Experiment-7

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Semester: 6th **Date of Performance:**
Subject: Project-Based Learning with Java **Subject Code: 22CSH-359**

Easy -Level

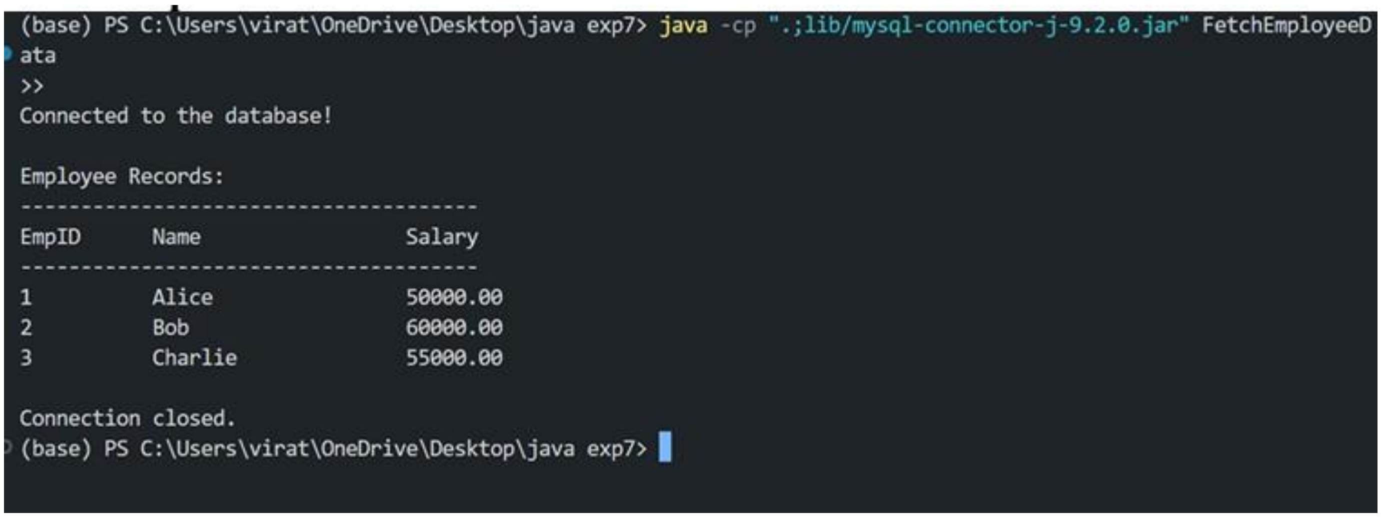
1. **Aim:** Create a java program to connect to a MySQL database and fetch data from a single table. The program should:
   - Use DriverManager and Connection objects
   - Retrieve and display all records from a table Employee with columns EmpID, Name and Salary

2. **Objective:** To develop a Java program that connects to a MySQL database, retrieves data from the Employee table, and displays all records, demonstrating basic JDBC connectivity and data retrieval operations.

3. **Implementation/Code:**

```
import java.sql.*;

public class FetchEmployeeData {
    public static void main(String[] args) {
        String url = "jdbc:mysql://localhost:3306/testdb";
        String user = "root";
        String password = "Ananya11";

        String query = "SELECT EmpID, Name, Salary FROM Employee";
        try {
            Class.forName("com.mysql.cj.jdbc.Driver");
            Connection con = DriverManager.getConnection(url, user, password);
            System.out.println("Connected to the database!");
            Statement stmt = con.createStatement();
            ResultSet rs = stmt.executeQuery(query);

            System.out.println("\nEmployee Records:");

            System.out.println("-------------------------");
            System.out.printf("%-10s %-20s %-10s%n", "EmpID", "Name", "Salary");
            System.out.println("-------------------------");

            while (rs.next()) {
                int empID = rs.getInt("EmpID");
                String name = rs.getString("Name");
                double salary = rs.getDouble("Salary");
                System.out.printf("%-10d %-20s %-10.2f%n", empID, name, salary);
            }
            rs.close();
            stmt.close();
            con.close();
            System.out.println("\nConnection closed.");
        }
        catch (ClassNotFoundException e) {
            System.out.println("MySQL Driver not found: " + e.getMessage());
        }
        catch (SQLException e) {
            System.out.println("SQL Error: " + e.getMessage());
        }
    }
  }
```

