Ans:-

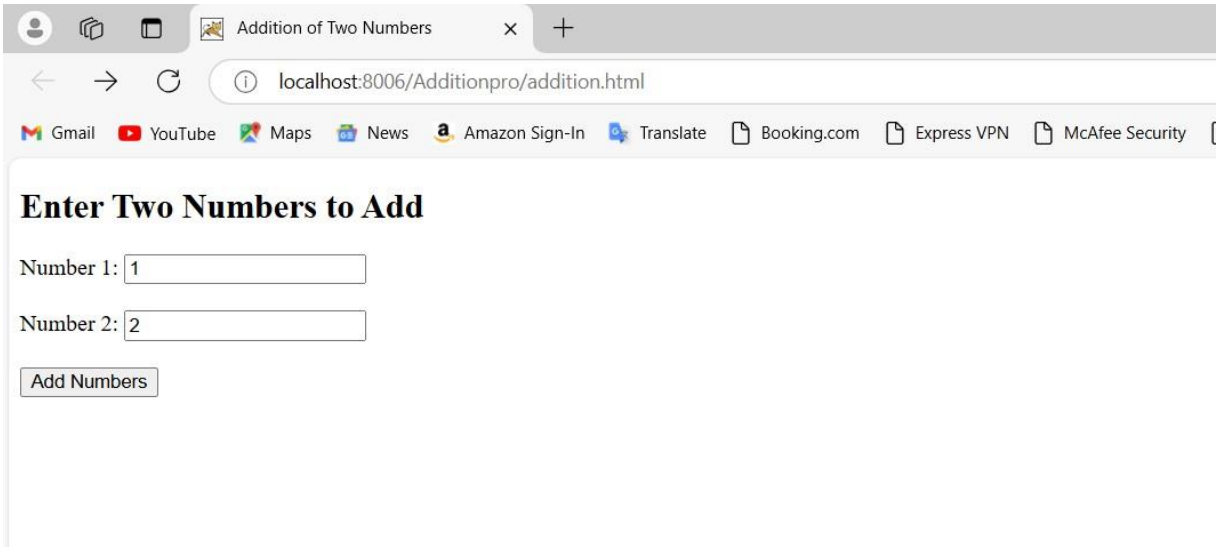
Additionservlet.java

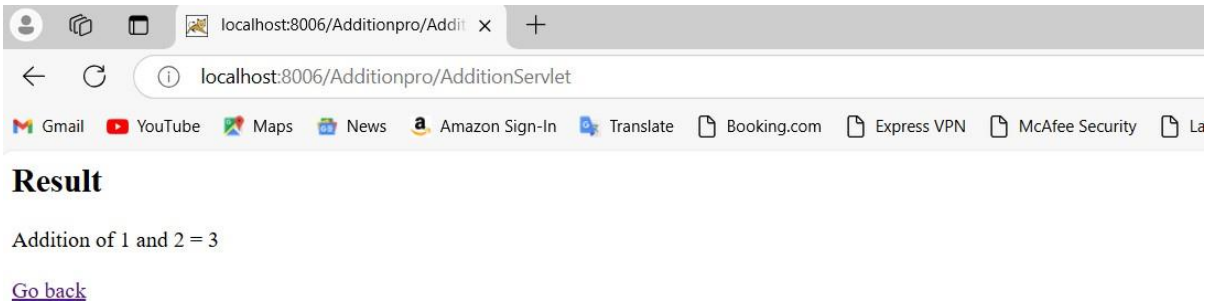
```
package com.addition;
import jakarta.servlet.*;
import jakarta.servlet.annotation.WebServlet;
import jakarta.servlet.http.*;
import java.io.*;
@WebServlet("/AdditionServlet")
public class AdditionServlet extends HttpServlet {

    @Override
    protected void doPost(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        String num1Str = request.getParameter("num1");
        String num2Str = request.getParameter("num2");

        int num1 = Integer.parseInt(num1Str);
        int num2 = Integer.parseInt(num2Str);

        int sum = num1 + num2;

        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        out.println("<html><body>");
        out.println("<h2>Result</h2>");
        out.println("Addition of " + num1 + " and " + num2 + " = " + sum);
        out.println("<br><br>");
        out.println("<a href='addition.html'>Go back</a>");
        out.println("</body></html>");
    }
}
```

Addition.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Addition of Two Numbers</title>
</head>
<body>
```

```
    <h2>Enter Two Numbers to Add</h2>
    <form action="AdditionServlet" method="POST">
        <label for="num1">Number 1:</label>
        <input type="number" id="num1" name="num1" required><br><br>

        <label for="num2">Number 2:</label>
        <input type="number" id="num2" name="num2" required><br><br>

        <input type="submit" value="Add Numbers">
    </form>
</body>
</html>
```





5. Write a Servlet Program to create a registration form using in html and CSS and print the message Registration is successful

Ans:-

RegistrationServlet.java

```
package com.registration;
import jakarta.servlet.*;
import jakarta.servlet.annotation.WebServlet;
```

```
import jakarta.servlet.http.*;
import java.io.*;

@WebServlet("/RegistrationServlet")
public class RegistrationServlet extends HttpServlet {

    @Override
    protected void doPost(HttpServletRequest request, HttpServletResponse
response) throws ServletException, IOException {
        // Get form data
        String name = request.getParameter("name");
        String email = request.getParameter("email");
        String password = request.getParameter("password");

        // Process registration (you can store it in a database or session, for
now we just show success)

        // Set the response content type to HTML
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        // Display success message
        out.println("<html><body>");
        out.println("<h2>Registration Successful!</h2>");
        out.println("<p>Thank you, " + name + "! Your registration was
successful.</p>");
        out.println("<br><br>");
        out.println("<a href='register.html'>Go back to Registration</a>");
        out.println("</body></html>");
    }
}
```

Register.html

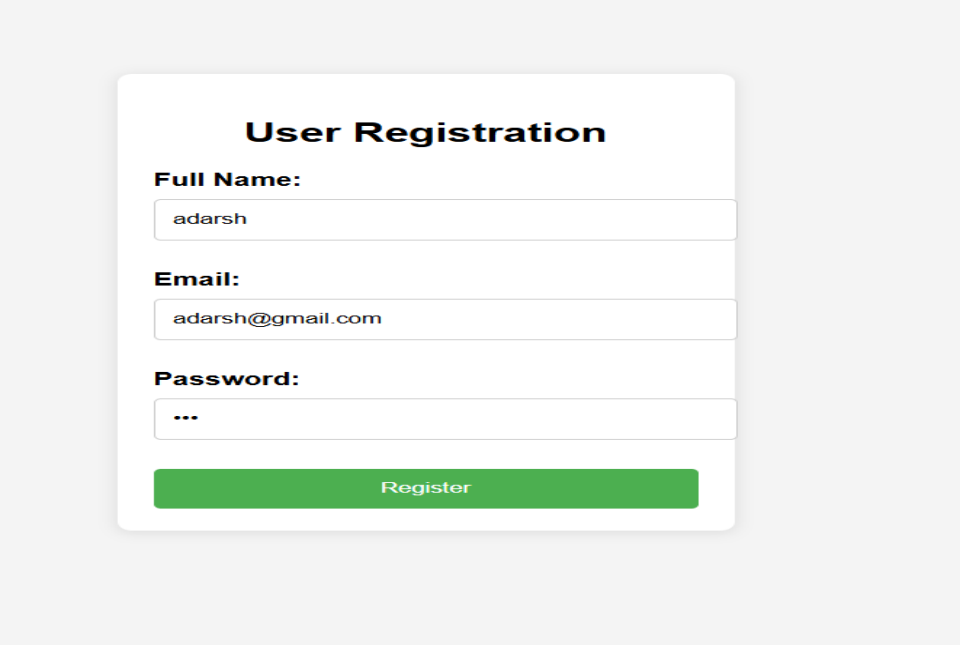
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>User Registration</title>
    <link rel="stylesheet" href="style.css">
</head>
<body>
    <div class="container">
        <h2>User Registration</h2>
        <form action="RegistrationServlet" method="POST">
            <label for="name">Full Name:</label>
```

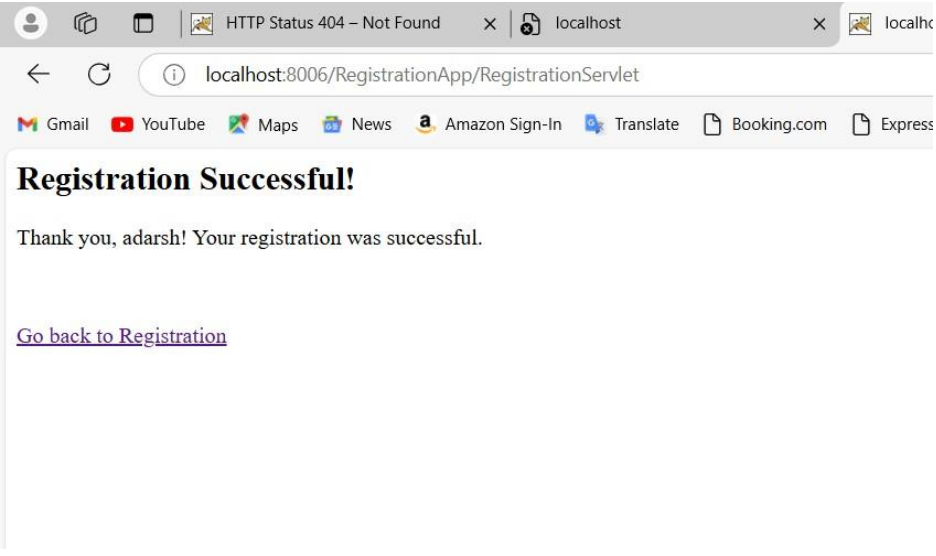
```
        <input type="text" id="name" name="name" required><br><br>

        <label for="email">Email:</label>
        <input type="email" id="email" name="email" required><br><br>

        <label for="password">Password:</label>
        <input type="password" id="password" name="password"
required><br><br>
        <input type="submit" value="Register">
      </form>
   </div>
</body>
</html>
```

Style.css

```
body {
   font-family: Arial, sans-serif;
   background-color: #f4f4f4;
   display: flex;
   justify-content: center;
   align-items: center;
   height:  100vh;
   margin: 0;
}

.container {
   background-color: #fff;
   padding: 20px;
   border-radius: 8px;
   box-shadow: 0 2px 10px rgba(0, 0, 0, 0.1);
   width: 300px;
}

h2 {
   text-align: center;
   margin-bottom: 20px;
}

label {
   font-weight: bold;
}
input[type="text"], input[type="email"], input[type="password"] {
   width: 100%;
   padding: 10px;
   margin: 8px 0;
```

```
    border: 1px solid #ccc;
    border-radius: 4px;
}
input[type="submit"] {
    width: 100%;
    padding: 10px;
    background-color: #4CAF50;
    color: white;
    border: none;
    border-radius: 4px;
    cursor: pointer;
}
input[type="submit"]:hover {
    background-color: #45a049;
}
```





Assignment 3: Java Server Pages(JSP)

