

# Project Based Learning in Java

## ASSIGNMENT - 7

*Submitted by,*

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**22BCS\_ IOT-637 (A)**

## Easy Problem

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.

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;

public class EmployeeFetcher {

    // Database URL, username, and password
    private static final String URL = "jdbc:mysql://localhost:3306/Zephyr";
    private static final String USER = "goLu";
    private static final String PASSWORD = "hehe";

    public static void main(String[] args) {
        Connection connection = null;
        Statement statement = null;
        ResultSet resultSet = null;

        try {
            // Load the MySQL JDBC driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // Establish a connection to the database
            connection = DriverManager.getConnection(URL, USER, PASSWORD);
            System.out.println("Connected to the database successfully.");

            // Create a statement object
            statement = connection.createStatement();

            // Define the SQL query to retrieve all records from the Employee
            table String sql = "SELECT EmpID, Name, Salary FROM Employee";

            // Execute the query and retrieve the result set
            resultSet = statement.executeQuery(sql);

            // Process the result set
            System.out.println("Employee Records:");
            while (resultSet.next()) {
                int empID = resultSet.getInt("EmpID");
                String name = resultSet.getString("Name");
                double salary = resultSet.getDouble("Salary");

                // Display the employee record
```

```

        System.out.printf("EmpID: %d, Name: %s, Salary: %.2f%n", empID,
name, salary);
    }

    } catch (ClassNotFoundException e) {
        System.err.println("MySQL JDBC Driver not found.");
        e.printStackTrace();
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred.");
        e.printStackTrace();
    } finally {
        // Close resources in reverse order of their creation
        try {
            if (resultSet != null) resultSet.close();
            if (statement != null) statement.close();
            if (connection != null) connection.close();
        } catch (SQLException e) {
            System.err.println("Error closing resources.");
            e.printStackTrace();
        }
    }
}
}
}

```

## OUTPUT:

```

+-----+-----+-----+
| EmpID | Name           | Salary  |
+-----+-----+-----+
|      1 | John Doe       | 50000.00 |
|      2 | Jane Smith     | 60000.00 |
|      3 | Alice Johnson  | 55000.00 |
+-----+-----+-----+
3 rows in set (0.00 sec)

```

```

Connected to the database successfully.
Employee Records:
EmpID: 1, Name: John Doe, Salary: 50000.00
EmpID: 2, Name: Jane Smith, Salary: 60000.00
EmpID: 3, Name: Alice Johnson, Salary: 55000.00

```

## Medium Problem

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.

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;
import java.util.Scanner;

public class ProductCRUD {

    // Database URL, username, and password
    private static final String URL = "jdbc:mysql://localhost:3306/Zephyr";
    private static final String USER = "goLu";
    private static final String PASSWORD = "hehe";

    private static Connection connection = null;
    private static Scanner scanner = new Scanner(System.in);

    public static void main(String[] args) {
        try {
            // Load the MySQL JDBC driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // Establish a connection to the database
            connection = DriverManager.getConnection(URL, USER, PASSWORD);
            System.out.println("Connected to the database successfully.");

            // Main menu loop
            boolean exit = false;
            while (!exit) {
                System.out.println("\nProduct Management Menu:");
                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(); // Consume newline

                switch (choice) {
                    case 1:
                        createProduct();
                        break;
```

```

        case 2:
            readProducts();
            break;
        case 3:
            updateProduct();
            break;
        case 4:
            deleteProduct();
            break;
        case 5:
            exit = true;
            break;
        default:
            System.out.println("Invalid option. Please try again.");
    }
}

} catch (ClassNotFoundException e) {
    System.err.println("MySQL JDBC Driver not found.");
    e.printStackTrace();
} catch (SQLException e) {
    System.err.println("SQL Exception occurred.");
    e.printStackTrace();
} finally {
    // Close resources
    try {
        if (connection != null)
            connection.close();
        scanner.close();
    } catch (SQLException e) {
        System.err.println("Error closing resources.");
        e.printStackTrace();
    }
}
}

// Create a new product
private static void createProduct() {
    System.out.print("Enter Product Name: ");
    String productName = scanner.nextLine();
    System.out.print("Enter Price: ");
    double price = scanner.nextDouble();
    System.out.print("Enter Quantity: ");
    int quantity = scanner.nextInt();
    scanner.nextLine(); // Consume newline

    String sql =
        "INSERT INTO Product (ProductName, Price, Quantity) VALUES (?, ?, ?)";
    try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
        pstmt.setString(1, productName);
        pstmt.setDouble(2, price);
        pstmt.setInt(3, quantity);

        int rowsAffected = pstmt.executeUpdate();
        if (rowsAffected > 0) {
            System.out.println("Product inserted successfully.");
        } else {

