



# DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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## ASSIGNMENT 1

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**Semester:** 6<sup>th</sup>

**Subject Name:** System Design

**Subject Code:** 23CSH-314

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

**Solution:**

### 1. Single Responsibility Principle (SRP)

#### **Definition**

*A class should have only one reason to change.*

This means **one class = one responsibility**.

#### **Why SRP is important**

- Easier maintenance
- Better readability
- Reduced impact of changes
- Improved testability

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

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

One class handling **business logic + storage + printing**

#### **SRP-Compliant Version**

```
class ReportGenerator {  
    void generateReport() {}  
}
```



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```
class ReportSaver {  
    void saveToFile() {}  
}
```

```
class ReportPrinter {  
    void printReport() {}  
}
```

Each class has one responsibility

## 2. Open–Closed Principle (OCP)

### Definition

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

### Why OCP is important

- Avoids breaking existing code
- Supports scalability
- Improves reliability

### Example (Violation)

```
class Discount {  
    double calculate(String type) {  
        if(type.equals("Student")) return 0.1;  
        if(type.equals("Senior")) return 0.2;  
        return 0;  
    }  
}
```

Adding a new discount requires modifying the class

### OCP-Compliant Version

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

```
class StudentDiscount implements Discount {  
    public double calculate() { return 0.1; }  
}
```



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```
class SeniorDiscount implements Discount {  
    public double calculate() { return 0.2; }  
}
```

New discounts can be added without changing existing code

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

**Solution :**

### SRP Violation

Violation

- A class performs multiple tasks
- Example: Authentication + Logging + Database operations

Problems

- Difficult to maintain
- High coupling
- Hard to test

Fix

- Split responsibilities into separate classes

### OCP Violation

Violation

- Use of if-else or switch for behavior changes
- Modifying existing code for new functionality

Problems

- Risk of introducing bugs
- Code becomes rigid

Fix

- Use interfaces, inheritance, and polymorphism

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

### Functional Requirements:

- User should be able to register and login
- System should support different roles (Student, Admin)



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- Admin should be able to create and schedule exams
- Admin should be able to add/manage questions
- Student should be able to attempt exams online
- System should evaluate answers automatically
- System should generate results
- System should notify users about exam and results

## Non Functional Requirements:

- A. Scalability
  - System should handle multiple students simultaneously during exams
- B. Security
  - Secure authentication and authorization
  - Exam data should be protected
- C. Performance
  - Low response time during exam submission
- D. Reliability
  - No data loss during exam submission
- E. Maintainability
  - Easy to add new exam or evaluation types

## Core Entities:

- User
- Exam
- Question
- Answer
- Result

## API Endpoints

### Auth & User Service APIs

- POST /login
- POST /register
- GET /users/{id}

### Exam Management Service APIs

- POST /exams

- GET /exams

### Question Bank Service APIs

- POST /questions
- GET /questions/{examId}

### Evaluation Service APIs

- POST /evaluate
- E. Result Service APIs
- GET /results/{userId}
- 

### High Level Diagram :

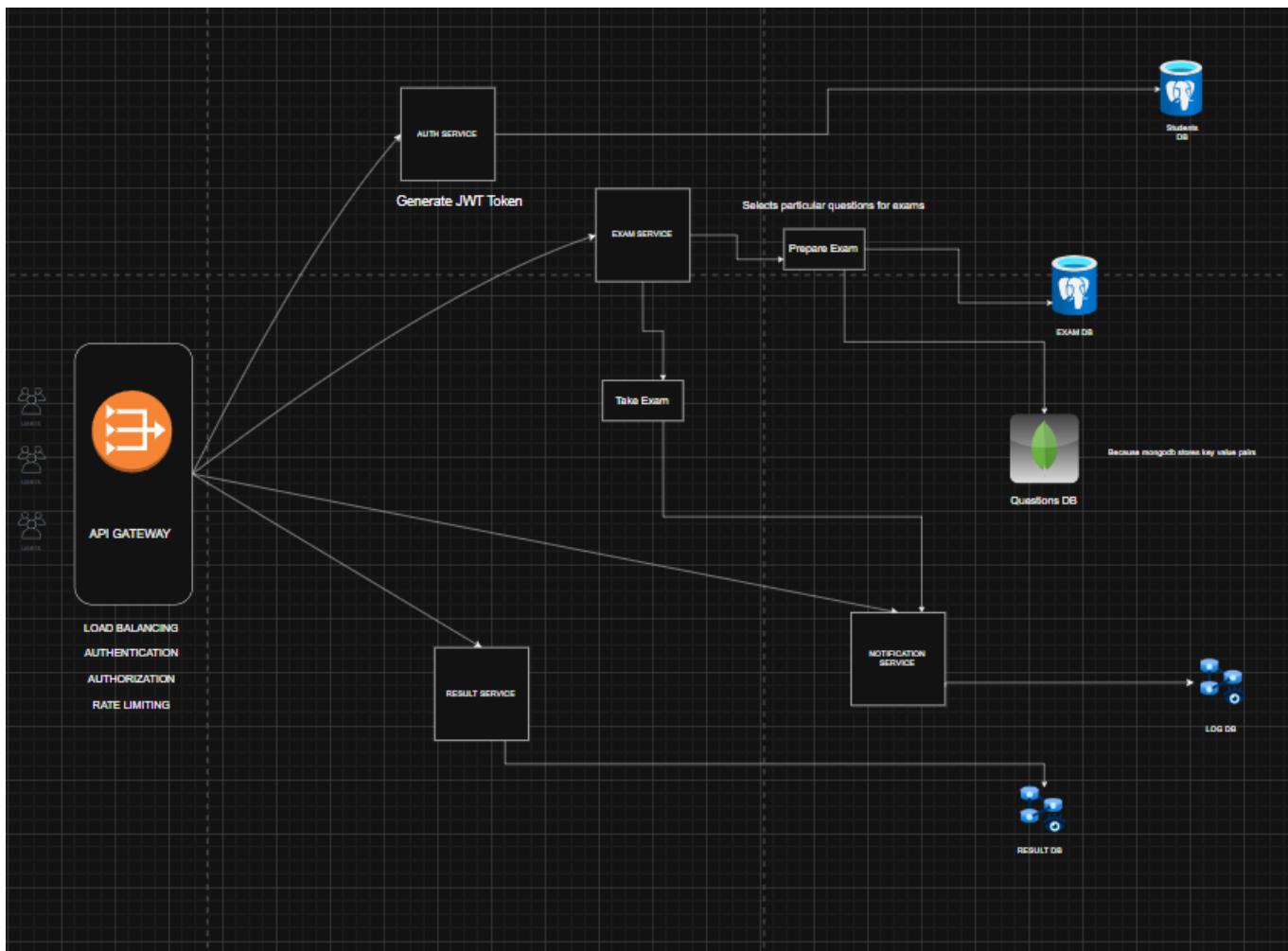


Figure 1: HLD of Online Examination System