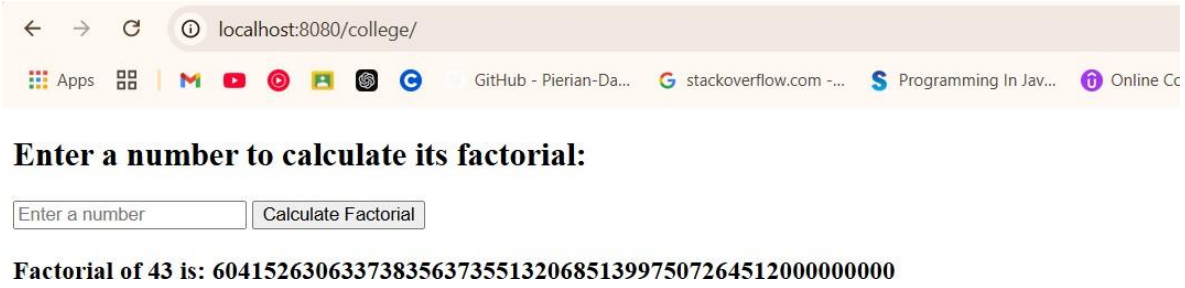
1. Write a JSP program calculates factorial of an integer number, while the input is taken from an HTML form

Ans:-

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1"%>
<%@ page import="java.math.BigInteger" %>
<!DOCTYPE html>
<html>
<head>
   <title>Factorial Calculator</title>
</head>
<body>
   <h2>Enter a number to calculate its factorial:</h2>
   <form action="" method="POST">
      <input type="number" name="number" placeholder="Enter a number"
required>
      <button type="submit">Calculate Factorial</button>
   </form>

   <%
      // Get the number from the request parameter
      String numberStr = request.getParameter("number");

      // Check if the number parameter is provided
      if (numberStr != null && !numberStr.isEmpty()) {
         try {
            // Convert the input to an integer
            int number = Integer.parseInt(numberStr);

            // Initialize the factorial result as 1
            BigInteger factorial = BigInteger.ONE;

            // Loop to calculate the factorial
            for (int i = 1; i <= number; i++) {
               factorial = factorial.multiply(BigInteger.valueOf(i));
            }

            // Display the result
            out.println("<h3>Factorial of " + number + " is: " + factorial.toString() +
"</h3>");


         } catch (NumberFormatException e) {
            out.println("<h3>Please enter a valid integer.</h3>");
         }
```

```
            out.println("<h3>Please enter a number to calculate its factorial.</h3>");
        }
    %>
</body>
</html>
```

OUTPUT:



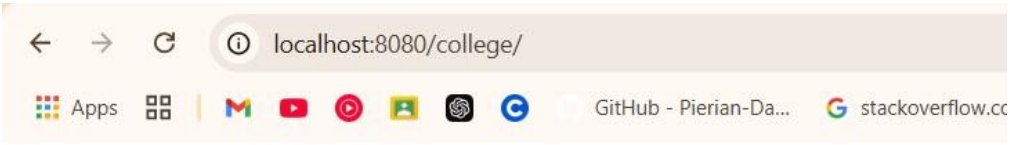
2. Write a JSP program to generate the Fibonacci series up to a particular term, while the input is taken from an HTML form.

Ans:-

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1"%>
<!DOCTYPE html>
<html>
<head>
    <title>Fibonacci Series Generator</title>
</head>
<body>
    <h2>Enter the number of terms for the Fibonacci Series:</h2>
    <form action="" method="POST">
        <input type="number" name="terms" placeholder="Enter number of terms"
required>
        <button type="submit">Generate Fibonacci Series</button>
    </form>

    <%
        // Get the number of terms from the request parameter
        String termsStr = request.getParameter("terms");

        // Check if the terms parameter is provided
        if (termsStr != null && !termsStr.isEmpty()) {
            try {
                // Convert the input to an integer
                int terms = Integer.parseInt(termsStr);
```

```
            // Initialize the first two Fibonacci numbers
            long first = 0, second = 1;

            // Print the Fibonacci series
            out.println("<h3>Fibonacci Series up to " + terms + " terms:</h3>");
            out.println("<ul>");
            for (int i = 1; i <= terms; i++) {
                out.println("<li>" + first + "</li>");
                long next = first + second; // next number in the series
                first = second;
                second = next;
            }
            out.println("</ul>");
        } catch (NumberFormatException e) {
            out.println("<h3>Please enter a valid integer.</h3>");
        }
    } else {
        out.println("<h3>Please enter a number to generate the Fibonacci
series.</h3>");
    }
%>
</body>
</html>
```

OUTPUT:



Enter the number of terms for the Fibonacci Series:

Enter number of terms | Generate Fibonacci Series

Fibonacci Series up to 10 terms:

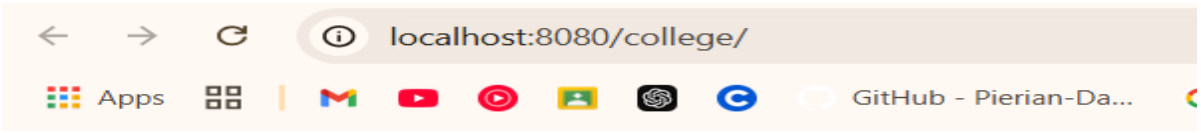
- 0
- 1
- 1
- 2
- 3
- 5
- 8
- 13
- 21
- 34

3. Write a JSP program to display the System date and time.

Ans:-

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1" %>
<!DOCTYPE html>
<html>
<head>
    <title>Current Date and Time</title>
</head>
<body>
    <h2>Current Date and Time</h2>
    <%
        // Get the current system date and time
        java.util.Date date = new java.util.Date();

        // Display the current date and time
        out.println("<p>Current Date and Time: " + date.toString() + "</p>");
    %>
</body>
</html>
```

OUTPUT:



Current Date and Time

Current Date and Time: Wed Nov 27 02:38:35 IST 2024

4. Write a JSP program to display a
Sample shopping Order calculation Form and display output in tabular form.

Ans:-

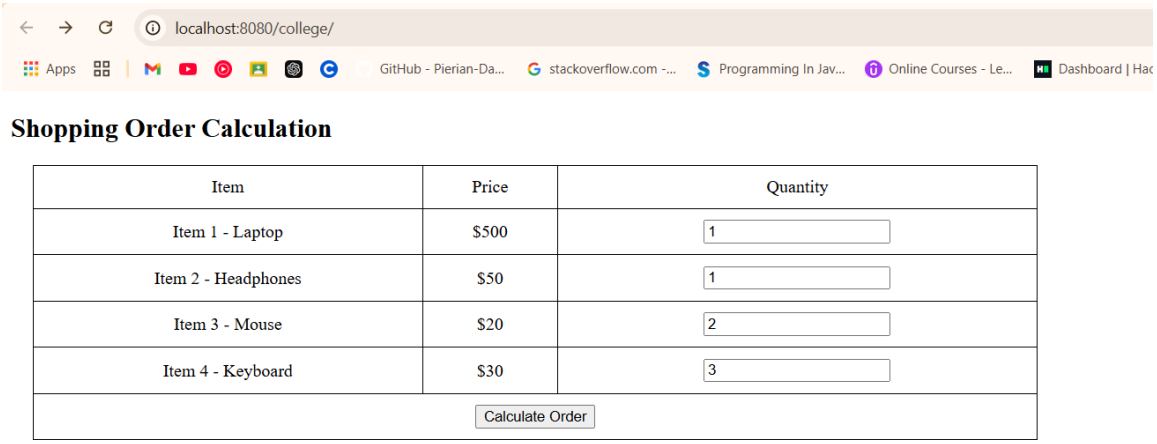
```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1" %>
<!DOCTYPE html>
<html>
<head>
    <title>Shopping Order Calculation</title>
    <style>
        table {
            width: 60%;
            margin: 20px;
            border-collapse: collapse;
        }
        table, th, td {
```

```
            border: 1px solid black;
        }
        th, td {
            padding: 10px;
            text-align: center;
        }
    </style>
</head>
<body>
    <h2>Shopping Order Calculation</h2>
    <!-- Shopping Form -->
    <form action="order.jsp" method="post">
        <table>
            <tr>
                <td>Item</td>
                <td>Price</td>
                <td>Quantity</td>
            </tr>
            <tr>
                <td>Item 1 - Laptop</td>
                <td>$500</td>
                <td><input type="number" name="item1" value="0" min="0" /></td>
            </tr>
            <tr>
                <td>Item 2 - Headphones</td>
                <td>$50</td>
                <td><input type="number" name="item2" value="0" min="0" /></td>
            </tr>
            <tr>
                <td>Item 3 - Mouse</td>
                <td>$20</td>
                <td><input type="number" name="item3" value="0" min="0" /></td>
            </tr>
            <tr>
                <td>Item 4 - Keyboard</td>
                <td>$30</td>
                <td><input type="number" name="item4" value="0" min="0" /></td>
            </tr>
            <tr>
                <td colspan="3" style="text-align: center;">
                    <input type="submit" value="Calculate Order" />
                </td>
            </tr>
        </table>
    </form>
```

```
    <%
        // Retrieving form values and calculating order total
        String item1Qty = request.getParameter("item1");
        String item2Qty = request.getParameter("item2");
        String item3Qty = request.getParameter("item3");
        if (item1Qty != null && item2Qty != null && item3Qty != null && item4Qty
!= null) {
            // Converting to integers
            int item1 = Integer.parseInt(item1Qty);
            int item2 = Integer.parseInt(item2Qty);
            int item3 = Integer.parseInt(item3Qty);
            int item4 = Integer.parseInt(item4Qty);
            // Prices
            int priceItem1 = 500;
            int priceItem2 = 50;
            int priceItem3 = 20;
            int priceItem4 = 30;
            // Calculating total cost for each item
            int totalItem1 = item1 * priceItem1;
            int totalItem2 = item2 * priceItem2;
            int totalItem3 = item3 * priceItem3;
            int totalItem4 = item4 * priceItem4;
            // Calculating final order total
            int totalOrder = totalItem1 + totalItem2 + totalItem3 + totalItem4;
    %>
    <!-- Displaying the order summary in tabular form -->
    <h3>Your Order Summary</h3>
    <table>
        <tr>
            <th>Item</th>
            <th>Quantity</th>
            <th>Price</th>
            <th>Total</th>
        </tr>
        <tr>
            <td>Item 1 - Laptop</td>
            <td><%= item1 %></td>
            <td>$500</td>
            <td>$<%= totalItem1 %></td>
        </tr>
        <tr>
            <td>Item 2 - Headphones</td>
            <td><%= item2 %></td>
            <td>$50</td>
            <td>$<%= totalItem2 %></td>
```

