Experiment 7

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Subject: Project Based Learning in Java **Subject Code: 22CSH-359**

Aim: Create Java applications with JDBC for database connectivity, CRUD operations, and MVC architecture.

Objective: To Create Java applications with JDBC for database connectivity, CRUD operations, and MVC architecture.

Easy Level:

Create a Java program to connect to a MySQL database and fetch data from a single table. The program should:

Use DriverManager and Connection objects.

Retrieve and display all records from a table named Employee with columns EmpID, Name, and Salary.

Code:

```
import java.sql.*;

import java.util.Scanner;


public class EmployeeDatabase {

    private static final String DB_URL = "jdbc:mysql://localhost:3808/test";

    private static final String USERNAME = "root";

    private static final String PASSWORD = "******";


    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);


        while (true) {

            System.out.println("\n=== Employee Management System ===");

            System.out.println("1) View Employee List");

            System.out.println("2) Exit");

            System.out.print("Select an option: ");
```

```
            int option = scanner.nextInt();

            if (option == 1) {
                fetchEmployees();
            } else if (option == 2) {
                System.out.println("Goodbye!");
                break;
            } else {
                System.out.println("Invalid choice! Please try again.");
            }
        }

        scanner.close();
    }

    private static void fetchEmployees() {
        String query = "SELECT EmpID, Name, Salary FROM Employee";

        try (Connection conn = DriverManager.getConnection(DB_URL, USERNAME, PASSWORD);
             Statement stmt = conn.createStatement();
             ResultSet rs = stmt.executeQuery(query)) {

            System.out.println("\nEmployee Details:");
            System.out.println("ID | Name | Salary");
            System.out.println("--------------------");

            while (rs.next()) {
                System.out.printf("%d | %s | %.2f%n", rs.getInt("EmpID"), rs.getString("Name"),
rs.getDouble("Salary"));
            }
        } catch (SQLException ex) {
            System.err.println("Database connection error: " + ex.getMessage());
        }
    }
```

```
}
```

Medium Level:

Build a program to perform CRUD operations (Create, Read, Update, Delete) on a database table Product with columns:

ProductID, ProductName, Price, and Quantity.

The program should include:

Menu-driven options for each operation.

Transaction handling to ensure data integrity.

Code:

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

public class ProductManager {
    private static final String DB_URL = "jdbc:mysql://localhost:3808/test";
    private static final String USER = "root";
    private static final String PASSWORD = "********";

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        boolean running = true;

        while (running) {
            System.out.println("\n===== Product Management =====");
            System.out.println("1) Add Product");
            System.out.println("2) View Products");
            System.out.println("3) Update Product");
            System.out.println("4) Delete Product");
            System.out.println("5) Exit");
            System.out.print("Choose an option: ");

            int choice = scanner.nextInt();
            scanner.nextLine(); // Clear newline buffer
```

```
            switch (choice) {
                case 1 -> addProduct(scanner);
                case 2 -> viewProducts();
                case 3 -> updateProduct(scanner);
                case 4 -> deleteProduct(scanner);
                case 5 -> {
                    System.out.println("Exiting application...");
                    running = false;
                }
                default -> System.out.println("Invalid option! Try again.");
            }
        }
        scanner.close();
    }

    private static void addProduct(Scanner scanner) {
        System.out.print("Enter product name: ");
        String name = scanner.nextLine();
        System.out.print("Enter price: ");
        double price = scanner.nextDouble();
        System.out.print("Enter quantity: ");
        int quantity = scanner.nextInt();

        String sql = "INSERT INTO Product (ProductName, Price, Quantity) VALUES (?, ?, ?)";

        try (Connection conn = DriverManager.getConnection(DB_URL, USER, PASSWORD);
             PreparedStatement stmt = conn.prepareStatement(sql)) {

            stmt.setString(1, name);
            stmt.setDouble(2, price);
            stmt.setInt(3, quantity);

            int rowsInserted = stmt.executeUpdate();
```

```
            if (rowsInserted > 0) {
                System.out.println("Product added successfully!");
            } else {
                System.out.println("Failed to add product.");
            }
        } catch (SQLException ex) {
            System.err.println("Error adding product: " + ex.getMessage());
        }
    }

    private static void viewProducts() {
        String sql = "SELECT * FROM Product";

        try (Connection conn = DriverManager.getConnection(DB_URL, USER, PASSWORD);
             Statement stmt = conn.createStatement();
             ResultSet rs = stmt.executeQuery(sql)) {

