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COMPUTER SCIENCE & ENGINEERING**

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ASSIGNMENT

Subject Name – System Design

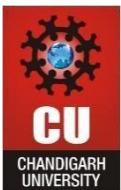
Subject Code – 23CST- 314

Submitted To:

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ASSIGNMENT-1

Q1. Explain SRP and OCP in detail with proper examples.

=> 1. Single Responsibility Principle (SRP)

Definition:

Single Responsibility Principle states that a **class should have only one reason to change**, i.e., it should perform **only one specific responsibility**.

Explanation:

If a class handles multiple responsibilities (like business logic, data storage, and printing), then a change in one responsibility may affect the others. This makes the system hard to maintain and error-prone.

Example (Violation):

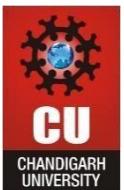
```
class Report {  
    void calculateReport() {}  
    void saveToFile() {}  
    void printReport() {}  
}
```

Here, the class is doing **calculation, storage, and printing**, which violates SRP.

SRP Applied (Correct Design):

```
class Report {  
    void calculateReport() {}  
}  
class ReportSaver {  
    void saveToFile() {}  
}  
class ReportPrinter {  
    void printReport() {}  
}
```

Benefit:



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Improves **maintainability, readability, and testability** of the code.

2. Open–Closed Principle (OCP)

Definition:

Open–Closed Principle states that **software entities should be open for extension but closed for modification**.

Explanation:

This means we should be able to **add new functionality without changing existing code**, reducing the risk of introducing bugs.

Example (Violation):

```
class Discount { double
    calculate(String type) {
        if(type.equals("Student"))
            return 10;
        else if(type.equals("Senior"))
            return 20;
        return 0;
    }
}
```

If a new discount type is added, the class must be modified → **OCP violated**.

OCP Applied (Correct Design):

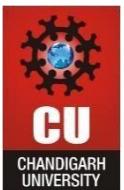
```
interface Discount {
    double calculate();
}

class StudentDiscount implements Discount {
    public double calculate() { return 10; }
}

class SeniorDiscount implements Discount {
    public double calculate() { return 20; }
}
```

Benefit:

Makes the system **flexible, scalable, and easy to extend**.



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

=> 1. Violation of Single Responsibility Principle (SRP)

Violation:

SRP is violated when **a single class performs multiple responsibilities**. If a class handles more than one task, it will have **multiple reasons to change**, which increases complexity and maintenance cost.

Example (SRP Violation):

```
class Invoice {  
    void calculateTotal() { }  
    void printInvoice() { }  
    void saveToDatabase() { }  
}
```

This class handles **calculation, printing, and database storage**, violating SRP.

Fix:

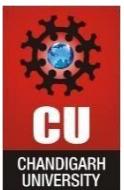
Separate each responsibility into different classes.

Correct Design (SRP Fix):

```
class Invoice {  
    void calculateTotal() { }  
}  
class InvoicePrinter {  
    void printInvoice() { }  
}  
class InvoiceRepository {  
    void saveToDatabase() { }  
}
```

Result:

Each class has **one responsibility**, making the system easier to maintain and test.



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2. Violation of Open–Closed Principle (OCP)

Violation:

OCP is violated when **existing code must be modified** to add new functionality. This can introduce bugs in already working code.

Example (OCP Violation):

```
class Payment {  
    void pay(String method) {  
        if(method.equals("CreditCard")) {}  
        else if(method.equals("UPI")) {}  
    }  
}
```

Adding a new payment method requires modifying the class.

Fix:

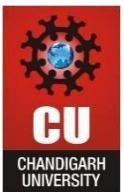
Use **abstraction (interface or inheritance)** to extend behavior without changing existing code.

Correct Design (OCP Fix):

```
interface Payment {  
    void pay();  
}  
class CreditCardPayment implements Payment {  
    public void pay() {}  
}  
class UPIPayment implements Payment {  
    public void pay() {}  
}
```

Result:

New payment methods can be added by creating new classes **without modifying existing code.**



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Q3. Design an HLD for an Online Examination System applying these principles.

=>

Designed the required HLD in attached .drawio file.