



## Assignment : 1

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### Question 1. Explain SRP and OCP in detail with proper examples.

#### 1. Single Responsibility Principle (SRP)

##### Definition

The **Single Responsibility Principle** states that:

*A class should have only one responsibility and therefore only one reason to change.*

In simple words, **one class = one job**.

##### Why SRP Is Important

- Makes code easier to understand
- Reduces impact of changes
- Improves maintainability
- Simplifies testing

##### Example (Without SRP)

```
class Employee {  
    void calculateSalary() {  
        // salary calculation logic  
    }  
  
    void saveEmployee() {  
        // database save logic  
    }  
  
    void generateReport() {  
        // report generation logic  
    }  
}
```

##### Problem:

This class has **three responsibilities**:

1. Business logic
2. Database operations
3. Reporting

Any change in database or reporting forces modification of the same class.



► **Example (With SRP Applied)**

```
class SalaryCalculator {
```

```
void calculateSalary() {  
    // salary calculation logic  
}  
}
```

```
class EmployeeRepository {  
void saveEmployee() {  
    // database logic  
}  
}
```

```
class ReportGenerator {  
void generateReport() {  
    // report generation logic  
}  
}
```

**Result:**

Each class has **one responsibility** and **one reason to change**.

## 2. Open/Closed Principle (OCP)

### Definition

The **Open/Closed Principle** states that:

*Software entities should be open for extension but closed for modification.*

This means you should be able to **add new features without changing existing code**.

### Why OCP Is Important

- Prevents breaking existing functionality
- Makes system extensible
- Encourages clean architecture
- Reduces regression bugs

### Example (Without OCP)

```
class Shape {  
String type;  
}
```

```
class AreaCalculator {  
double calculateArea(Shape shape) {  
    if (shape.type.equals("Circle")) {  
        // circle area logic  
    } else if (shape.type.equals("Rectangle")) {  
        // rectangle area logic  
    }  
}
```



**Problem:**

Adding a new shape (Triangle) requires modifying calculateArea().

► **Example (With OCP Applied)**

```
interface Shape {  
    double calculateArea();  
}
```

```
class Circle implements Shape {  
    double radius;
```

```
    public double calculateArea() {  
        return Math.PI * radius * radius;  
    }  
}
```

```
class Rectangle implements Shape {  
    double length, breadth;
```

```
    public double calculateArea() {  
        return length * breadth;  
    }  
}
```

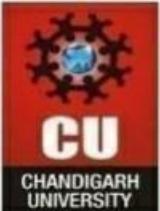
```
class AreaCalculator {  
    double calculateArea(Shape shape) {  
        return shape.calculateArea();  
    }  
}
```

**Result:**

To add a new shape:

```
Class Triangle implements Shape {  
    double base, height;
```

```
    public double calculateArea() {  
        return 0.5 * base * height;  
    }  
}
```



**Q2. Discuss in detail about the violations in SRP and OCP along with their fixes.**

### **1. Violations of Single Responsibility Principle (SRP)**

#### **SRP Reminder**

The **Single Responsibility Principle** states that a class should have **only one responsibility** and one

#### **SRP Violation**

violation occurs when a **single class performs multiple unrelated tasks**.

#### **Example (SRP Violation)**

```
class User {  
    void validateUser() {  
        // validation logic  
    }  
  
    void saveUser() {  
        // database operation  
    }  
  
    void sendEmail() {  
        // email notification  
    }  
}
```

#### **Why This Is a Violation**

This class has **three responsibilities**:

1. Validation logic
2. Database persistence
3. Email communication

Changes in **any one responsibility** force changes in the same class, making it:

- Hard to maintain
- Difficult to test
- Error-prone

#### **Fix for SRP Violation**

**Solution:** Separate each responsibility into its own class.

#### **Example (SRP Applied)**

```
class UserValidator {  
    void validateUser() {  
        // validation logic  
    }  
}  
  
class UserRepository {  
    void saveUser() {  
        // database logic  
    }  
}
```



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```
class EmailService {  
    void sendEmail() {  
        // email logic  
    }  
}
```

## Advantages After Fix

- Each class has **one clear purpose**
- Changes are isolated
- Code becomes more readable and reusable

## 2. Violations of Open/Closed Principle (OCP)

### OCP Reminder

The **Open/Closed Principle** states that software components should be **open for extension** but **closed for modification**.

### OCP Violation

Violation occurs when **new functionality requires modifying existing code**, usually through if-else

#### Example (OCP Violation)

```
class DiscountCalculator {  
    double calculateDiscount(String customerType) {  
        if (customerType.equals("Regular")) {  
            return 10;  
        } else if (customerType.equals("Premium")) {  
            return 20;  
        }  
        return 0;  
    }  
}
```

### Why This Is a Violation

- Adding a new customer type requires **modifying the method**
- Existing tested code is altered
- Increases chances of regression bugs

### Fix for OCP Violation

**Solution:** Use **abstraction and polymorphism**.

#### Example (OCP Applied)

```
interface Discount {  
    double getDiscount();  
}
```

```
class RegularCustomer implements Discount {  
    public double getDiscount() {  
        return 10;  
    }  
}
```

```
class PremiumCustomer implements Discount {  
    public double getDiscount() {  
        return 20;  
    }  
}
```



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```
return 20;
}
}

class DiscountCalculator {
    double calculateDiscount(Discount discount) {
        return discount.getDiscount();
    }
}
```

### Adding New Discount Type (No Modification)

```
class VIPCustomer implements Discount {
    public double getDiscount() {
        return 30;
    }
}
```

No changes required in existing classes.