            System.out.println("\nProduct List:");
            System.out.println("ID | Name | Price | Quantity");
            System.out.println("--------------------------------");

            while (rs.next()) {
                System.out.printf("%d | %s | %.2f | %d%n",
                        rs.getInt("ProductID"),
                        rs.getString("ProductName"),
                        rs.getDouble("Price"),
                        rs.getInt("Quantity"));
            }
        } catch (SQLException ex) {
            System.err.println("Error retrieving products: " + ex.getMessage());
        }
    }
```

```
    private static void updateProduct(Scanner scanner) {
        System.out.print("Enter product ID to update: ");
        int id = scanner.nextInt();
        scanner.nextLine(); // Clear buffer
        System.out.print("Enter new product name: ");
        String name = scanner.nextLine();
        System.out.print("Enter new price: ");
        double price = scanner.nextDouble();
        System.out.print("Enter new quantity: ");
        int quantity = scanner.nextInt();

        String sql = "UPDATE Product SET ProductName=?, Price=?, Quantity=? WHERE ProductID=?";

        try (Connection conn = DriverManager.getConnection(DB_URL, USER, PASSWORD);
             PreparedStatement stmt = conn.prepareStatement(sql)) {

            stmt.setString(1, name);
            stmt.setDouble(2, price);
            stmt.setInt(3, quantity);
            stmt.setInt(4, id);

            int rowsUpdated = stmt.executeUpdate();
            if (rowsUpdated > 0) {
                System.out.println("Product updated successfully!");
            } else {
                System.out.println("Product ID not found.");
            }
        } catch (SQLException ex) {
            System.err.println("Error updating product: " + ex.getMessage());
        }
    }

    private static void deleteProduct(Scanner scanner) {
```

```
        System.out.print("Enter product ID to delete: ");
        int id = scanner.nextInt();

        String sql = "DELETE FROM Product WHERE ProductID=?";

        try (Connection conn = DriverManager.getConnection(DB_URL, USER, PASSWORD);
             PreparedStatement stmt = conn.prepareStatement(sql)) {

            stmt.setInt(1, id);
            int rowsDeleted = stmt.executeUpdate();

            if (rowsDeleted > 0) {
                System.out.println("Product deleted successfully!");
            } else {
                System.out.println("Product ID not found.");
            }
        } catch (SQLException ex) {
            System.err.println("Error deleting product: " + ex.getMessage());
        }
    }
}
```

Hard Level:

Develop a Java application using JDBC and MVC architecture to manage student data. The application should:

Use a Student class as the model with fields like StudentID, Name, Department, and Marks.

Include a database table to store student data.

Allow the user to perform CRUD operations through a simple menu-driven view.

Implement database operations in a separate controller class.

Code:

Model

```
public class Student {
```

```
    private int id;
    private String fullName;
    private String dept;
    private int score;

    public Student(int id, String fullName, String dept, int score) {
        this.id = id;
        this.fullName = fullName;
        this.dept = dept;
        this.score = score;
    }

    // Getters and Setters
    public int getId() { return id; }
    public void setId(int id) { this.id = id; }

    public String getFullName() { return fullName; }
    public void setFullName(String fullName) { this.fullName = fullName; }

    public String getDept() { return dept; }
    public void setDept(String dept) { this.dept = dept; }

    public int getScore() { return score; }
    public void setScore(int score) { this.score = score; }

    @Override
    public String toString() {
        return "Student ID: " + id + ", Name: " + fullName + ", Department: " + dept + ", Score: " + score;
    }
}
```

View