```
        </tr>
        <tr>
            <td>Item 3 - Mouse</td>
            <td><%= item3 %></td>
            <td>$20</td>
            <td>$<%= totalItem3 %></td>
        </tr>
        <tr>
            <td>Item 4 - Keyboard</td>
            <td><%= item4 %></td>
            <td>$30</td>
            <td>$<%= totalItem4 %></td>
        </tr>
        <tr>
            <td colspan="3"><strong>Total Order Cost</strong></td>
            <td><strong>$<%= totalOrder %></strong></td>
        </tr>
    </table>
    <% } %>
</body>
</html>
```

OUTPUT:



5. Write a JSP program to perform Arithmetic operations such as Addition, Subtraction, Multiplication and Division. Design a HTML to accept two numbers in text box and radio buttons to display operations. On submit display result as per the selected operation on next page using JSP

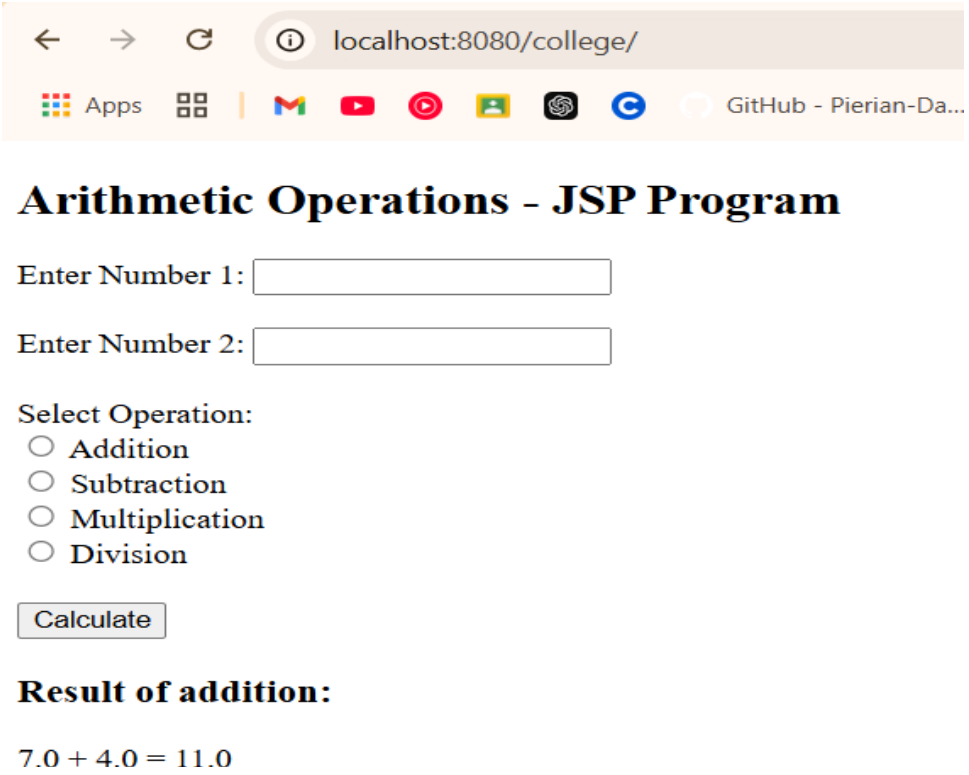
Ans:-

```
<%@ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>
<!DOCTYPE html>
<html>
```

```
<head>
   <title>Arithmetic Operations</title>
</head>
<body>
   <h2>Arithmetic Operations - JSP Program</h2>

   <form method="post">
      <!-- Input Fields -->
      <label for="num1">Enter Number 1:</label>
      <input type="number" name="num1" required><br><br>

      <label for="num2">Enter Number 2:</label>
      <input type="number" name="num2" required><br><br>

      <!-- Radio Buttons for Operations -->
      <label>Select Operation:</label><br>
      <input type="radio" name="operation" value="addition" required>
Addition<br>
      <input type="radio" name="operation" value="subtraction"> Subtraction<br>
      <input type="radio" name="operation" value="multiplication">
Multiplication<br>
      <input type="radio" name="operation" value="division"> Division<br><br>

      <input type="submit" value="Calculate">
   </form>
   <%
      // Only perform calculation if the form is submitted
      if (request.getMethod().equalsIgnoreCase("POST")) {
         // Retrieve numbers and operation from the form
         String num1Str = request.getParameter("num1");
         String num2Str = request.getParameter("num2");
         String operation = request.getParameter("operation");

         // Convert input values to numbers
         double num1 = Double.parseDouble(num1Str);
         double num2 = Double.parseDouble(num2Str);
         double result = 0;
         String errorMessage = "";

         // Perform arithmetic operation based on the selected radio button
         switch (operation) {
            case "addition":
               result = num1 + num2;
               break;
            case "subtraction":
```

```
                result = num1 - num2;
                break;
            case "multiplication":
                result = num1 * num2;
                break;
            case "division":
                if (num2 != 0) {
                    result = num1 / num2;
                } else {
                    errorMessage = "Error: Division by zero is not allowed!";
                }
                break;
            default:
                errorMessage = "Invalid operation.";
        }

        // Display the result or error message
        if (errorMessage.isEmpty()) {
    %>
            <h3>Result of <%= operation %>:</h3>
            <p><%= num1 %> <%= (operation.equals("addition") ? "+" :
operation.equals("subtraction") ? "-" : operation.equals("multiplication") ? "*" : "/")
%> <%= num2 %> = <%= result %></p>
    <%
        } else {
    %>
            <h3><%= errorMessage %></h3>
    <%
        }
      }
    %>

</body>
</html>
```

OUTPUT:



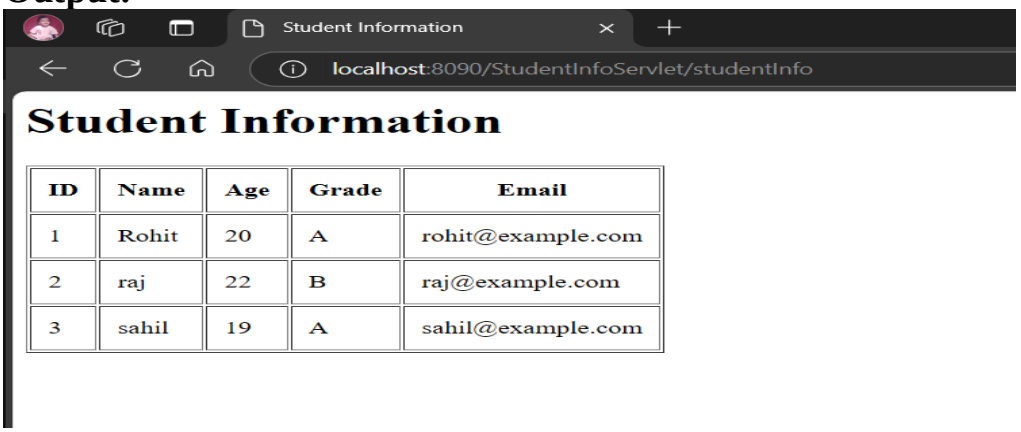
6. Write a servlet Program for student information and display the information in tabular form by selecting the details from student database table.
Studt.java
Ans:-

```
package com.example;
import java.io.PrintWriter;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.Statement;
import jakarta.servlet.ServletException;
import jakarta.servlet.annotation.WebServlet;
import jakarta.servlet.http.HttpServlet;
import jakarta.servlet.http.HttpServletRequest;
import jakarta.servlet.http.HttpServletResponse;
import java.io.IOException;
import java.sql.SQLException;
/**
 * Servlet implementation class StudentInfoServlet
 */
@WebServlet("/studentInfo")
public class StudentInfoServlet extends HttpServlet {
        private static final long serialVersionUID = 1L;
```

```
    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
throws ServletException, IOException {
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        // JDBC setup
        String jdbcURL = "jdbc:mysql://localhost:3306/student_db";
        String jdbcUsername = "root";
        String jdbcPassword = "Rohit@0801"; // Replace with your MySQL password

        try {
            // Establish connection
          Class.forName("com.mysql.cj.jdbc.Driver");
            Connection connection = DriverManager.getConnection(jdbcURL,
jdbcUsername, jdbcPassword);

            // Query student details
            String sql = "SELECT * FROM students";
            Statement statement = connection.createStatement();
            ResultSet resultSet = statement.executeQuery(sql);

            // Display student details in a table
            out.println("<html><head><title>Student
Information</title></head><body>");
            out.println("<h1>Student Information</h1>");
            out.println("<table border='1' cellpadding='10'>");

out.println("<tr><th>ID</th><th>Name</th><th>Age</th><th>Grade</th><th>Em
ail</th></tr>");

            while (resultSet.next()) {
                int id = resultSet.getInt("id");
                String name = resultSet.getString("name");
                int age = resultSet.getInt("age");
                String grade = resultSet.getString("grade");
                String email = resultSet.getString("email");
                out.println("<tr>");
                out.println("<td>" + id + "</td>");
                out.println("<td>" + name + "</td>");
                out.println("<td>" + age + "</td>");
                out.println("<td>" + grade + "</td>");
                out.println("<td>" + email + "</td>");
                out.println("</tr>");
```

```
            }

            out.println("</table>");
            out.println("</body></html>");

            resultSet.close();
            statement.close();
            connection.close();

        } catch (Exception e) {
            e.printStackTrace();
            out.println("<p>Error: Unable to fetch data from the database.</p>");
            out.println("<p>Details: " + e + "</p>");
        }
        }


 }
```

Output:-



7. Write a Java Servlet program to read employee details including employee number (empno), name, designation, basic pay, deductions, and allowances, and then calculate and display the net salary. display the information in tabular form by selecting the details from Emp_sal database table.

Ans:-

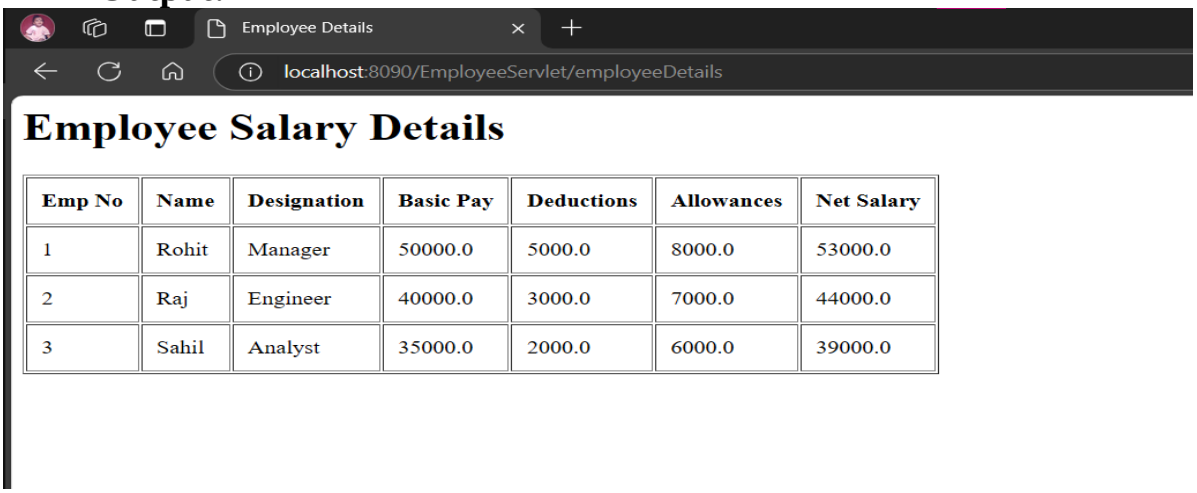
Emp.java

```
package com.example;
import java.io.IOException;
import java.io.PrintWriter;
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.Statement;
import jakarta.servlet.ServletException;
import  jakarta.servlet.annotation.WebServlet;
```