4. Output:



```
(base) PS C:\Users\virat\OneDrive\Desktop\java exp7> java -cp ".;lib/mysql-connector-j-9.2.0.jar" FetchEmployeeD
ata
>>
Connected to the database!

Employee Records:
-------------------------------------
EmpID      Name                Salary
-------------------------------------
1          Alice               50000.00
2          Bob                 60000.00
3          Charlie             55000.00

Connection closed.
(base) PS C:\Users\virat\OneDrive\Desktop\java exp7>
```

5. Learning Outcomes:

- Learn how Java interacts with MySQL using JDBC.
- Manage SQLException and ClassNotFoundException.
- Understand the role of com.mysql.cj.jdbc.Driver.
- Learn the format of jdbc:mysql://host:port/database
- Use username and password securely for authentication.
- Recognize how database operations fit into a layered application.
- Identify and resolve common database connectivity issues.

Medium -Level

1. **Aim:** Build a program to perform CRUD operations in 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.

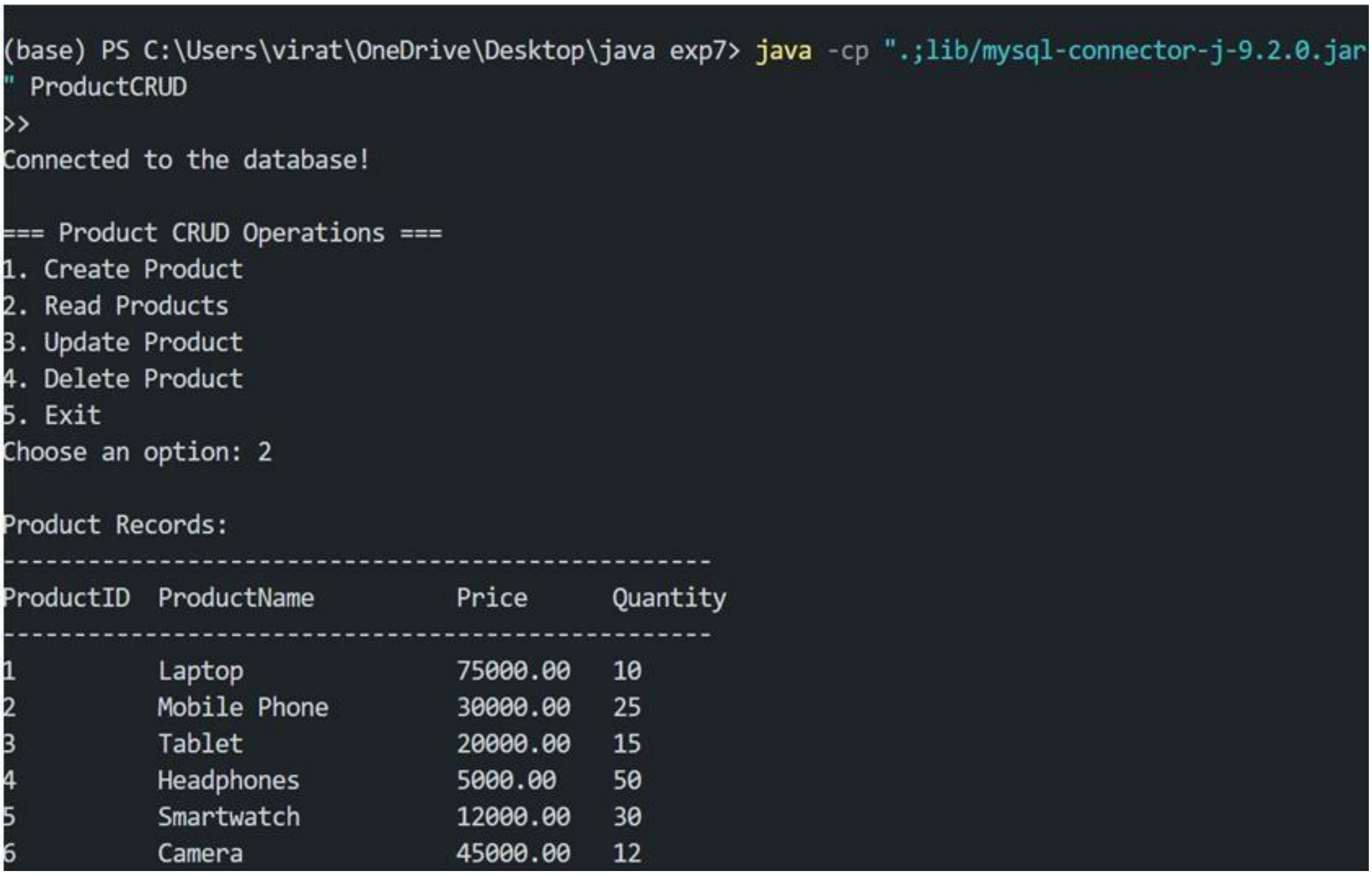
2. **Objective:** To develop a Java program that connects to a MySQL database and performs CRUD operations (Create, Read, Update, Delete) on the Product table. The program ensures data integrity by using transaction handling and provides a menu-driven interface for user-friendly interaction.