```
import java.util.List;
```

```
import java.util.Scanner;

public class StudentView {
    private final StudentController studentController = new StudentController();
    private final Scanner inputScanner = new Scanner(System.in);

    public void showMenu() {
        int option;
        do {
            System.out.println("\n=== Student Management Portal ===");
            System.out.println("1. Register Student");
            System.out.println("2. Display All Students");
            System.out.println("3. Modify Student Details");
            System.out.println("4. Remove Student");
            System.out.println("5. Exit");
            System.out.print("Select an option: ");
            option = inputScanner.nextInt();
            inputScanner.nextLine(); // Consume newline

            switch (option) {
                case 1:
                    registerStudent();
                    break;
                case 2:
                    listStudents();
                    break;
                case 3:
                    modifyStudent();
                    break;
                case 4:
                    removeStudent();
                    break;
                case 5:
```

```
                System.out.println("Closing application...");
                break;
            default:
                System.out.println("Invalid option, please try again.");
        }
    } while (option != 5);
}

private void registerStudent() {
    System.out.print("Enter Student Name: ");
    String fullName = inputScanner.nextLine();
    System.out.print("Enter Department: ");
    String department = inputScanner.nextLine();
    System.out.print("Enter Marks: ");
    int score = inputScanner.nextInt();

    Student newStudent = new Student(0, fullName, department, score);
    studentController.addStudent(newStudent);
}

private void listStudents() {
    List<Student> studentList = studentController.getAllStudents();
    if (studentList.isEmpty()) {
        System.out.println("No student records available.");
    } else {
        System.out.println("\n--- Student Records ---");
        for (Student student : studentList) {
            System.out.println(student);
        }
    }
}

private void modifyStudent() {
```

```
        System.out.print("Enter Student ID to update: ");
        int studentId = inputScanner.nextInt();
        inputScanner.nextLine(); // Consume newline
        System.out.print("Enter Updated Name: ");
        String updatedName = inputScanner.nextLine();
        System.out.print("Enter Updated Department: ");
        String updatedDepartment = inputScanner.nextLine();
        System.out.print("Enter Updated Marks: ");
        int updatedScore = inputScanner.nextInt();

        Student updatedStudent = new Student(studentId, updatedName, updatedDepartment, updatedScore);
        studentController.updateStudent(updatedStudent);
    }

    private void removeStudent() {
        System.out.print("Enter Student ID to remove: ");
        int studentId = inputScanner.nextInt();
        studentController.deleteStudent(studentId);
    }
}
```

Controller

```
import java.sql.*;
import java.util.ArrayList;
import java.util.List;

public class StudentController {
    private static final String DB_URL = "jdbc:mysql://localhost:3306/javadb";
    private static final String DB_USER = "root";
    private static final String DB_PASSWORD = "karan.111";

    public void insertStudent(Student student) {
        String sql = "INSERT INTO Students (Name, Department, Marks) VALUES (?, ?, ?)";
```

```
    try (Connection connection = DriverManager.getConnection(DB_URL, DB_USER, DB_PASSWORD);
         PreparedStatement preparedStatement = connection.prepareStatement(sql)) {

        connection.setAutoCommit(false);
        preparedStatement.setString(1, student.getName());
        preparedStatement.setString(2, student.getDepartment());
        preparedStatement.setInt(3, student.getMarks());

        preparedStatement.executeUpdate();
        connection.commit();
        System.out.println("Student successfully registered!");

    } catch (SQLException ex) {
        ex.printStackTrace();
    }
}

public List<Student> fetchAllStudents() {
    List<Student> studentList = new ArrayList<>();
    String sql = "SELECT * FROM Students";

    try (Connection connection = DriverManager.getConnection(DB_URL, DB_USER, DB_PASSWORD);
         Statement statement = connection.createStatement();
         ResultSet resultSet = statement.executeQuery(sql)) {

        while (resultSet.next()) {
            studentList.add(new Student(resultSet.getInt("StudentID"),
                    resultSet.getString("Name"),
                    resultSet.getString("Department"),
                    resultSet.getInt("Marks")));
        }
```

```
    } catch (SQLException ex) {
        ex.printStackTrace();
    }
    return studentList;
}

public void modifyStudent(Student student) {
    String sql = "UPDATE Students SET Name=?, Department=?, Marks=? WHERE StudentID=?";

    try (Connection connection = DriverManager.getConnection(DB_URL, DB_USER, DB_PASSWORD);
         PreparedStatement preparedStatement = connection.prepareStatement(sql)) {

        connection.setAutoCommit(false);
        preparedStatement.setString(1, student.getName());
        preparedStatement.setString(2, student.getDepartment());
        preparedStatement.setInt(3, student.getMarks());
        preparedStatement.setInt(4, student.getStudentID());

        int affectedRows = preparedStatement.executeUpdate();
        if (affectedRows > 0) {
            connection.commit();
            System.out.println("Student details updated!");
        } else {
            System.out.println("No record found with the given Student ID.");
        }