```

```

        System.out.println("Failed to insert product.");
    }
} catch (SQLException e) {
    System.err.println("SQL Exception occurred while creating product.");
    e.printStackTrace();
}
}

// Read all products
private static void readProducts() {
    String sql = "SELECT ProductID, ProductName, Price, Quantity FROM Product";
    try (Statement stmt = connection.createStatement();
        ResultSet rs = stmt.executeQuery(sql)) {

        System.out.println("\nProduct List:");
        System.out.println("-----");
        System.out.printf("%-10s %-30s %-10s %-10s\n", "ProductID", "ProductName",
            "Price", "Quantity");
        System.out.println("-----");
        while (rs.next()) {
            int productID = rs.getInt("ProductID");
            String productName = rs.getString("ProductName");
            double price = rs.getDouble("Price");
            int quantity = rs.getInt("Quantity");

            System.out.printf("%-10d %-30s %-10.2f %-10d\n", productID, productName,
                price, quantity);
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while reading products.");
        e.printStackTrace();
    }
}

// Update an existing product
private static void updateProduct() {
    System.out.print("Enter Product ID to update: ");
    int productID = scanner.nextInt();
    scanner.nextLine(); // Consume newline

    System.out.print("Enter New Product Name: ");
    String productName = scanner.nextLine();
    System.out.print("Enter New Price: ");
    double price = scanner.nextDouble();
    System.out.print("Enter New Quantity: ");
    int quantity = scanner.nextInt();
    scanner.nextLine(); // Consume newline

    String sql = "UPDATE Product SET ProductName = ?, Price = ?, Quantity = " +
        "? WHERE ProductID = ?";
    try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
        pstmt.setString(1, productName);
        pstmt.setDouble(2, price);
        pstmt.setInt(3, quantity);
        pstmt.setInt(4, productID);

        int rowsAffected = pstmt.executeUpdate();
    }
}

```

```

        if (rowsAffected > 0) {
            System.out.println("Product updated successfully.");
        } else {
            System.out.println("Failed to update product. Product ID not found.");
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while updating product.");
        e.printStackTrace();
    }
}

// Delete a product
private static void deleteProduct() {
    System.out.print("Enter Product ID to delete: ");
    int productID = scanner.nextInt();
    scanner.nextLine(); // Consume newline

    String sql = "DELETE FROM Product WHERE ProductID = ?";
    try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
        pstmt.setInt(1, productID);

        int rowsAffected = pstmt.executeUpdate();
        if (rowsAffected > 0) {
            System.out.println("Product deleted successfully.");
        } else {
            System.out.println("Failed to delete product. Product ID not found.");
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while deleting product.");
        e.printStackTrace();
    }
}
}
}

```

## OUTPUT:

Field	Type	Null	Key	Default	Extra
ProductID	int	NO	PRI	NULL	auto_increment
ProductName	varchar(100)	NO		NULL	
Price	decimal(10,2)	NO		NULL	
Quantity	int	NO		NULL	

Connected to the database successfully.

Product Management Menu:

1. Create Product
2. Read Products
3. Update Product
4. Delete Product
5. Exit

Choose an option: 1

Enter Product Name: laptop

Enter Price: 75000

Enter Quantity: 4

Product inserted successfully.

