EASTERN INTERNATIONAL UNIVERSITY

SCHOOL OF COMPUTING

AND INFORMATION TECHNOLOGY

Practice Assignment – Quarter 1, 2024-2025

Course Name: OOD

Course Code: CSE 203

Student's Full Name:

Student ID:

Lab 6

1. Shape Drawing Application (Open/Closed Principle)

Description:

- Develop an application that can draw different shapes and calculate their areas.

Requirements:

- Define an abstract class or interface `Shape` with methods `draw()` and `calculateArea()`.
- Implement subclasses like `Circle`, `Rectangle`, and `Triangle`.
- Allow adding new shapes without modifying existing code.

Objectives:

- Apply the **Open/Closed Principle** by designing a system that is open for extension but closed for modification.

2. Employee Management System (Liskov Substitution Principle)

Description**:**

- Create an employee management system that handles full-time and part-time employees.

Requirements:

- Define a base class `Employee` with an abstract method `calculatePay()`.
- Implement subclasses `FullTimeEmployee` (payment is salary) and `PartTimeEmployee` (payment is based on hourly rate and the hours worked).
- Ensure that substituting a subclass instance in place of a base class instance does not break the system.

Objectives**:**

- Practice the **Liskov Substitution Principle** by making subclasses substitutable for their base class.

3. Payment Processing Interfaces (Interface Segregation Principle)

Description:

- Design a payment processing system that supports multiple payment methods.

Requirements:

- Define separate interfaces for different payment capabilities (e.g., `ICreditCardPayment`, `IPayPalPayment`).
- Implement payment classes that only use the interfaces they need.
- Avoid forcing classes to implement methods they do not use.

Objectives:

- Apply the **Interface Segregation Principle** by creating small, client-specific interfaces.

4. Messaging Service (Dependency Inversion Principle)

Description:

- Develop a messaging service that sends notifications via different channels (Email, SMS, Push Notification).

Requirements:

- Create an interface `INotificationService` with a method `send(message)`.
- Implement concrete classes `EmailService`, `SMSService`, and `PushNotificationService`.
- The high-level module (e.g., `NotificationManager`) should depend on the `INotificationService` interface, not concrete classes.

Objectives:

- Practice the **Dependency Inversion Principle** by depending on abstractions rather than concrete implementations.

5. Order Processing System (Single Responsibility and Open/Closed Principles)

Description:

- Build an order processing system for an online store.

Requirements:

- Create an `Order` class responsible for order data.
- Implement separate classes/interfaces for order validation, payment processing, and order fulfillment.
- Allow adding new payment methods or validation rules without modifying existing code.

Objectives:

- Apply the **Single Responsibility Principle** by separating concerns.
- Use the **Open/Closed Principle** to make the system extensible.

6. Vehicle Rental Service (Interface Segregation Principle)

Description:

- Create a vehicle rental service that rents different types of vehicles (Cars, Bikes, Trucks).

Requirements:

- Define interfaces like `IDrivable`, `ICargoCarrier`, `IPassengerCarrier`.
- Implement vehicle classes that only implement the interfaces relevant to them.
- For example, a `Truck` may implement `IDrivable` and `ICargoCarrier` but not `IPassengerCarrier`.

Objectives:

- Practice the **Interface Segregation Principle** by avoiding fat interfaces.

The main method should look like this:

```java
public static void main(String[] args) {
    IDrivable car = new Car();
    IDrivable truck = new Truck();

    car.drive();
    ((Car) car).carryPassengers();

    truck.drive();
    ((Truck) truck).carryCargo();
}
```

7. Plugin System (Open/Closed Principle)

Description:

- Develop a plugin system for an application that allows adding new features through plugins.