    } catch (SQLException ex) {
        ex.printStackTrace();
    }
}

public void removeStudent(int studentID) {
    String sql = "DELETE FROM Students WHERE StudentID=?";
```

```
        try (Connection connection = DriverManager.getConnection(DB_URL, DB_USER, DB_PASSWORD);
             PreparedStatement preparedStatement = connection.prepareStatement(sql)) {

            connection.setAutoCommit(false);
            preparedStatement.setInt(1, studentID);

            int affectedRows = preparedStatement.executeUpdate();
            if (affectedRows > 0) {
                connection.commit();
                System.out.println("Student record deleted!");
            } else {
                System.out.println("No record found with the given Student ID.");
            }

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

Main

```
public class StudentApplication {
    public static void main(String[] args) {
        StudentView studentView = new StudentView();
        studentView.showMenu();
    }
}
```

Output:

```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>javac -cp ".;mysql-connector-j-9.2.0.jar" MySQLConnectionCode.java

C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>java -cp ".;mysql-connector-j-9.2.0.jar" MySQLConnectionCode

Menu:
1. Display Employees
2. Exit
Enter your choice: 1

EmpID | Name | Salary
----------------------
1 | Saket Agarwal | 55000.0
2 | Ram | 32000.5
3 | Dam | 41000.75
4 | Pam | 53000.25

Menu:
1. Display Employees
2. Exit
Enter your choice: 2
Exiting...
```

1. **Easy Problem**

```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>javac -cp ".;mysql-connector-j-9.2.0.jar" ProductCRUD.java

C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>java -cp ".;mysql-connector-j-9.2.0.jar" ProductCRUD

--- Product Management System ---
1. Add Product
2. View Products
3. Update Product
4. Delete Product
5. Exit
Enter your choice: 2

ProductID | ProductName | Price | Quantity
-----------------------------------------
1 | Laptop | 75000.0 | 10
2 | Mouse | 1500.0 | 50
3 | Keyboard | 2500.0 | 30

--- Product Management System ---
1. Add Product
2. View Products
3. Update Product
4. Delete Product
5. Exit
Enter your choice: 4
Enter Product ID to delete: 3
Product deleted successfully!

--- Product Management System ---
1. Add Product
2. View Products
3. Update Product
4. Delete Product
5. Exit
Enter your choice: 2

ProductID | ProductName | Price | Quantity
-----------------------------------------
1 | Laptop | 75000.0 | 10
2 | Mouse | 1500.0 | 50

--- Product Management System ---
1. Add Product
2. View Products
3. Update Product
4. Delete Product
5. Exit
Enter your choice: 5
Exiting...
```

2. Medium Problem

```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>java -cp ".;mysql-connector-j-9.2.0.jar" StudentMain

--- Student Management System ---
1. Add Student
2. View Students
3. Update Student
4. Delete Student
5. Exit
Enter your choice: 2

Student List:
ID: 1, Name: Saket, Dept: Computer Science, Marks: 95
ID: 2, Name: Ram, Dept: Electronics, Marks: 78
ID: 3, Name: Dam, Dept: Mechanical, Marks: 92

--- Student Management System ---
1. Add Student
2. View Students
3. Update Student
4. Delete Student
5. Exit
Enter your choice: 5
Exiting...
```

3. Hard Probem

Learning Outcomes:

1. **Integrating Java with Databases – Learn how Java applications interact with databases to store and retrieve data efficiently**.
2. **Enhancing Data Security – Explore best practices for securing database connections and preventing SQL injection attacks in Java applications.**
3. **Optimizing Query Performance – Understand how to write efficient SQL queries and use indexing to improve database performance.**
4. **Building Scalable Applications – Learn how to design a Java-based system that can handle increasing data loads while maintaining performance.**