```
import jakarta.servlet.http.HttpServlet;
import jakarta.servlet.http.HttpServletRequest;
import jakarta.servlet.http.HttpServletResponse;
import java.io.IOException;

/**
 * Servlet implementation class EmployeeServlet
 */
@WebServlet("/employeeDetails")
public class EmployeeServlet extends HttpServlet {
        private static final long serialVersionUID = 1L;

    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
throws ServletException, IOException {
        response.setContentType("text/html");
        PrintWriter out = response.getWriter();

        // Database credentials
        String jdbcURL = "jdbc:mysql://localhost:3306/employee_db";
        String jdbcUsername = "root";
        String jdbcPassword = "Rohit@0801"; // Replace with your MySQL password

        try {
            // Load JDBC driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // Establish connection
            Connection connection = DriverManager.getConnection(jdbcURL,
jdbcUsername, jdbcPassword);

            // Query the employee salary details
            String sql = "SELECT * FROM Emp_sal";
            Statement statement = connection.createStatement();
            ResultSet resultSet = statement.executeQuery(sql);

            // Display employee details in a table
            out.println("<html><head><title>Employee Details</title></head><body>");
            out.println("<h1>Employee Salary Details</h1>");
            out.println("<table border='1' cellpadding='10'>");
            out.println("<tr><th>Emp
No</th><th>Name</th><th>Designation</th><th>Basic
Pay</th><th>Deductions</th><th>Allowances</th><th>Net  Salary</th></tr>");
            while (resultSet.next()) {
                int empno = resultSet.getInt("empno");
```

```
            String name = resultSet.getString("name");
            String designation = resultSet.getString("designation");
            double basicPay = resultSet.getDouble("basic_pay");
            double deductions = resultSet.getDouble("deductions");
            double allowances = resultSet.getDouble("allowances");

            // Calculate net salary
            double netSalary = basicPay + allowances - deductions;

            // Display employee data
            out.println("<tr>");
            out.println("<td>" + empno + "</td>");
            out.println("<td>" + name + "</td>");
            out.println("<td>" + designation + "</td>");
            out.println("<td>" + basicPay + "</td>");
            out.println("<td>" + deductions + "</td>");
            out.println("<td>" + allowances + "</td>");
            out.println("<td>" + netSalary + "</td>");
            out.println("</tr>");
        }

        out.println("</table>");
        out.println("</body></html>");

        resultSet.close();
        statement.close();
        connection.close();
    } catch (Exception e) {
        e.printStackTrace();
        out.println("<p>Error: Unable to fetch employee details.</p>");
        out.println("<p>Details: " + e.getMessage() + "</p>");
    }}}
```

Output:-



Employee Salary Details

Emp No	Name	Designation	Basic Pay	Deductions	Allowances	Net Salary
1	Rohit	Manager	50000.0	5000.0	8000.0	53000.0
2	Raj	Engineer	40000.0	3000.0	7000.0	44000.0
3	Sahil	Analyst	35000.0	2000.0	6000.0	39000.0

Assignment 4: Java Persistence API

4.1 Define and illustrate the concept of entity mapping in JPA.Explain how JPA maps Java classes (entities) to database tables.Provide an example of an entity class with annotations and its corresponding database table schema

ANS:

Entity Mapping in JPA (Java Persistence API)

Entity Mapping in JPA refers to the process of linking a Java class (often called an **entity class**) to a database table. This mapping allows Java objects to be stored in and retrieved from a relational database. JPA provides a set of annotations to specify how the fields of the Java class correspond to the columns in the database table.

How JPA Maps Java Classes to Database Tables

1. **Entity Class**:
   - An entity class in JPA is a Java class that is mapped to a database table.
   - Each instance of the class represents a row in the corresponding table.
   - The class must be annotated with the @Entity annotation to indicate that it is an entity.
2. **Primary Key**:
   - Every entity class must have a primary key, which uniquely identifies each row. This is typically represented by a field annotated with @Id.
   - The @GeneratedValue annotation can be used to auto-generate the primary key values.
3. **Field to Column Mapping**:
   - Fields in the Java class represent columns in the database table. By default, JPA assumes that the field names correspond to column names, but this can be customized using the @Column annotation.
4. **Table Mapping**:
   - The @Table annotation allows you to specify the table name in the database if it differs from the class name.
5. **Relationships**:
   - JPA also supports mapping relationships between entities, such as One-to-One, One-to-Many, Many-to-One, and Many-to-Many, using annotations like @OneToMany, @ManyToOne, etc.

Example of an Entity Class with Annotations

Let's consider an entity class called Customer, which is mapped to a customers table in the database.

Java Class (Entity):

```
import javax.persistence.*;
@Entity
@Table(name = "customers") // Specifies the table name in the database
public class Customer {
```

```
@Id // Marks this field as the primary key
@GeneratedValue(strategy = GenerationType.IDENTITY) // Auto-generate the
        primary key value
private Long id;

@Column(name = "first_name", nullable = false) // Maps this field to the
        'first_name' column in the table
private String firstName;

@Column(name = "last_name", nullable = false) // Maps this field to the
        'last_name' column in the table
private String lastName;

@Column(name = "email", unique = true) // Maps this field to the 'email' column
        in the table
private String email;

// Constructors, Getters, and Setters
public Customer() {}

public Customer(String firstName, String lastName, String email) {
   this.firstName = firstName;
   this.lastName = lastName;
   this.email = email;
}

public Long getId() {
   return id;
}

public void setId(Long id) {
   this.id = id;
}

public String getFirstName() {
   return firstName;
}

public void setFirstName(String firstName) {
   this.firstName = firstName;
}
public String getLastName() {
   return lastName;
}
```

```
    public void setLastName(String lastName) {
        this.lastName = lastName;
    }

    public String getEmail() {
        return email;
    }

    public void setEmail(String email) {
        this.email = email;
    }
}
```

Explanation of the Annotations:

1. **@Entity**: Specifies that the class is an entity and should be mapped to a database table.
2. **@Table(name = "customers")**: Maps the Customer class to the customers table in the database.
3. **@Id**: Specifies the field id as the primary key of the entity.
4. **@GeneratedValue(strategy = GenerationType.IDENTITY)**: Configures the primary key to be generated automatically using an identity column (auto-increment).
5. **@Column**: Used to specify column details (e.g., nullable, unique).
    - name: Specifies the column name in the database.
    - nullable: Indicates whether the column can accept null values.
    - unique: Ensures that values in this column are unique.

Corresponding Database Table Schema

After mapping the Customer class to the customers table, the corresponding database table schema would look like this:

```
CREATE TABLE customers (
    id BIGINT AUTO_INCREMENT PRIMARY KEY, -- Maps to @Id and
            @GeneratedValue
    first_name VARCHAR(100) NOT NULL,      -- Maps to @Column(name =
            "first_name")
    last_name VARCHAR(100) NOT NULL,       -- Maps to @Column(name =
            "last_name")
    email VARCHAR(100) UNIQUE              -- Maps to @Column(name = "email")
);
```

4.2 Describe the different types of relationships between entities (one-to-one, one-to- many, many-to-one, many-to-many).

- **Explain how JPA represents these relationships using annotations.**
- **Provide code examples for each type of relationship.**

ANS:

Different Types of Relationships between Entities in JPA

In Java Persistence API (JPA), entities can be related to each other in different ways. These relationships help model real-world associations between objects and allow for complex data structures in relational databases. JPA provides annotations to define these relationships. The four main types of relationships between entities in JPA are:

1. One-to-One (1:1)
2. One-to-Many (1:M)
3. Many-to-One (M:1)
4. Many-to-Many (M:M)

Each of these relationships can be mapped using JPA annotations to represent the database schema.

1. One-to-One Relationship (1:1)

A **one-to-one relationship** means that one entity is associated with exactly one other entity. For example, a **Person** might have one **Passport**.

JPA Representation:

- **@OneToOne** annotation is used to represent a one-to-one relationship.
- **@JoinColumn** is used to specify the foreign key column.

Example:

```
import javax.persistence.*;

@Entity

public class Person {
```

```
@Id

@GeneratedValue(strategy = GenerationType.IDENTITY)

private Long id;

private String name;

@OneToOne

@JoinColumn(name = "passport_id") // Foreign key column in the 'person' table

private Passport passport;

// Getters and Setters

}

@Entity

public class Passport {

@Id

@GeneratedValue(strategy = GenerationType.IDENTITY)

private Long id;

private String passportNumber;

// Getters and Setters

}
```

Explanation:

- The **Person** entity has a @OneToOne relationship with the **Passport** entity.
- **@JoinColumn** indicates that the foreign key (passport_id) is present in the **Person** table.
- In the database, **person** will have a column passport_id that references the **passport** table.

2. One-to-Many Relationship (1:M)

A **one-to-many relationship** means that one entity is associated with multiple other entities. For example, one **Department** can have many **Employees**.

JPA Representation:

- **@OneToMany** is used in the "one" side of the relationship.
- **@ManyToOne** is used in the "many" side of the relationship.
- **@JoinColumn** is used on the "many" side to specify the foreign key column.

Example:

```
import javax.persistence.*;

import java.util.List;

@Entity

public class Department {

    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)
```

```
    private Long id;

    private String departmentName;

    @OneToMany(mappedBy = "department") // 'department' is the field in Employee class

    private List<Employee> employees;

    // Getters and Setters

}

@Entity

public class Employee {

    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)

    private Long id;

    private String name;

    @ManyToOne

    @JoinColumn(name = "department_id") // Foreign key in Employee table

    private Department department;

    // Getters and Setters

}
```

Explanation:

- The **Department** entity has a @OneToMany relationship with the **Employee** entity.
- The **Employee** entity has a @ManyToOne relationship to **Department**.
- The foreign key department_id is stored in the **Employee** table.

3. Many-to-One Relationship (M:1)

A **many-to-one relationship** means that multiple entities are associated with a single entity. For example, many **Employees** belong to one **Department**.

JPA Representation:

- **@ManyToOne** is used to map the relationship from the "many" side.
- **@OneToMany** is used from the "one" side (reverse side).

Example:

This relationship is essentially the reverse of the **One-to-Many** example:

```
@Entity

public class Employee {



    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)

    private Long id;
```

```
    private String name;

    @ManyToOne

    @JoinColumn(name = "department_id") // Foreign key in Employee table

    private Department department;

    // Getters and Setters

}
```

- **Employee** is mapped to **Department** using @ManyToOne.
- **Department** is mapped to **Employee** using @OneToMany, and the foreign key (department_id) is stored in **Employee**.

4. Many-to-Many Relationship (M:M)

A **many-to-many relationship** means that many entities are associated with many other entities. For example, a **Student** can enroll in many **Courses**, and each **Course** can have many **Students**.

JPA Representation:

- **@ManyToMany** annotation is used on both sides of the relationship.
- **@JoinTable** is used to specify the intermediary table that stores the relationships (because many-to-many relationships require an association table).

Example:

```
import javax.persistence.*;
```

```
import java.util.List;

@Entity

public class Student {

    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)

    private Long id;

    private String name;

    @ManyToMany

    @JoinTable(

        name = "student_course", // Join table name

        joinColumns = @JoinColumn(name = "student_id"), // Foreign key in join table

        inverseJoinColumns = @JoinColumn(name = "course_id") // Foreign key for
Course

    )

    private List<Course> courses;

