SDLC ASSIGNMENT – 9

Skill Description:

Apply software design concepts to create a comprehensive design document for the development of EduLearn Pro, a revolutionary e-learning platform. Gain hands-on experience in assessing and improving coupling and cohesion within a specific module of the application. This assignment focuses on enhancing practical skills in software design, architectural patterns, and principles, while also emphasizing the importance of modular and maintainable design practices.

Scenario Background:

You are a software architect at InnovateTech Solutions, a company specializing in creating cutting-edge applications. The company is currently working on developing a new e-learning platform, EduLearn Pro, to revolutionize online education.

Problem Statement 9: Coupling & Cohesion

Focus on the user authentication module of EduLearn Pro. Evaluate the current level of coupling and cohesion in the design. Propose and implement modifications to improve cohesion and reduce coupling, ensuring a more modular and maintainable authentication system.

Learning Outcomes:

- Identify and assess coupling and cohesion in a real-world software module.
- Apply design modifications to improve module cohesion and reduce coupling.

This assignment provides students with hands-on experience in applying software design concepts to a real-world scenario. By working on the design of EduLearn Pro, students will enhance their skills in creating scalable and maintainable software, while also gaining a deeper understanding of coupling and cohesion principles in the context of a specific module.

Design Document: User Authentication Module for EduLearn Pro

1. Introduction The user authentication module is a critical part of EduLearn Pro, responsible for managing user login, registration, password recovery, and session management. This document evaluates the current design based on coupling and cohesion principles and proposes improvements for a modular, maintainable system.

2. Current State Evaluation

2.1. Coupling Analysis

- High Coupling Indicators:
    - Direct dependencies between the authentication controller, data access layer, and notification services.
    - Database queries embedded in the business logic.
    - Dependency on a third-party email service directly in the module.

2.2. Cohesion Analysis

- Low Cohesion Indicators:
    - Multiple unrelated responsibilities handled within the authentication service.
    - Password hashing, email notification, and session management mixed in a single class.

3. Proposed Design Improvements

3.1. Reducing Coupling:

- Introduce Interfaces: Define interfaces for data access and notification services.
- Dependency Injection: Use a dependency injection framework to inject dependencies.
- Service Abstraction: Create a service layer to abstract third-party API interactions.

3.2. Improving Cohesion:

- Separate Responsibilities:
    - AuthenticationService: Manages login and registration logic.
    - PasswordService: Handles password hashing and validation.
    - NotificationService: Sends email and SMS notifications.
    - SessionManager: Manages active sessions.

4. Updated Module Design

4.1. Architecture Diagram: [Insert diagram showing the separation of components with clear interfaces.]

4.2. Component Responsibilities:

- AuthenticationController: Orchestrates requests and responses.
- AuthenticationService: Contains core authentication logic.
- UserRepository (Interface): Abstracts database operations.
- NotificationService: Manages email and SMS notifications.
- SessionManager: Manages session creation and expiration.

5. Justification for Proposed Changes

- Reduced Coupling: By abstracting services and using dependency injection, module components become independently testable and replaceable.

- Increased Cohesion: Each service has a single, well-defined responsibility, making the system easier to maintain and extend.

6. Implementation Considerations

- Use modern design patterns such as Factory, Singleton, and Observer where applicable.
- Follow SOLID principles and adhere to REST API standards.
- Ensure robust error handling and logging mechanisms.

7. Conclusion: The proposed design ensures that the user authentication module of EduLearn Pro is modular, maintainable, and scalable. By reducing coupling and enhancing cohesion, the system becomes more reliable and easier to extend with future features such as multi-factor authentication and social login integration.