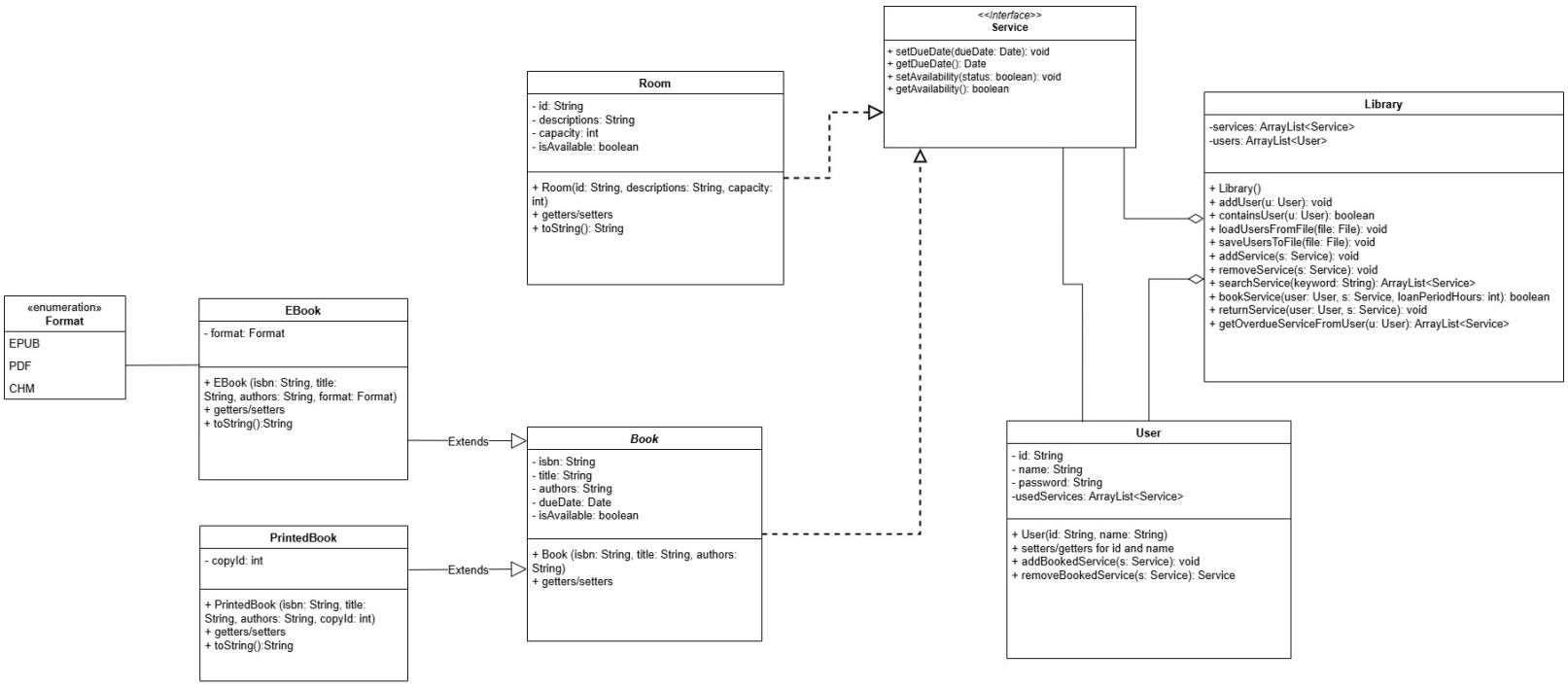
Requirements:

- Define an interface `IPlugin` with a method `execute()`.
- The application should load and execute plugins without modification.
- New plugins (`SavePlugin`, `PrintPlugin`,…) can be added by implementing the `IPlugin` interface.

Objectives:

- Apply the **Open/Closed Principle** to enable extensibility without changing existing code.

8. Library system



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The UML of the system has been designed in the above Figure. Implement the code for the system.

Verify the open/close principle for the system by adding a new service Tutoring. The Tutoring class should have fields to contain id, tutor name, subject, availability, and due date as well as other necessary methods.

Demonstrate the whole system in a complete program.

Submit: Must include:

- a pdf file containing your information (student id, name), and images of the class diagrams, codes, answers
- and all source code files (if any)

in a zipped (.zip or *.rar) file to Moodle