    // Getters and Setters

}

@Entity

public class Course {
```

```
    @Id

    @GeneratedValue(strategy = GenerationType.IDENTITY)

    private Long id;

    private String courseName;

    @ManyToMany(mappedBy = "courses") // 'courses' is the field in the Student
class

    private List<Student> students;

    // Getters and Setters

}
```

Explanation:

- The **Student** entity has a @ManyToMany relationship with the **Course** entity.
- The **@JoinTable** annotation specifies the join table student_course, which will have two foreign keys: student_id and course_id.
- The **Course** entity has the reverse @ManyToMany annotation, with mappedBy specifying that the relationship is already mapped by the **Student** entity.

4.3 Create a JPA application to perform CRUD operations on a simple entity (e.g., Product).

- **Include methods for creating, retrieving, updating, and deleting Product entities.**
- **Demonstrate the use of `EntityManager` for persistence operations.**

Ans:

Product.java

```
import javax.persistence.Entity;
import    javax.persistence.GeneratedValue;
import    javax.persistence.GenerationType;
import javax.persistence.Id;
@Entity
public class Product {
   @Id
   @GeneratedValue(strategy = GenerationType.IDENTITY)
   private Long id;
   private String name;
   private double price;
   // Constructors
   public Product() {
   public Product(String name, double price) {
      this.name = name;
      this.price = price;
   }
   // Getters and Setters
   public Long getId() {
      return id;
```

```
    public void setId(Long id) {
        this.id = id;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public double getPrice() {
        return price;
    }
    public void setPrice(double price) {
        this.price = price;
    }
    @Override
    public String toString() {
        return "Product{id=" + id + ", name='" + name + "', price=" + price + "}";
    }
}
```

ProductService.java

```
import javax.persistence.EntityManager;
import javax.persistence.EntityManagerFactory;
import javax.persistence.Persistence;

public class ProductService {
    private static EntityManagerFactory emf =
                Persistence.createEntityManagerFactory("productPU");
    private static EntityManager em = emf.createEntityManager();
```

```
    // Create Product
    public void createProduct(Product product) {
        em.getTransaction().begin();
        em.persist(product);
        em.getTransaction().commit();
        System.out.println("Product Created: " + product);
    }

    // Retrieve Product by ID
    public Product getProduct(Long id) {
        Product product = em.find(Product.class, id);
        System.out.println("Product Retrieved: " + product);
        return product;
    }

    // Update Product
    public void updateProduct(Long id, String newName, double newPrice) {
        em.getTransaction().begin();
        Product product = em.find(Product.class, id);
        if (product != null) {
            product.setName(newName);
            product.setPrice(newPrice);
            em.getTransaction().commit();
            System.out.println("Product Updated: " + product);
        }
    }

    // Delete Product
    public void deleteProduct(Long id) {
        em.getTransaction().begin();
        Product product = em.find(Product.class, id);
        if (product != null) {
            em.remove(product);
            em.getTransaction().commit();
            System.out.println("Product Deleted: " + product);
        }
    }

    // Close EntityManager
    public void close() {
        em.close();
        emf.close();
    }
}
```

Main.java

```
public class Main {
    public static void main(String[] args) {
        ProductService productService = new ProductService();
        // Create products
        Product product1 = new Product("Laptop", 1200.0);
        Product product2 = new Product("Smartphone", 800.0);
        productService.createProduct(product1);
        productService.createProduct(product2);
        // Retrieve product by ID
        Product retrievedProduct = productService.getProduct(1L);
        // Update product
        productService.updateProduct(1L, "Gaming Laptop", 1500.0);
        // Delete product
        productService.deleteProduct(2L);
        // Close resources
        productService.close();
    }
}
```

OUTPUT:

```
INFO: HHH000490: Using JtaPlatform implementation: [org.hibernate.engine.transaction
Hibernate:
    /* insert Product
        */ insert
        into
            Product
            (name, price)
        values
            (?, ?)
Product Created: Product{id=1, name='Laptop', price=1200.0}
Hibernate:
    /* insert Product
        */ insert
        into
            Product
            (name, price)
        values
            (?, ?)
Product Created: Product{id=2, name='Smartphone', price=800.0}
Product Retrieved: Product{id=1, name='Laptop', price=1200.0}
Hibernate:
    /* update
        Product */ update
            Product
        set
            name=?,
            price=?
        where
            id=?
Product Updated: Product{id=1, name='Gaming Laptop', price=1500.0}
Hibernate:
    /* delete Product */ delete
        from
            Product
        where
            id=?
Product Deleted: Product{id=2, name='Smartphone', price=800.0}
```

Assignment 5:Spring Boot

1. **Configure a Spring Boot application to connect to a specific MySQL database without explicitly defining beans for connection pool, DataSource, etc.**
   - **Use only the necessary dependencies and demonstrate how auto-configuration sets up the connection.**
   - **Explore using application.properties to customize connection details (URL, username, password).**

Main Application Class

File Name: `SpringbootFirstApplication.java`
Location: `src/main/java/com/java/springboot`

```
package com.java.springboot;

        import org.springframework.boot.SpringApplication;
        import org.springframework.boot.autoconfigure.SpringBootApplication;

        @SpringBootApplication
        public class SpringbootFirstApplication {
            public static void main(String[] args) {
                SpringApplication.run(SpringbootFirstApplication.class, args);
            }
        }
```

2. Entity Class
File Name: User.java
Location: src/main/java/com/java/springboot/model

```
package com.java.springboot.Model;

        import jakarta.persistence.Entity;
        import jakarta.persistence.Id;

        @Entity
        public class User {
            @Id
            private Long id;
            private String name;
            private String email;

            // Getters and Setters
            public Long getId() {
```

```
        return id;
    }

    public void setId(Long id) {
        this.id = id;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public String getEmail() {
        return email;
    }

    public void setEmail(String email) {
        this.email = email;
    }
}
```

3. Repository Interface
File Name: UserRepository.java
Location: src/main/java/com/java/springboot/repository

```
package com.java.springboot.repository;

import org.springframework.data.jpa.repository.JpaRepository;
import com.java.springboot.Model.User;

public interface UserRepository extends JpaRepository<User, Long> {
}
```

4. Controller
File Name: UserController.java
Location: src/main/java/com/java/springboot/controller

```
package com.java.springboot.controller;

import com.java.springboot.Model.User;
import com.java.springboot.repository.UserRepository;
import org.springframework.web.bind.annotation.*;
import java.util.List;
```

```
@RestController
@RequestMapping("/api/users")
public class UserController {

    private final UserRepository userRepository;

    public UserController(UserRepository userRepository) {
        this.userRepository = userRepository;
    }

    @GetMapping
    public List<User> getAllUsers() {
        return userRepository.findAll();
    }

    @PostMapping
    public User createUser(@RequestBody User user) {
        return userRepository.save(user);
    }
}
```

5. Application Properties

File Name: application.properties

Location: src/main/resourc

```
# MySQL database connection
spring.datasource.url=jdbc:mysql://localhost:3306/company_db
spring.datasource.username=root
spring.datasource.password=1234567890

# JPA and Hibernate settings
spring.jpa.hibernate.ddl-auto=update
spring.jpa.show-sql=true
spring.jpa.properties.hibernate.dialect=org.hibernate.dialect.MySQLDia
lect
```

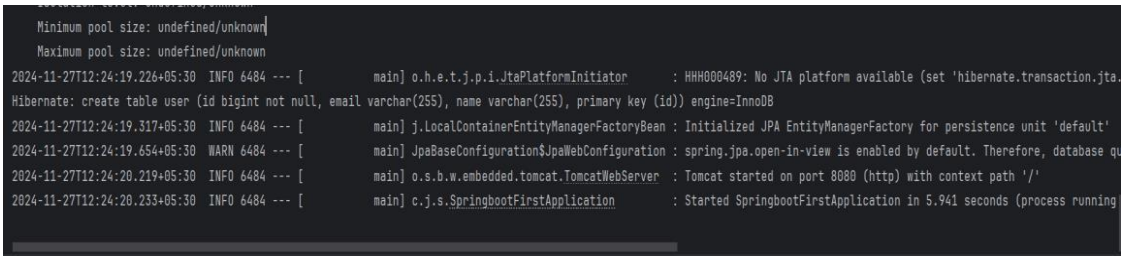
6)pom.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
https://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <parent>
```

```
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>3.4.0</version>
    <relativePath/> <!-- lookup parent from repository -->
  </parent>
  <groupId>com.java</groupId>
  <artifactId>springboot-first</artifactId>
  <version>0.0.1-SNAPSHOT</version>
  <name>springboot-first</name>
  <description>Demo project for Spring Boot</description>
  <url/>
  <licenses>
    <license/>
  </licenses>
  <developers>
    <developer/>
  </developers>
  <scm>
    <connection/>
    <developerConnection/>
    <tag/>
    <url/>
  </scm>
  <properties>
    <java.version>17</java.version>
  </properties>
  <dependencies>
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-data-jpa</artifactId>
    </dependency>
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-web</artifactId>
    </dependency>
    <dependency>
      <groupId>com.mysql</groupId>
      <artifactId>mysql-connector-j</artifactId>
      <scope>runtime</scope>
    </dependency>
    <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-test</artifactId>
      <scope>test</scope>
    </dependency>
```

```
    </dependencies>

    <build>
      <plugins>
        <plugin>
          <groupId>org.springframework.boot</groupId>
          <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>
      </plugins>
    </build>

</project>
```

OUTPUT:



2. Create a Spring Boot application that utilizes JPA repositories. Persist and retrieve data from an in-memory database (e.g., H2) without manual configuration.

