Experiment 7

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Subject: 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("ProductNam
                e"), 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: "); intid = 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: ");  intid = 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(intid, 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(stude
        nt); }
    }
}

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.executeUpd
        ate(); 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("Departmen
                t"), 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();
    }
}
```

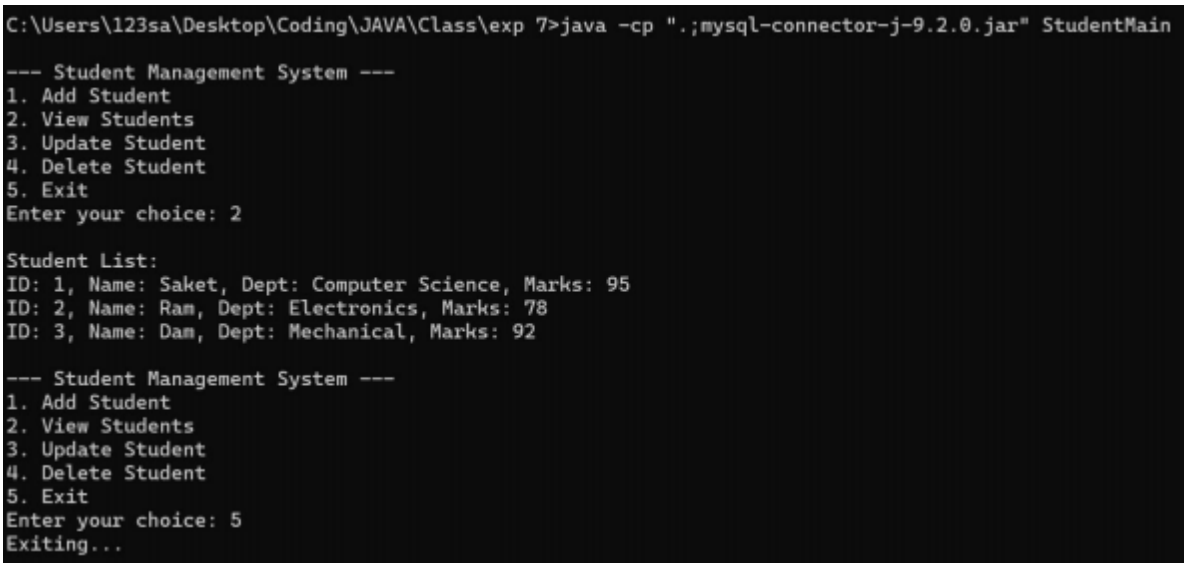
Output:

```
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



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.