

Final Examination

Date: 13/06/2025 Duration: 105 minutes

Only printed slides and handwritten notes are allowed

SUBJECT: Object-Oriented Programming (IT069IU)	
Approval by School of Computer Science and Engineering Signature 	Lecturer: Signature 
Full name: Assoc. Prof. Nguyen Van Sinh	Full name: Tran Thanh Tung
Proctor 1 Signature 	Proctor 2 Signature
Full name:	Full name:
STUDENT INFO	
Student name: Phạm Hoàng Tuân Tú Student ID: PTSIU24092	

INSTRUCTIONS: the total point is 100 (equivalent to 40% of the course)

1. Purpose:

- Test your knowledge on object-oriented programming in the following topics: Classes, Objects, Encapsulation, Abstraction, Inheritance, Polymorphism, Generic, SOLID principles, and design patterns (CLO1, CLO3)
- Examine your skill in analysis and design classes and algorithms (CLO2)

2. Requirement:

- Read carefully each question and answer it following the requirements
- You can only answer coding questions in JAVA.

Question 1: (20 marks)

- What is the primary purpose of generics in Object-Oriented Programming?
- What does the placeholder T in a generic class or method represent?
- Declare a sample generic method

Question 2: (50 marks)

Given the following Java Code.

```
public class MySQLDatabase {  
    public void connect() {  
        System.out.println("Connecting to MySQL Database...");  
    }  
  
    public class Application {  
        private MySQLDatabase database;  
        Low  
        public Application() {  
            this.database = new MySQLDatabase();  
        }  
  
        public void start() {  
            database.connect();  
            System.out.println("Application started.");  
        }  
    }  
}
```

- Explain why the design violates the Dependency Inversion Principle (10 marks)
- Propose a new design to fix it with respect to Dependency Inversion Principle
 - draw a UML model of your design (15 marks)
 - implementing classes (15 marks)
 - implement a main function to call the start() function of the Application class of your proposed design (10 marks)

Question 3: (30 marks) – Designing

You are tasked with designing a **notification system** that can send messages through multiple channels like **Email**, **SMS**, and **Push Notification**.

Initially, the company only supports **Email**, but they plan to add more channels later (like SMS, Push, Slack, etc.).

The requirements:

- Each notification should support sending a message to a user.
- The system should be easy to extend (new channels) without modifying existing code.

Open / Close

- iii. Each class should have a single reason to change. SR
- iv. The system should work well with dependency injection. DI
- v. All added types should be interchangeable without breaking the system. LS

Task: Propose classes/interfaces to fullfill the requirement. Your design should have at least

- a class **NotificationService** with a function "void **notify(String user, String message)**"
- a way to send notification by Email
 - a. Draw UML of your design (15 marks).
 - b. Implement a test function to show how to send notification by Email (5 marks).
 - c. Implement code to add new channel SMS, and show how to switch from Email to SMS for notification (10 marks).

---- The end ----