- **Focus on the simplicity achieved through auto-configuration for JPA and repositories.**
- **Implement basic CRUD operations using JPA repositorie**

ProductController.java

```
package com.example.project2.controller;

import com.example.project2.model.Product;
import com.example.project2.service.ProductService;
import org.springframework.http.ResponseEntity;
import org.springframework.web.bind.annotation.*;

import java.util.List;
@RestController
@RequestMapping("/products")
public class ProductController {
```

```
    private final ProductService productService;

    public ProductController(ProductService productService) {
        this.productService = productService;
    }

    @GetMapping
    public List<Product> getAllProducts() {
        return productService.getAllProducts();
    }

    @GetMapping("/{id}")
    public ResponseEntity<Product> getProductById(@PathVariable Long id) {
        return productService.getProductById(id)
                .map(ResponseEntity::ok)
                .orElse(ResponseEntity.notFound().build());
    }
    @PostMapping
    public Product addProduct(@RequestBody Product product) {
        return productService.addProduct(product);
    }

    @PutMapping("/{id}")
    public ResponseEntity<Product> updateProduct(@PathVariable Long id,
@RequestBody Product product) {
        try {
            return ResponseEntity.ok(productService.updateProduct(id, product));
        } catch (RuntimeException e) {
            return ResponseEntity.notFound().build();
        }
    }

    @DeleteMapping("/{id}")
    public ResponseEntity<Void> deleteProduct(@PathVariable Long id) {
        productService.deleteProduct(id);
        return ResponseEntity.noContent().build();
    }
}
```

Product.java

```
package com.example.project2.model;

import jakarta.persistence.Entity;
import jakarta.persistence.GeneratedValue;
```

```
import jakarta.persistence.GenerationType;
import jakarta.persistence.Id;

@Entity
public class Product {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;

    private String name;
    private double price;

    public Product() {}

    public Product(String name, double price) {
        this.name = name;
        this.price = price;
    }

    public Long getId() {
        return id;
    }

    public void setId(Long id) {
        this.id = id;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public double getPrice() {
        return price;
    }

    public void setPrice(double price) {
        this.price = price;
    }
}
```

ProductRespository.java

```
package com.example.project2.repository;

import com.example.project2.model.Product;
import org.springframework.data.jpa.repository.JpaRepository;

public interface ProductRepository extends JpaRepository<Product, Long> {
}
```

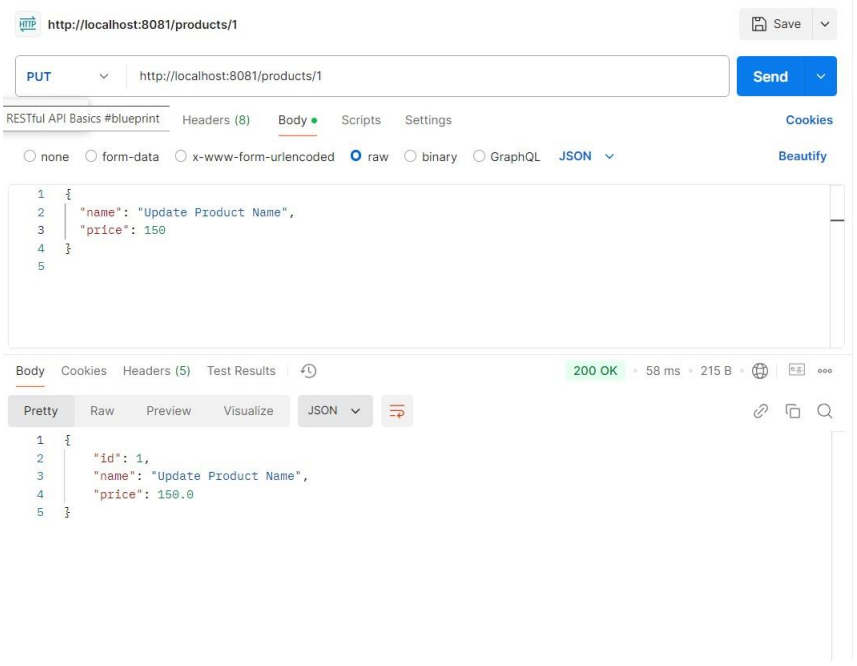
ProductService.java

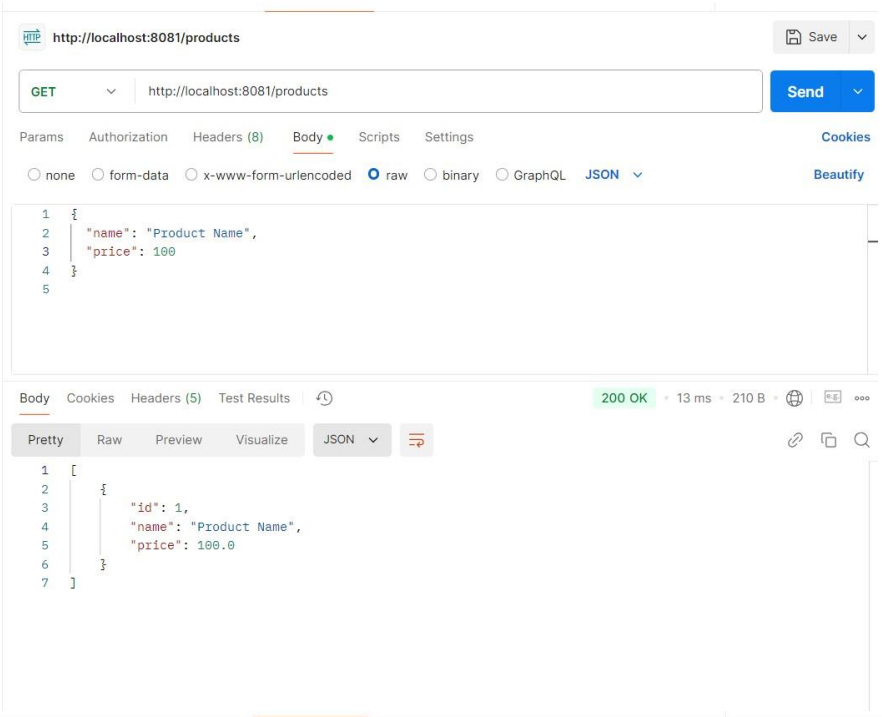
```
package com.example.project2.service;

import com.example.project2.model.Product;
import com.example.project2.repository.ProductRepository;
import org.springframework.stereotype.Service;

import java.util.List;
import java.util.Optional;

@Service
public class ProductService {

    private final ProductRepository productRepository;

    public ProductService(ProductRepository productRepository) {
        this.productRepository = productRepository;
    }

    public List<Product> getAllProducts() {
        return productRepository.findAll();
    }

    public Optional<Product> getProductById(Long id) {
        return productRepository.findById(id);
    }

    public Product addProduct(Product product) {
        return productRepository.save(product);
    }
    public Product updateProduct(Long id, Product updatedProduct) {
        return productRepository.findById(id).map(product -> {
            product.setName(updatedProduct.getName());
            product.setPrice(updatedProduct.getPrice());
            return productRepository.save(product);
        }).orElseThrow(() -> new RuntimeException("Product not found"));
    }
```

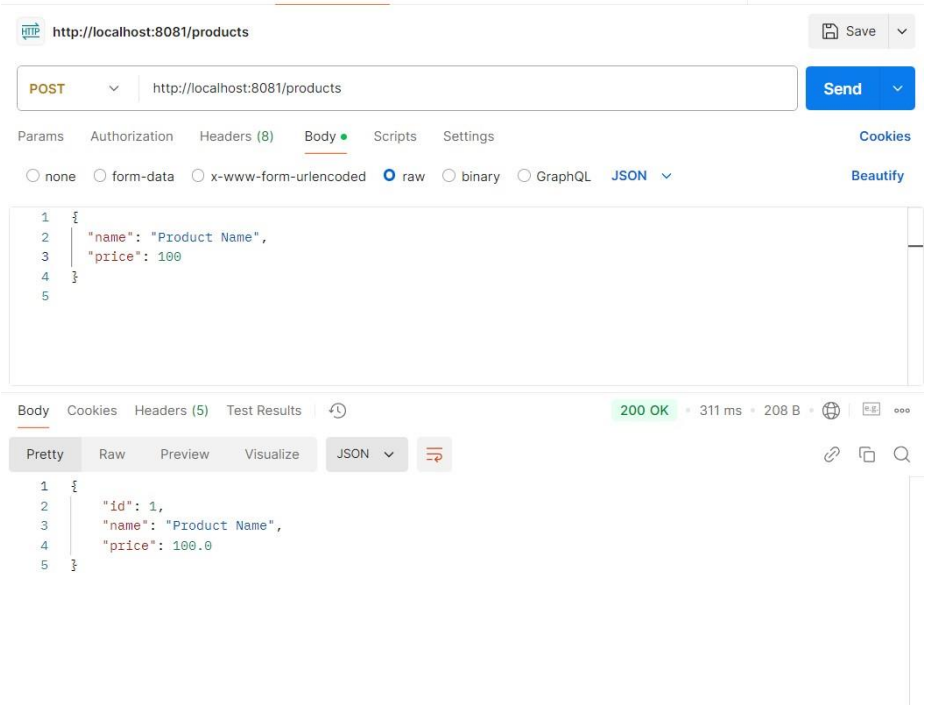
```
    public void deleteProduct(Long id) {
        productRepository.deleteById(id);
    }
}
```

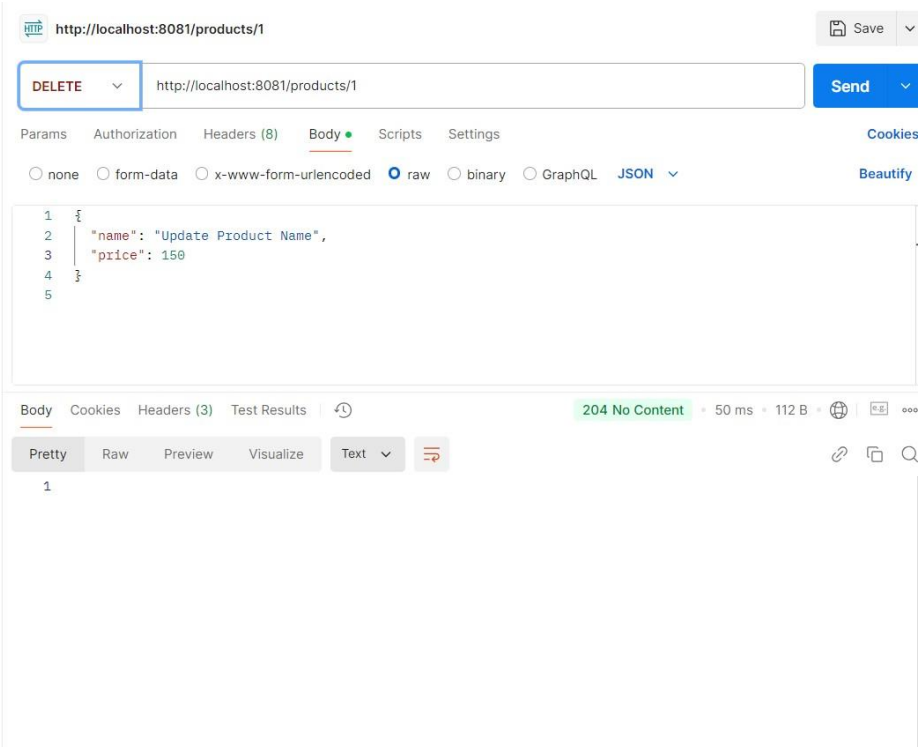
application.properties

```
# H2 Database settings
spring.datasource.url=jdbc:h2:mem:DEMO
spring.datasource.driverClassName=org.h2.Driver
spring.datasource.username=root
spring.datasource.password=12345
spring.h2.console.enabled=true
spring.jpa.show-sql=true
spring.jpa.hibernate.ddl-auto=update
server.port=8081
```




http://localhost:8081/products
Save
GET
http://localhost:8081/products
Send
Params
Authorization
Headers (8)
Body
Scripts
Settings
Cookies
none
form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
Beautify
{
"name": "Product Name",
"price": 100
}
Body
Cookies
Headers (5)
Test Results
200 OK
13 ms
210 B
Pretty
Raw
Preview
Visualize
JSON
[
{
"id": 1,
"name": "Product Name",
"price": 100.0
}
]


http://localhost:8081/products
Save
POST
http://localhost:8081/products
Send
Params
Authorization
Headers (8)
Body
Scripts
Settings
Cookies
none
form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
Beautify
{
"name": "Product Name",
"price": 100
}
Body
Cookies
Headers (5)
Test Results
200 OK
311 ms
208 B
Pretty
Raw
Preview
Visualize
JSON
{
"id": 1,
"name": "Product Name",
"price": 100.0
}



3.Develop a Spring Boot application with a RESTful API that exposes an endpoint to retrieve a list of products.