3. **Implementation/Code:**

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

public class ProductCRUD {

    private static final String URL = "jdbc:mysql://localhost:3306/ProductDB";
    private static final String USER = "root";
    private static final String PASSWORD = "Ananya11";

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

        try (Connection conn = DriverManager.getConnection(URL, USER, PASSWORD)) {
            Class.forName("com.mysql.cj.jdbc.Driver");
            System.out.println("Connected to the database!");

            boolean exit = false;

            while (!exit) {
                System.out.println("\n=== Product CRUD Operations ===");
                System.out.println("1. Create Product");
                System.out.println("2. Read 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();
                switch (choice) {
                    case 1 -> createProduct(conn, scanner);
                    case 2 -> readProducts(conn);
                    case 3 -> updateProduct(conn, scanner);
                    case 4 -> deleteProduct(conn, scanner);
                    case 5 -> exit = true;
                    default -> System.out.println("Invalid option. Try again.");
                }
            }
        }
        catch (ClassNotFoundException e) {
            System.out.println("MySQL Driver not found: " + e.getMessage());
        }
        catch (SQLException e) {
            System.out.println("SQL Error: " + e.getMessage());
        }
        scanner.close();
    }
    private static void createProduct(Connection conn, Scanner scanner) throws SQLException {
        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 query = "INSERT INTO Product (ProductName, Price, Quantity) VALUES (?, ?, ?)";

        try (PreparedStatement pstmt = conn.prepareStatement(query)) {
            conn.setAutoCommit(false);

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

            int rows = pstmt.executeUpdate();
            conn.commit();

            System.out.println(rows + " product(s) inserted successfully!");
        }
        catch (SQLException e) {
            conn.rollback();
            System.out.println("Transaction rolled back due to error: " + e.getMessage());
        }
        finally {
            conn.setAutoCommit(true);
        }
    }
    private static void readProducts(Connection conn) throws SQLException {
        String query = "SELECT * FROM Product";

        try (Statement stmt = conn.createStatement();
             ResultSet rs = stmt.executeQuery(query)) {

            System.out.println("\nProduct Records:");
            System.out.println("------------------------------------------------");
            System.out.printf("%-10s %-20s %-10s %-10s%n", "ProductID", "ProductName", "Price", "Quantity");
            System.out.println("------------------------------------------------");

            while (rs.next()) {
                int id = rs.getInt("ProductID");
                String name = rs.getString("ProductName");
                double price = rs.getDouble("Price");
                int quantity = rs.getInt("Quantity");

                System.out.printf("%-10d %-20s %-10.2f %-10d%n", id, name, price, quantity);
            }
        }
    }
    private static void updateProduct(Connection conn, Scanner scanner) throws SQLException {
        System.out.print("Enter product ID to update: ");
        int id = scanner.nextInt();
        scanner.nextLine();

