Experiment 7

Student Name: Mayank Bhatt **UID: 22BCS10511**
Branch: CSE **Section:KRG 2B**
Semester: 6th DOP: 18/03/25
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.printl
n("\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;
```

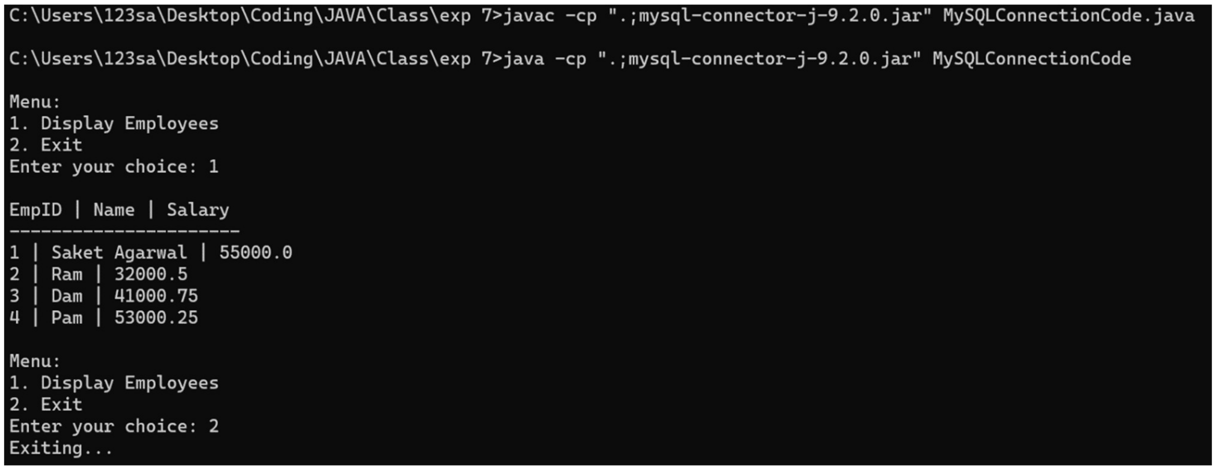
```
public class StudentController {     private static final String DB_URL =
"jdbc:mysql://localhost:3306/javadb";     private static final String
DB_USER = "root";     private static final String DB_PASSWORD =
"karan.111";