- **Utilize Spring MVC annotations like @RestController and @GetMapping.**
- **Implement a service layer to interact with a product repository (in-memory or database).**
- **Return the list of products in JSON format using @ResponseBody**

ProductController.java

```
package com.example.productapi.controller;
import  com.example.productapi.model.Product;
import  com.example.productapi.service.ProductService;
import  org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
import java.util.List;
@RestController
public class ProductController {
    private final ProductService productService;

    public ProductController(ProductService productService) {
        this.productService = productService;
    }

    @GetMapping("/products")
    public List<Product> getProducts() {
        return productService.getProducts();
    }
}
```

Product.java

```
package com.example.productapi.model;

public class Product {
    private Long id;
    private String name;
    private double price;
    // Constructors
    public Product(Long id, String name, double price) {
        this.id = id;
        this.name = name;
        this.price = price;
    }
    // Getters and Setters
    public Long getId() {
        return id;
    }

    public void setId(Long id) {
        this.id = id;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public double getPrice() {
        return price;
    }
    public void setPrice(double price) {
        this.price = price;
    }
}
```

ProductRepository.java

```
package com.example.productapi.repository;
import com.example.productapi.model.Product;
import org.springframework.stereotype.Repository;
import java.util.Arrays;
import java.util.List;
@Repository
public class ProductRepository {
    public List<Product> getAllProducts() {
        return Arrays.asList(
                new Product(1L, "Laptop", 999.99),
```

```
            new Product(2L, "Smartphone", 599.99),
            new Product(3L, "Headphones", 199.99)
        );
    }
}
```

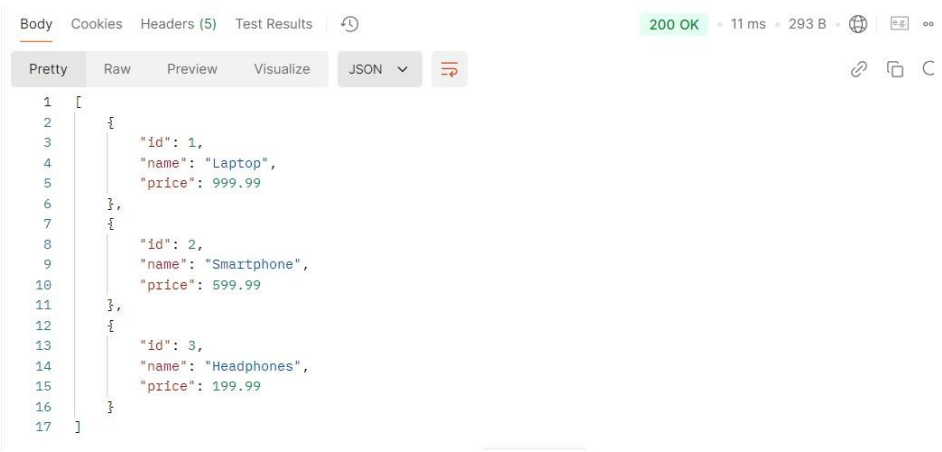
ProductService.java

```
package com.example.productapi.service;
import     com.example.productapi.model.Product;
import com.example.productapi.repository.ProductRepository;
import org.springframework.stereotype.Service;
import java.util.List;
@Service
public class ProductService {
    private final ProductRepository productRepository;

    public ProductService(ProductRepository productRepository) {
        this.productRepository = productRepository;
    }

    public List<Product> getProducts() {
        return productRepository.getAllProducts();
    }
}
```

application.properties

```
spring.h2. console.enabled=true
spring.h2.console.path=/h2-console
spring.datasource.url=jdbc:h2:mem:DEMO
spring.datasource.driverClassName=org.h2.Driver
spring.datasource.username=root
spring.datasource.password=12345
```

OUTPUT :



Assignment 6: Hibernate Framework

6.1 Write a Hibernate program to create the product table (product id,product name,product category,product price) and delete the specific product record.(using through the product id)

Product.java

```
import javax.persistence.Entity;

import javax.persistence.Id;

@Entity

public class Product {

    @Id

    private int id;

    private String name;

    private String category;

    private double price;

    // Default constructor (required by JPA)

    public Product() {

    }
    // Constructor with parameters

    public Product(int id, String name, String category, double price) {

        this.id = id;

        this.name = name;

        this.category = category;

        this.price = price;

    }

    public int getId() {

        return id;
```

```
    }
    public void setId(int id) {
        this.id = id;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public String getCategory() {
        return category;
    }
    public void setCategory(String category) {
        this.category = category;
    }
    public double getPrice() {
        return price;
    }
    public void setPrice(double price) {
        this.price = price;
    }
}
```

ProductService.java

```
import org.hibernate.Session;
import org.hibernate.SessionFactory;
import org.hibernate.Transaction;
public class ProductService {
    public void createProduct(Product product) {
        // Get session factory
        SessionFactory factory = HibernateUtil.getSessionFactory();
        // Get session from the factory
        Session session = factory.getCurrentSession();
        // Begin transaction
        Transaction transaction = session.beginTransaction();
        try {
            // Save the product
            session.save(product);
            // Commit transaction
            transaction.commit();
        } catch (Exception e) {
            // Handle exception, roll back transaction
            if (transaction != null) {
                transaction.rollback();
            }
            e.printStackTrace();
        } finally {
            // Close the session (do not call closeSession here, just use session.close())
```

```
            session.close();
        }
    }
}
```

Main.java

```
public class Main {
    public static void main(String[] args) {
        try {
            // Create a new product
           Product newProduct = new Product(2, "Laptop", "Electronics", 1200.00);
            // Create ProductService instance
            ProductService productService = new ProductService();
            // Call method to create product
            productService.createProduct(newProduct);
        } finally {
            // Clean up resources by closing the SessionFactory
            HibernateUtil.closeSessionFactory();
        }
    }
}
```

InsertProduct.java

```
import org.hibernate.Session;
import org.hibernate.SessionFactory;
import org.hibernate.Transaction;
```

```
public class InsertProduct {

    public static void main(String[] args) {

        // Create a new Product object

          Product newProduct = new Product(2, "Laptop", "Electronics", 1200.00);  // id changed to 2

        // Get session factory

        SessionFactory factory = HibernateUtil.getSessionFactory();

        // Get session from factory

        Session session = factory.getCurrentSession();

        // Begin transaction

        Transaction transaction = session.beginTransaction();

        try {

            // Save the Product object

            session.save(newProduct);

            // Commit the transaction (this will persist the product in the database)

            transaction.commit();

        } catch (Exception e) {

            // Handle exception (in case of any errors, roll back the transaction)

            if (transaction != null) {

                transaction.rollback();

            }

            e.printStackTrace();

        } finally {

            // Close the session

            session.close();
```

```
        }
    }
}
```

HibernateUtil.java

```
import org.hibernate.SessionFactory;
import org.hibernate.cfg.Configuration;
public class HibernateUtil {
    private static SessionFactory sessionFactory;
    static {
        try {
            // Initialize SessionFactory from Hibernate configuration file
            sessionFactory = new
Configuration().configure("hibernate.cfg.xml").addAnnotatedClass(Product.class).bu
ildSessionFactory();
        } catch (Exception e) {
            e.printStackTrace();
            throw new ExceptionInInitializerError("SessionFactory initialization
failed.");
        }
    }
    // Method to get SessionFactory
    public static SessionFactory getSessionFactory() {
        return sessionFactory;
    }
    // Method to close the SessionFactory
    public static void closeSessionFactory() {
```

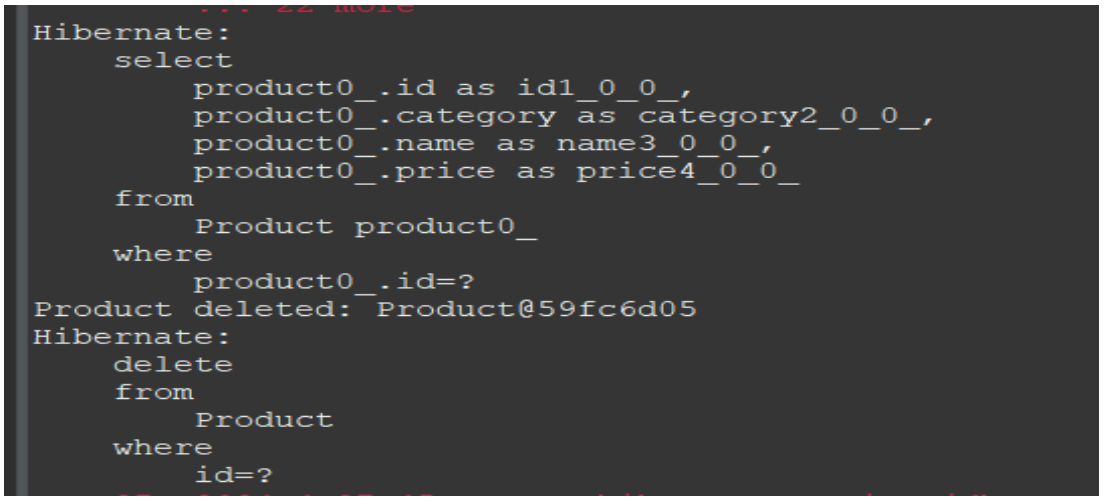
```
        if (sessionFactory != null) {
            sessionFactory.close();
        }
    }
}
```

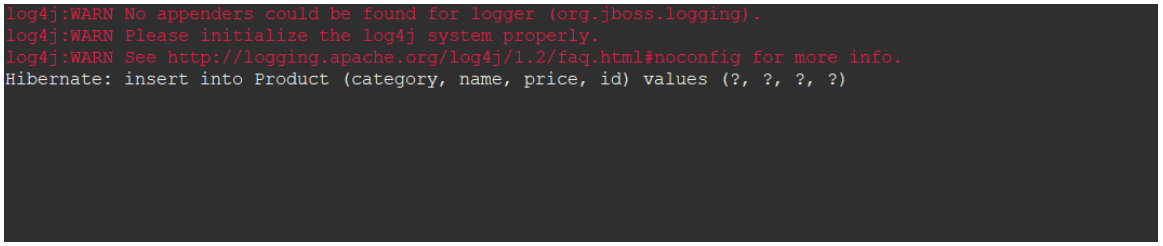
Hibernate.cfg.xml

```
<!DOCTYPE hibernate-configuration PUBLIC "-//Hibernate/Hibernate Configuration DTD 3.0//EN" "http://hibernate.sourceforge.net/hibernate-configuration-3.0.dtd">

<hibernate-configuration>
    <session-factory>
        <!-- JDBC Database connection settings -->
        <property name="hibernate.connection.driver_class">com.mysql.cj.jdbc.Driver</property>
        <property name="hibernate.connection.url">jdbc:mysql://localhost:3306/products</property>
        <property name="hibernate.connection.username">root</property>
        <property name="hibernate.connection.password">1234567890</property>
        <!-- JDBC connection pool settings -->
        <property name="hibernate.c3p0.min_size">5</property>
        <property name="hibernate.c3p0.max_size">20</property>
        <!-- Specify dialect -->
        <property name="hibernate.dialect">org.hibernate.dialect.MySQLDialect</property>
        <!-- Enable Hibernate's automatic session context management -->
        <property name="hibernate.current_session_context_class">thread</property>
```

```
        <!-- Echo all executed queries -->
        <property name="hibernate.show_sql">true</property>
        <!-- Drop and re-create the database schema on startup -->
        <property name="hibernate.hbm2ddl.auto">update</property>
        <!-- Disable the second-level cache -->
        <property
name="hibernate.cache.provider_class">org.hibernate.cache.NoCacheProvider</pro
perty>
        <!-- Drop and re-create the database schema on startup -->
        <property name="hibernate.hbm2ddl.auto">update</property>
    </session-factory>
</hibernate-configuration>
```