        System.out.print("Enter new name: ");
        String name = scanner.nextLine();
        double price = scanner.nextDouble();
        System.out.print("Enter new quantity: ");
        int quantity = scanner.nextInt();

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

        try (PreparedStatement pstmt = conn.prepareStatement(query)) {
            conn.setAutoCommit(false);

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

            int rows = pstmt.executeUpdate();
            conn.commit();

            System.out.println(rows + " product(s) updated successfully!");

        }
        catch (SQLException e) {
            conn.rollback();
            System.out.println("Transaction rolled back due to error: " + e.getMessage());
        }
        finally {
            conn.setAutoCommit(true);
        }
    }
    private static void deleteProduct(Connection conn, Scanner scanner) throws SQLException {
        System.out.print("Enter product ID to delete: ");
        int id = scanner.nextInt();

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

        try (PreparedStatement pstmt = conn.prepareStatement(query)) {
            conn.setAutoCommit(false);

            pstmt.setInt(1, id);
            int rows = pstmt.executeUpdate();  conn.commit();

            System.out.println(rows + " product(s) deleted successfully!");
        }
```

```
        catch (SQLException e) {
            conn.rollback();
            System.out.println("Transaction rolled back due to error: " + e.getMessage());
        }
        finally {
            conn.setAutoCommit(true);
        }
    }
  }
```

4. **Output:**



```
(base) PS C:\Users\virat\OneDrive\Desktop\java exp7> java -cp ".;lib/mysql-connector-j-9.2.0.jar
" ProductCRUD
>>
Connected to the database!

=== Product CRUD Operations ===
1. Create Product
2. Read Products
3. Update Product
4. Delete Product
5. Exit
Choose an option: 2

Product Records:
--------------------------------------------------
ProductID  ProductName          Price      Quantity
--------------------------------------------------
1          Laptop               75000.00   10
2          Mobile Phone         30000.00   25
3          Tablet               20000.00   15
4          Headphones           5000.00    50
5          Smartwatch           12000.00   30
6          Camera               45000.00   12
```

5. **Learning Outcomes:**

- Implement CRUD Operations(INSERT, SELECT, UPDATE, and DELETE) using JDBC.
- Use commit(), rollback(), and setAutoCommit(false) for data integrity.
- Implement a user-friendly console-based menu for CRUD actions.
- Manage SQL and user input errors effectively.
- Retrieve and format database records dynamically.

Hard -Level

1. **Aim:** Develop a Java application using JDBC and MVC architecture to manage student data. The application should include-
   - 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.

2. **Objective:** The objective of this program is to develop a menu-driven Java application that allows users to add employee details, display all stored employees, and exit the program. Employee details, including ID, name, designation, and salary, are stored persistently in a file using serialization.

3. Implementation/Code:

StudentController.java

```
package controller;
import model.Student;
import java.sql.*;
import java.util.ArrayList;
import java.util.List;
public class StudentController {
    private static final String URL = "jdbc:mysql://localhost:3306/StudentDB";
    private static final String USER = "root";
    private static final String PASSWORD = "Ananya11";

    public void createStudent(Student student) throws SQLException {
        String query = "INSERT INTO Student (Name, Department, Marks) VALUES (?, ?, ?)";

        try (Connection conn = DriverManager.getConnection(URL, USER, PASSWORD);
             PreparedStatement pstmt = conn.prepareStatement(query)) {

            pstmt.setString(1, student.getName());
            pstmt.setString(2, student.getDepartment());
            pstmt.setDouble(3, student.getMarks());
            pstmt.executeUpdate();
            System.out.println("Student added successfully!");
        }
    }
    public List<Student> getAllStudents() throws SQLException {
        List<Student> students = new ArrayList<>();
        String query = "SELECT * FROM Student";