    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

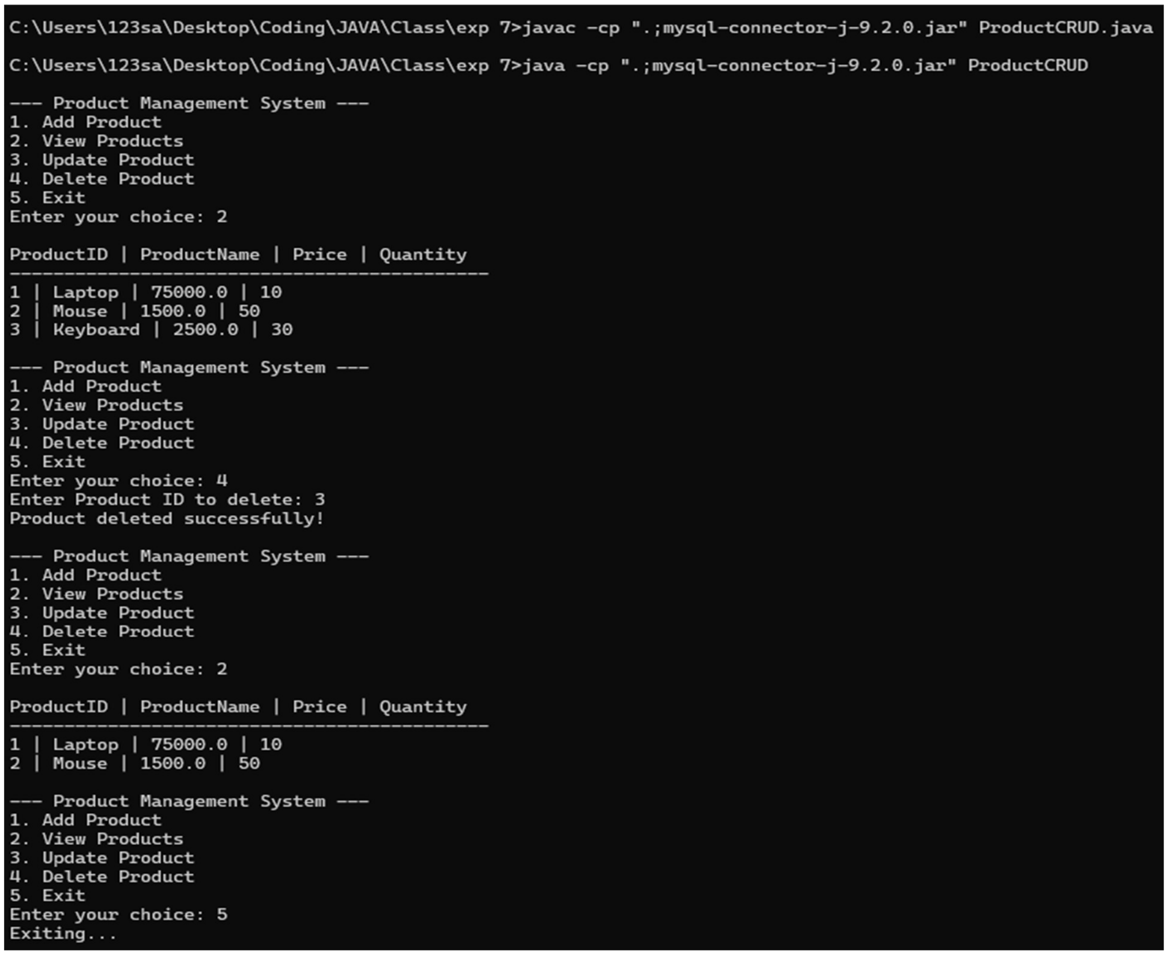
```
public class StudentApplication {
public static void main(String[] args) {
        StudentView studentView = new StudentView();
studentView.showMenu();
    }
}
```

Output:



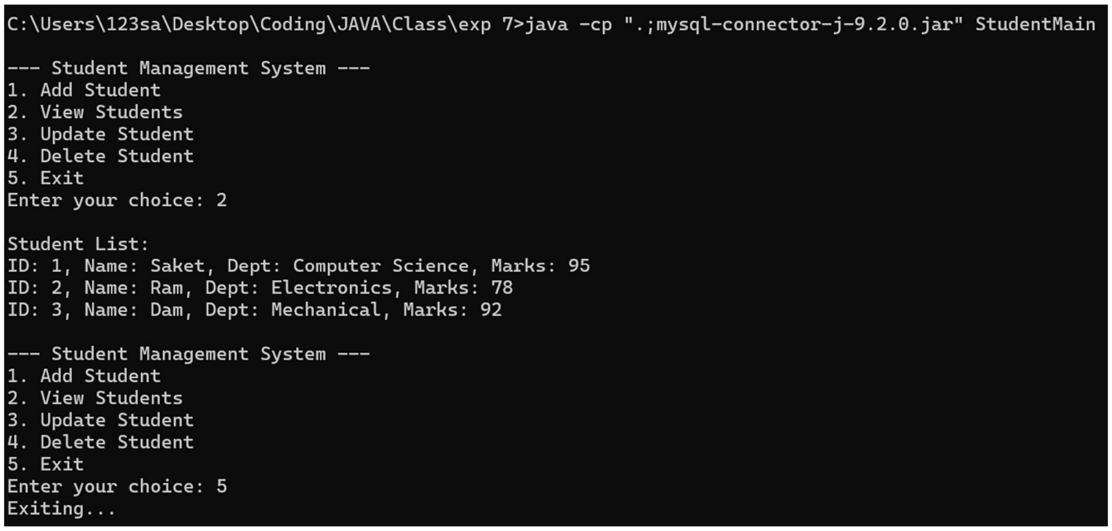
```
C:\Users\123sa\Desktop\Coding\JAVA\Class\exp 7>javac -cp ".;mysql-connector-j-9.2.0.jar" MySQLConnectionCode.java

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.