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COMPUTER SCIENCE & ENGINEERING

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Experiment 7

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Branch: CSE

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Subject: Project Based Learning in Java

UID: 22BCS13919

Section: kpit-902

DOP: 13/03/25

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: ");
```



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```
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());
    }
}
```



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```
}  
  
}  
  
}
```

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: ");
```



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```
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)) {
```



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```
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"));
```



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



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```
    }  
    } 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:



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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; }
```




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@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:
```



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```
        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()) {
```



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```
        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



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```
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";
```



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```
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) {
```



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```
        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();
    }

}
```



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```
}
```

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 Problem



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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.**