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

            while (rs.next()) {
                students.add(new Student(
                        rs.getInt("StudentID"),
                        rs.getString("Name"),
                    rs.getString("Department"),
                    rs.getDouble("Marks")
                ));
            }
        }
        return students;
    }
    public void updateStudent(Student student) throws SQLException {
        String query = "UPDATE Student SET Name = ?, Department = ?, Marks = ? WHERE StudentID = ?";

        try (Connection conn = DriverManager.getConnection(URL, USER, PASSWORD);
             PreparedStatement pstmt = conn.prepareStatement(query)) {

            pstmt.setString(1, student.getName());
            pstmt.setString(2, student.getDepartment());
            pstmt.setDouble(3, student.getMarks());
            pstmt.setInt(4, student.getStudentID());

            int rows = pstmt.executeUpdate();
            if (rows > 0) {
                System.out.println("Student updated successfully!");
            }
            else {
                System.out.println("Student not found.");
            }
        }
    }
    public void deleteStudent(int studentID) throws SQLException {
        String query = "DELETE FROM Student WHERE StudentID = ?";

        try (Connection conn = DriverManager.getConnection(URL, USER, PASSWORD);
             PreparedStatement pstmt = conn.prepareStatement(query)) {

            pstmt.setInt(1, studentID);
            int rows = pstmt.executeUpdate();
            if (rows > 0) {
                System.out.println("Student deleted successfully!");
            }
            else {
                System.out.println("Student not found.");
            }
        }
    }
}
```

Student.java

```
package model;
public class Student {
    private int studentID;
    private String name;
    private String department;
    private double marks;
    public Student(int studentID, String name, String department, double marks) {
        this.studentID = studentID;
        this.name = name;
        this.department = department;
        this.marks = marks;
    }
    public int getStudentID() {
        return studentID;
    }
    public void setStudentID(int studentID) {
        this.studentID = studentID;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public String getDepartment() {
        return department;
    }
    public void setDepartment(String department) {
        this.department = department;
    }
    public double getMarks() {
        return marks;
    }
    public void setMarks(double marks) {
        this.marks = marks;
    }
    public String toString() {
        return String.format("ID: %d, Name: %s, Dept: %s, Marks: %.2f",
                studentID, name, department, marks);
    }
}
```

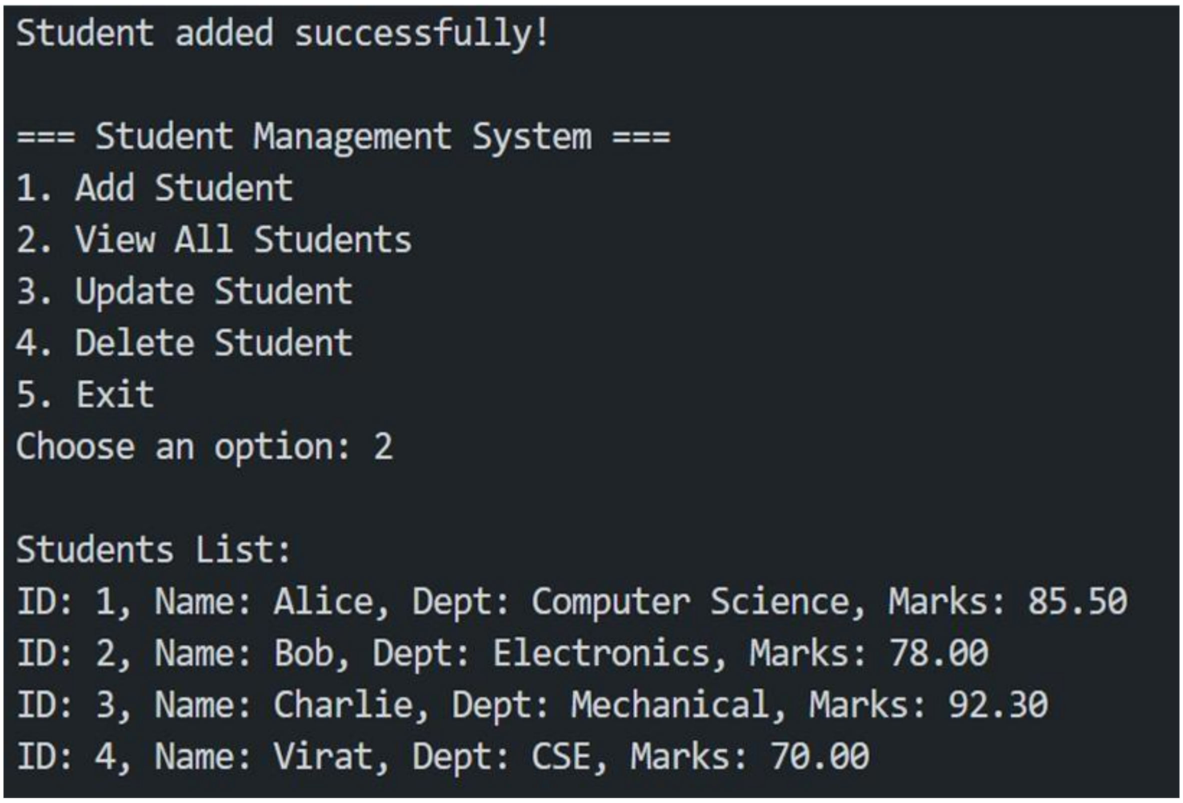
StudentView.java