OUTPUT





```
mysql> select * from product;
+----+-------------+--------+-------+
| id | category    | name   | price |
+----+-------------+--------+-------+
|  2 | Electronics | Laptop |  1200 |
+----+-------------+--------+-------+
1 row in set (0.00 sec)

mysql>
```

6.2 Write a Hibernate program to update the product price data from product table.(Using HQL)

Product.java

```
import javax.persistence.Entity;

import javax.persistence.Id;

import javax.persistence.Table;

@Entity

@Table(name = "product")  // This maps the entity to the "product" table

public class Product {

    @Id  // Marks the "id" field as the primary key

    private int id;

    private String name;

    private String category;

    private double price;

    // Default constructor

    public Product() {}

    // Constructor with all fields

    public Product(int id, String name, String category, double price) {

        this.id = id;

        this.name = name;
```

```
    this.category = category;
    this.price = price;
}
// Getters and Setters
public int getId() {
    return id;
}
public void setId(int id) {
    this.id = id;
}
public String getName() {
    return name;
}
public void setName(String name) {
    this.name = name;
}
public String getCategory() {
    return category;
}
public void setCategory(String category) {
    this.category = category;
}
public double getPrice() {
    return price;
}
```

```
    public void setPrice(double price) {
        this.price = price;
    }
    @Override
    public String toString() {
        return "Product [id=" + id + ", name=" + name + ", category=" + category + ",
price=" + price + "]";
    }
}
```

ProductService.java

```
import org.hibernate.Session;
import org.hibernate.Transaction;
public class ProductService {
    public void updateProductPrice(int productId, double newPrice) {
        // Start session
        Session session = HibernateUtil.getSessionFactory().openSession();
        // Begin transaction
        Transaction transaction = null;
        try {
            transaction = session.beginTransaction();
            // HQL Query to update product price
            String hql = "UPDATE Product p SET p.price = :price WHERE p.id =
:productId";
            // Create query and set parameters
            int updatedEntities = session.createQuery(hql)
                                .setParameter("price", newPrice)
```

```
                .setParameter("productId", productId)
                .executeUpdate();
            // Commit the transaction
            transaction.commit();
            // Output success message
            if (updatedEntities > 0) {
                System.out.println("Product price updated successfully!");
            } else {
                System.out.println("Product not found with id: " + productId);
            }
        } catch (Exception e) {
            if (transaction != null) {
                transaction.rollback();  // Rollback transaction on error
            }
            e.printStackTrace();
        } finally {
            session.close();  // Close session
        }
    }
}
```

HibernateUtil.java

```
import org.hibernate.SessionFactory;
import org.hibernate.cfg.Configuration;
public class HibernateUtil {
    private static SessionFactory sessionFactory;
```

```
    // Static block to initialize sessionFactory
    static {
        try {
            // Build the session factory using the configuration
            sessionFactory = new Configuration().configure("hibernate.cfg.xml")
                    .addAnnotatedClass(Product.class)  // Add the annotated entity class (Product)
                    .buildSessionFactory();
        } catch (Exception e) {
            e.printStackTrace();
            throw new ExceptionInInitializerError(e);
        }
    }
    // Method to get the sessionFactory
    public static SessionFactory getSessionFactory() {
        return sessionFactory;
    }
    // Method to close the sessionFactory
    public static void closeSessionFactory() {
        if (sessionFactory != null) {
            sessionFactory.close();
        }
    }
}
```

Main.java

```
public class Main {
    public static void main(String[] args) {
        ProductService productService = new ProductService();


        // Update product price where productId is 1 and new price is 899.99
        productService.updateProductPrice(1, 899.99);
    }
}
```

Hibernate.cfg.xml

```
<!DOCTYPE hibernate-configuration PUBLIC "-//Hibernate/Hibernate Configuration DTD 3.0//EN" "http://hibernate.sourceforge.net/hibernate-configuration-3.0.dtd">
<hibernate-configuration>
    <!-- JDBC Database connection settings -->
    <session-factory>
        <!-- JDBC driver -->
        <property name="hibernate.dialect">org.hibernate.dialect.MySQLDialect</property>
        <property name="hibernate.connection.driver_class">com.mysql.cj.jdbc.Driver</property>
        <property name="hibernate.connection.url">jdbc:mysql://localhost:3306/products</property>
        <property name="hibernate.connection.username">root</property>
        <property name="hibernate.connection.password">1234567890</property>
        <!-- JDBC connection pool settings -->
        <property name="hibernate.c3p0.min_size">5</property>
```

```
        <property name="hibernate.c3p0.max_size">20</property>
        <property name="hibernate.c3p0.timeout">300</property>
       <property     name="hibernate.c3p0.max_statements">50</property>
        <!-- Specify the JDBC transaction handling -->
        <property
name="hibernate.transaction.factory_class">org.hibernate.transaction.JDBCTransact
ionFactory</property>
        <!-- Echo all executed SQL to stdout -->
        <property name="hibernate.show_sql">true</property>
        <!-- Drop and re-create the database schema on startup -->
        <property name="hibernate.hbm2ddl.auto">update</property>
        <!-- Enable Hibernate's automatic session context management -->
        <property name="hibernate.current_session_context_class">thread</property>
        <!-- Disable the second-level cache -->
        <property
name="hibernate.cache.provider_class">org.hibernate.cache.NoCacheProvider</pro
perty>
        <!-- Echo all executed SQL to stdout -->
        <property name="hibernate.format_sql">true</property>
        <!-- Specify annotated class for the entity -->
        <mapping class="Product"/>
    </session-factory>
</hibernate-configuration>
```

OUTPUT:

```
log4j:WARN No appenders could be found for logger (org.jboss.logging).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more
Hibernate:
    update
        product
    set
        price=?
    where
        id=?
Product price updated successfully!
```

```
mysql> select * from product;
+----+-------------+--------+--------+
| id | category    | name   | price  |
+----+-------------+--------+--------+
|  2 | Electronics | Laptop | 899.99 |
+----+-------------+--------+--------+
1 row in set (0.00 sec)
```

6.3Write a Hibernate Program for product information and display the information by selecting the details from product database table

Product.java

```
import javax.persistence.Entity;
import javax.persistence.Id;
import javax.persistence.Table;

@Entity
@Table(name = "product")  // Map to the 'product' table in the database
public class Product {

    @Id
    private int id;
    private String name;
    private String category;
    private double price;
```

```
    // Constructor, Getters, and Setters
    public Product() {}

    public Product(int id, String name, String category, double price) {
        this.id = id;
        this.name = name;
        this.category = category;
        this.price = price;
    }

    public int getId() {
        return id;
    }
    public void setId(int id) {
        this.id = id;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public String getCategory() {
        return category;
    }
    public void setCategory(String category) {
        this.category = category;
    }
    public double getPrice() {
        return price;
    }
    public void setPrice(double price) {
        this.price = price;
    }

    @Override
    public String toString() {
        return "Product [id=" + id + ", name=" + name + ", category=" + category + ",
                price=" + price + "]";
    }
}
```

ProductService.java

```
import org.hibernate.Session;
import org.hibernate.Transaction;
```

```
import java.util.List;  // Add this import statement

public class ProductService {

    public void displayProductInfo() {
        // Get the session from the session factory
        Session session = HibernateUtil.getSessionFactory().getCurrentSession();

        // Begin a transaction
        Transaction transaction = session.beginTransaction();

        try {
            // Retrieve product data using HQL (Hibernate Query Language)
            String hql = "FROM Product"; // Get all product records
            List<Product> products = session.createQuery(hql,
                    Product.class).getResultList(); // List is now recognized

            // Display each product
            for (Product product : products) {
                System.out.println(product);
            }

            // Commit the transaction
            transaction.commit();
        } catch (Exception e) {
            e.printStackTrace();
            if (transaction != null) {
                transaction.rollback();
            }
        } finally {
            HibernateUtil.closeSessionFactory();
        }
    }
}
```

Main.java

```
public class Main {

    public static void main(String[] args) {
        // Create an instance of ProductService
        ProductService productService = new ProductService();

        // Display product information from the database
        productService.displayProductInfo();
    }
```

```
}
```

HibernateUtil.java

```
import org.hibernate.SessionFactory;
import org.hibernate.cfg.Configuration;

public class HibernateUtil {

   private static SessionFactory sessionFactory;

   static {
      try {
         sessionFactory = new Configuration().configure("hibernate.cfg.xml")
               .addAnnotatedClass(Product.class)  // Add Product class for mapping
               .buildSessionFactory();
      } catch (Exception e) {
         e.printStackTrace();
         throw new ExceptionInInitializerError(e);
      }
   }

   public static SessionFactory getSessionFactory() {
      return sessionFactory;
   }

   public static void closeSessionFactory() {
      if (sessionFactory != null) {
         sessionFactory.close();
      }
   }
}
```

Hibernate.cfg.xml

```
<!DOCTYPE hibernate-configuration PUBLIC "-//Hibernate/Hibernate
            Configuration DTD 3.0//EN"
            "http://hibernate.sourceforge.net/hibernate-configuration-3.0.dtd">
<hibernate-configuration>
   <session-factory>
      <!-- JDBC Database connection settings -->
      <property     name="hibernate.connection.driver_class">org.h2.Driver</property>
      <property
            name="hibernate.connection.url">jdbc:h2:~/test;DB_CLOSE_ON_EXI
            T=FALSE</property>
      <property name="hibernate.connection.username">sa</property>
```

```
        <property name="hibernate.connection.password"></property>

        <!-- JDBC connection pool settings -->
        <property name="hibernate.c3p0.min_size">5</property>
        <property name="hibernate.c3p0.max_size">20</property>
        <property name="hibernate.c3p0.timeout">300</property>
        <property name="hibernate.c3p0.max_statements">50</property>
        <property name="hibernate.c3p0.idle_test_period">3000</property>

        <!-- Specify dialect -->
        <property
                name="hibernate.dialect">org.hibernate.dialect.H2Dialect</property>

        <!-- Echo all executed queries -->
        <property name="hibernate.show_sql">true</property>

        <!-- Drop and re-create the database schema on startup -->
       <property name="hibernate.hbm2ddl.auto">update</property>


        <!-- Enable Hibernate's automatic session context management -->
        <property name="hibernate.current_session_context_class">thread</property>

        <!-- Disable the second-level cache -->
        <property
                name="hibernate.cache.provider_class">org.hibernate.cache.NoCacheP
                rovider</property>
    </session-factory>
</hibernate-configuration>
```

Output:-