Product Management Menu:

1. Create Product
2. Read Products
3. Update Product
4. Delete Product
5. Exit

Choose an option: 2

Product List:

ProductID	ProductName	Price	Quantity
2	laptop	75000.00	4

Product Management Menu:

1. Create Product
2. Read Products
3. Update Product
4. Delete Product
5. Exit

Choose an option: 4

Enter Product ID to delete: 2

Product deleted successfully.

Product Management Menu:

1. Create Product
2. Read Products
3. Update Product
4. Delete Product
5. Exit

Choose an option: 5



## Hard Problem

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.

---

*Student.java*

---

```
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 Student(String name, String department, double marks) {
        this.name = name;
        this.department = department;
        this.marks = marks;
    }

    // Getters and Setters
    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; }
```

```

@Override
public String toString() {
    return "Student{"
        + "studentID=" + studentID + ", name='" + name + '\'' +
        ", department='" + department + '\'' + ", marks=" + marks + '}';
}
}

```

---

### *StudentView.java*

---

```

import java.util.List;
import java.util.Scanner;

public class StudentView {
    private Scanner scanner = new Scanner(System.in);

    public int getMenuChoice() {
        System.out.println("\nStudent Management Menu:");
        System.out.println("1. Create Student");
        System.out.println("2. Read Students");
        System.out.println("3. Update Student");
        System.out.println("4. Delete Student");
        System.out.println("5. Exit");
        System.out.print("Choose an option: ");
        return scanner.nextInt();
    }

    public Student getStudentDetails() {
        scanner.nextLine(); // Consume newline
        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();
        return new Student(name, department, marks);
    }

    public int getStudentID() {
        System.out.print("Enter Student ID: ");
        return scanner.nextInt();
    }

    public void displayStudent(Student student) {
        System.out.println("Student Details: " + student);
    }

    public void displayStudents(List<Student> students) {
        System.out.println("\nStudent List:");
        System.out.println("-----");
        System.out.printf("%-10s %-30s %-30s %-10s\n", "StudentID", "Name",
            "Department", "Marks");
        System.out.println("-----");
    }
}

```

```

        for (Student student : students) {
            System.out.printf("%-10d %-30s %-30s %-10.2f%n", student.getStudentID(),
                               student.getName(), student.getDepartment(),
                               student.getMarks());
        }
    }

    public void displayMessage(String message) { System.out.println(message); }
}

```

---

### *StudentController.java*

---

```

import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;
import java.util.ArrayList;
import java.util.List;

public class StudentController {
    // Database URL, username, and password
    private static final String URL = "jdbc:mysql://localhost:3306/Zephyr";
    private static final String USER = "golu";
    private static final String PASSWORD = "hehe";

    private Connection connection;

    public StudentController() {
        try {
            // Load the MySQL JDBC driver
            Class.forName("com.mysql.cj.jdbc.Driver");

            // Establish a connection to the database
            connection = DriverManager.getConnection(URL, USER, PASSWORD);
            System.out.println("Connected to the database successfully.");
        } catch (ClassNotFoundException e) {
            System.err.println("MySQL JDBC Driver not found.");
            e.printStackTrace();
        } catch (SQLException e) {
            System.err.println("SQL Exception occurred.");
            e.printStackTrace();
        }
    }

    // Create a new student
    public void createStudent(Student student) {
        String sql =
            "INSERT INTO Student (Name, Department, Marks) VALUES (?, ?, ?)";
        try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
            pstmt.setString(1, student.getName());
            pstmt.setString(2, student.getDepartment());