```
package view;
import controller.StudentController;
import model.Student;
import java.util.List;
import java.util.Scanner;
public class StudentView {
    private static final Scanner scanner = new Scanner(System.in);
    private static final StudentController controller = new StudentController();
    public void displayMenu() {
        boolean exit = false;

        while (!exit) {
            System.out.println("\n=== Student Management System ===");
            System.out.println("1. Add Student");
            System.out.println("2. View All Students");
            System.out.println("3. Update Student");
            System.out.println("4. Delete Student");
            System.out.println("5. Exit");
            System.out.print("Choose an option: ");
            int choice = scanner.nextInt();
            scanner.nextLine();
            try {
                switch (choice) {
                    case 1 -> addStudent();
                    case 2 -> viewStudents();
                    case 3 -> updateStudent();
                    case 4 -> deleteStudent();
                    case 5 -> exit = true;
                    default -> System.out.println("Invalid option. Try again.");
                }
            } catch (Exception e) {
                System.out.println("Error: " + e.getMessage());
            }
        }
        scanner.close();
    }
    private void addStudent() throws Exception {
        System.out.print("Enter name: ");
        String name = scanner.nextLine();
        System.out.print("Enter department: ");
        String department = scanner.nextLine();

        System.out.print("Enter marks: ");
        double marks = scanner.nextDouble();

        Student student = new Student(0, name, department, marks);
        controller.createStudent(student);
    }
    private void viewStudents() throws Exception {
        List<Student> students = controller.getAllStudents();
        System.out.println("\nStudents List:");
        for (Student student : students) {
            System.out.println(student);
        }
    }
    private void updateStudent() throws Exception {
        System.out.print("Enter student ID to update: ");
        int id = scanner.nextInt();
        scanner.nextLine();
        System.out.print("Enter new name: ");
        String name = scanner.nextLine();
        System.out.print("Enter new department: ");
        String department = scanner.nextLine();
        System.out.print("Enter new marks: ");
        double marks = scanner.nextDouble();

        Student student = new Student(id, name, department, marks);
        controller.updateStudent(student);
    }
    private void deleteStudent() throws Exception {
        System.out.print("Enter student ID to delete: ");
        int id = scanner.nextInt();
        controller.deleteStudent(id);
    }
}
```

MainApp.java

```
import view.StudentView;
public class MainApp {
    public static void main(String[] args) {
        StudentView view = new StudentView();
        view.displayMenu();
        }
      }
```

4. **Output:**



```
Student added successfully!

=== Student Management System ===
1. Add Student
2. View All Students
3. Update Student
4. Delete Student
5. Exit
Choose an option: 2

Students List:
ID: 1, Name: Alice, Dept: Computer Science, Marks: 85.50
ID: 2, Name: Bob, Dept: Electronics, Marks: 78.00
ID: 3, Name: Charlie, Dept: Mechanical, Marks: 92.30
ID: 4, Name: Virat, Dept: CSE, Marks: 70.00
```

5. **Learning Outcomes:**

- Understand how to separate concerns into Model, View, and Controller.
- Implement CRUD operations in a dedicated controller class.
- Develop an interactive console-based interface for user input.
- Properly manage SQLException and ClassNotFoundException.
- Keep data secure using getter and setter methods.