



DEPARTMENT OF

COMPUTER SCIENCE & ENGINEERING

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Experiment 7

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Branch: CSE

Semester: 6th

Subject: Project Based Learning in Java

UID: 22BCS16520

Section:kpit-902B

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: ");
```

```
            int option = scanner.nextInt();
```



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```
        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: ");

            int choice = scanner.nextInt();
            scanner.nextLine(); // Clear newline buffer
            switch (choice) {
```



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```
        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) {
```



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```
        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("-----");
        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: ");
```



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```
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.");
```

```
    }
```

```
    } 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();
```



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```
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
```



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```
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; }
```

```
    @Override  
    public String toString() {  
        return "Student ID: " + id + ", Name: " + fullName + ", Department: " + dept + ", Score: " + score;  
    }  
}
```

View

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




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```
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);  
  
        }  
    }  
}
```



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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: ");  
    String updatedName = inputScanner.nextLine();  
    System.out.print("Enter Updated Department: ");
```



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```
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);
```



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```
        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")));
        }
    } catch (SQLException ex) {
        ex.printStackTrace();
    }

    return studentList;
}

public void modifyStudent(Student student) {
```



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```
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();
```



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```
        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...
```



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```
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...
```

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...
```

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.