



Experiment 7

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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");
```



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```
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"));
        }
    }
}
```



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```
    }  
    } 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");
```



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```
        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: ");
```



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```
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:");
```



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```
        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)) {
```



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```
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!");
        }
    }
}
```



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```
        } 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;  
    }  
}
```




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```
// 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 {
```



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```
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);
```



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```
}
```

```
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: ");
```



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```
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 (?, ?, ?)";
```



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```
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")));
        }
    }
}
```



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```
    } 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();
```

```
    }
```

```
}
```



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```
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();  
    }  
}
```



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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 Problem

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.