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";
```

```java
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");
```

```java
        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")));

        }
```

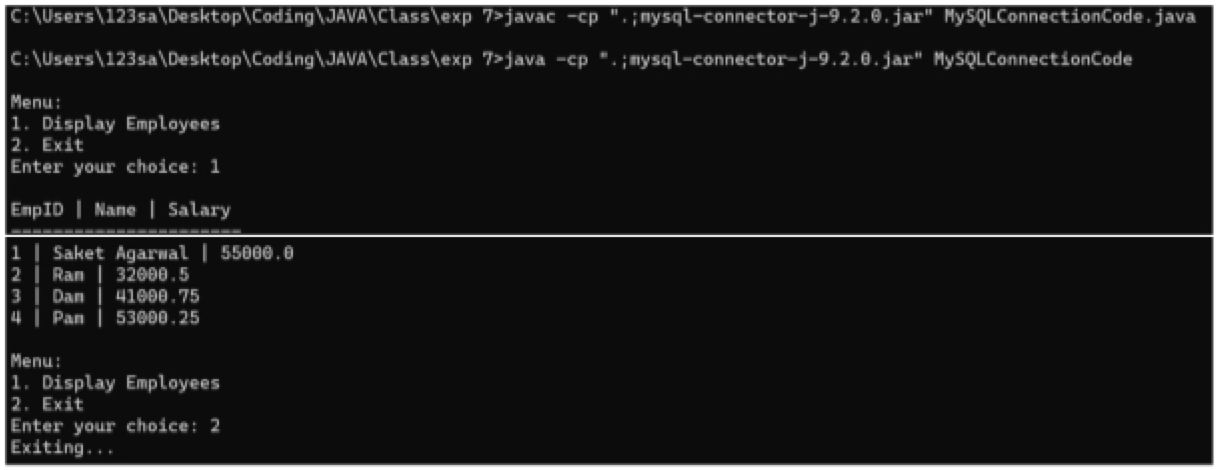
```
        } catch (SQLException ex) {

            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

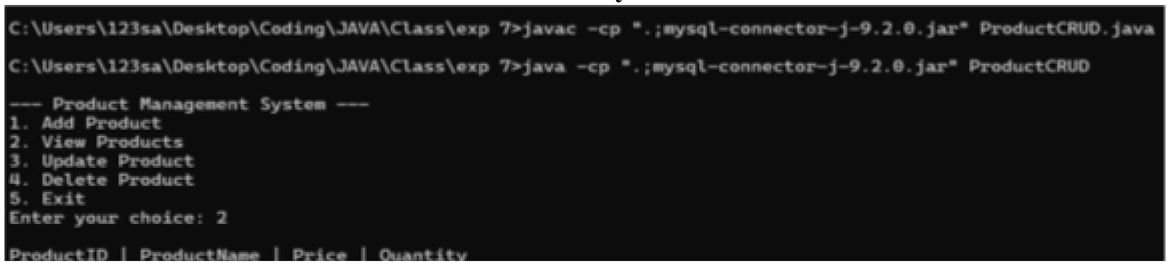
```
public class StudentApplication {
    public static void main(String[] args) {
        StudentView studentView = new StudentView();
        studentView.showMenu();
    }
}
```

Output:

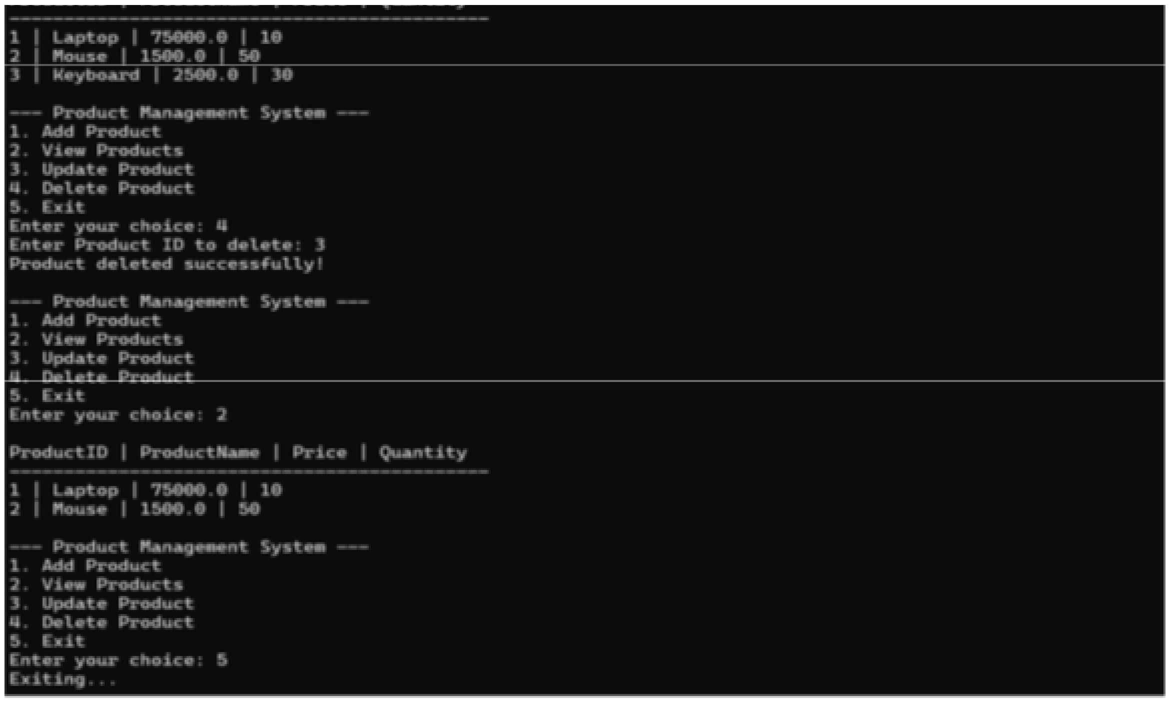


```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>javac -cp ".;mysql-connector-j-9.2.0.jar" MySQLConnectionCode.java

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...
```

1.1 Easy Problem

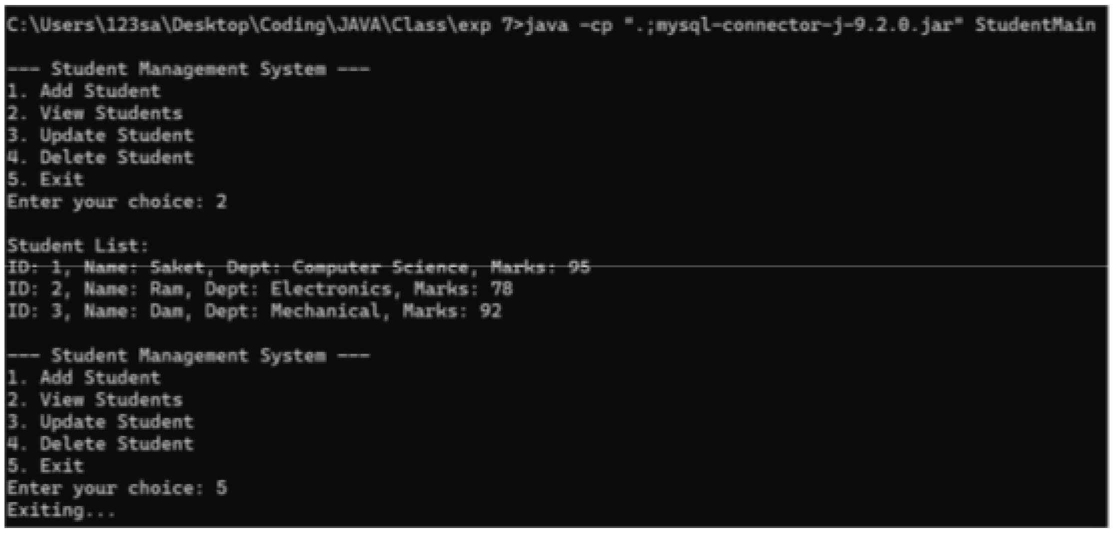


```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>javac -cp ".;mysql-connector-j-9.2.0.jar" ProductCRUD.java

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...
```

1.2 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...
```

1.3 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.