```

```

        pstmt.setDouble(3, student.getMarks());

        int rowsAffected = pstmt.executeUpdate();
        if (rowsAffected > 0) {
            System.out.println("Student inserted successfully.");
        } else {
            System.out.println("Failed to insert student.");
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while creating student.");
        e.printStackTrace();
    }
}

// Read all students
public List<Student> readStudents() {
    List<Student> students = new ArrayList<>();
    String sql = "SELECT StudentID, Name, Department, Marks FROM Student";
    try (Statement stmt = connection.createStatement();
        ResultSet rs = stmt.executeQuery(sql)) {

        while (rs.next()) {
            int studentID = rs.getInt("StudentID");
            String name = rs.getString("Name");
            String department = rs.getString("Department");
            double marks = rs.getDouble("Marks");

            students.add(new Student(studentID, name, department, marks));
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while reading students.");
        e.printStackTrace();
    }
    return students;
}

// Update an existing student
public void updateStudent(int studentID, Student student) {
    String sql = "UPDATE Student SET Name = ?, Department = ?, Marks = ? "
        + "WHERE StudentID = ?";
    try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
        pstmt.setString(1, student.getName());
        pstmt.setString(2, student.getDepartment());
        pstmt.setDouble(3, student.getMarks());
        pstmt.setInt(4, studentID);

        int rowsAffected = pstmt.executeUpdate();
        if (rowsAffected > 0) {
            System.out.println("Student updated successfully.");
        } else {
            System.out.println("Failed to update student. Student ID not found.");
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while updating student.");
        e.printStackTrace();
    }
}

```

```

// Delete a student
public void deleteStudent(int studentID) {
    String sql = "DELETE FROM Student WHERE StudentID = ?";
    try (PreparedStatement pstmt = connection.prepareStatement(sql)) {
        pstmt.setInt(1, studentID);

        int rowsAffected = pstmt.executeUpdate();
        if (rowsAffected > 0) {
            System.out.println("Student deleted successfully.");
        } else {
            System.out.println("Failed to delete student. Student ID not found.");
        }
    } catch (SQLException e) {
        System.err.println("SQL Exception occurred while deleting student.");
        e.printStackTrace();
    }
}

// Close the connection
public void closeConnection() {
    try {
        if (connection != null)
            connection.close();
    } catch (SQLException e) {
        System.err.println("Error closing resources.");
        e.printStackTrace();
    }
}
}

```

---

### *StudentApp.java*

---

```

import java.util.List;
import java.util.Scanner;

public class StudentApp {
    private StudentView view;
    private StudentController controller;
    private Scanner scanner;

    public StudentApp() {
        view = new StudentView();
        controller = new StudentController();
        scanner = new Scanner(System.in);
    }

    public void run() {
        boolean exit = false;
        while (!exit) {
            int choice = view.getMenuChoice();

            switch (choice) {

```

```

        case 1:
            createStudent();
            break;
        case 2:
            readStudents();
            break;
        case 3:
            updateStudent();
            break;
        case 4:
            deleteStudent();
            break;
        case 5:
            exit = true;
            break;
        default:
            view.displayMessage("Invalid option. Please try again.");
    }
}
controller.closeConnection();
scanner.close();
}

private void createStudent() {
    Student student = view.getStudentDetails();
    controller.createStudent(student);
}

private void readStudents() {
    List<Student> students = controller.readStudents();
    view.displayStudents(students);
}

private void updateStudent() {
    int studentID = view.getStudentID();
    Student student = view.getStudentDetails();
    controller.updateStudent(studentID, student);
}

private void deleteStudent() {
    int studentID = view.getStudentID();
    controller.deleteStudent(studentID);
}

public static void main(String[] args) {
    StudentApp app = new StudentApp();
    app.run();
}
}

```

## OUTPUT:

```
Enter the number of employees: 3
Enter the name of employee 1: Alice
Enter the age of employee 1: 30
Enter the salary of employee 1: 50000
Enter the name of employee 2: Bob
Enter the age of employee 2: 25
Enter the salary of employee 2: 75000
Enter the name of employee 3: Charlie
Enter the age of employee 3: 35
Enter the salary of employee 3: 60000
Choose the field to sort by (name, age, salary): salary
Choose the order (asc for ascending, desc for descending): asc
Sorted Employees-
{name='Alice', age=30, salary=50000}
{name='Charlie', age=35, salary=60000}
{name='Bob', age=25, salary=75000}
```