International University - VNUHCM
School of Computer Science and Engineering

Midterm Examination

Date: 31/03/2023; Duration: 90 minutes
Offline; closed book exam
Slides, and hand-written notes are allowed.

SUBJECT: Object-Oriented Programming (IT069IU)	
Approval Signature Full name: Tran Thanh Tung, Ph.D.	Lecturer: Signature Full name: Le Duy Tan, Ph.D.
Proctor 1 Signature Full name:	Proctor 2 Signature Full name:
STUDENT INFO	
Student name: **Student ID:**	

INSTRUCTIONS: the total point is 100 (equivalent to 30% of the course)

1. Purpose:
   - Test your knowledge on object-oriented programming in the following topics: Classes, Objects, Encapsulation, Abstraction, Inheritance, and Polymorphism (CLO1)
   - Examine your skill in analysis and design classes and algorithms (CLO2)

2. Requirement:
   - You can only answer coding questions in JAVA.

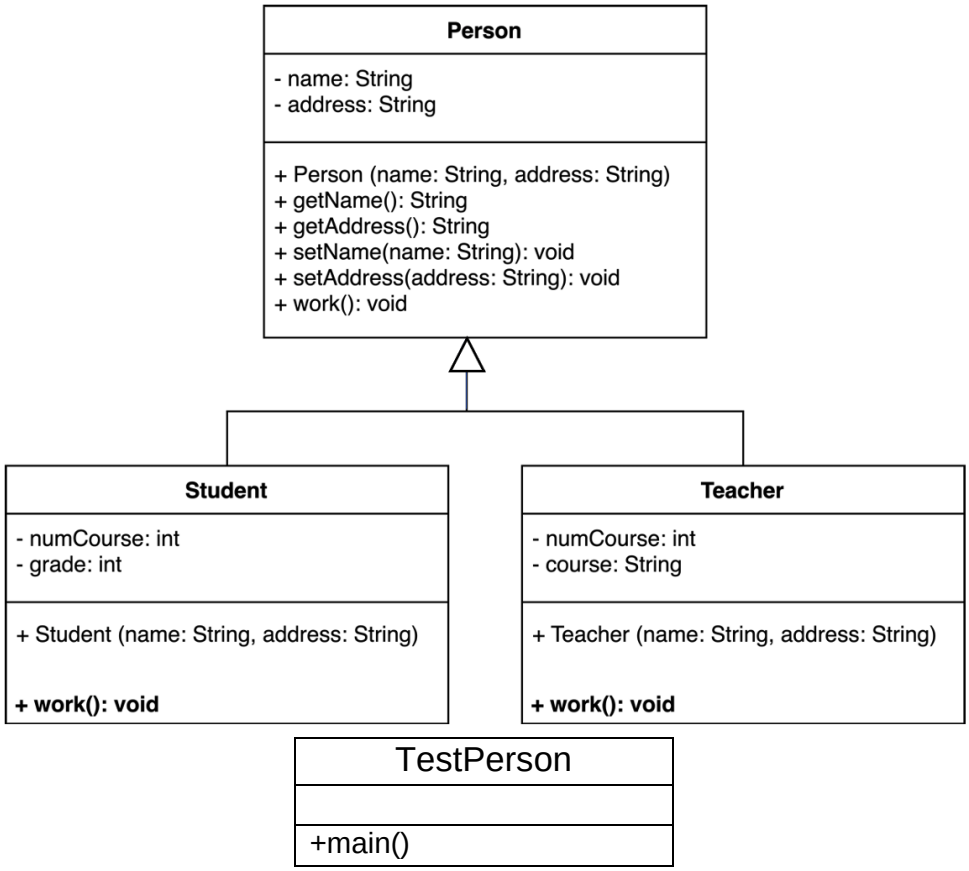
Question 1: In Object-Oriented Programming, describe, explain, and give an example to illustrate each of the following keywords or concept marks (30 marks):

a. public, protected, and private (10 marks)
b. super
    i. in constructors of subclass (10 marks)
    ii. in methods of subclass (10 marks)

Question 2: (20 marks)

Suppose that we are required to model students and teachers in our application. Based on the provided UML

- (5 marks) Define a **superclass** called Person to store common properties such as name and address,
- (10 marks) Define subclasses Student and Teacher for their specific properties.
  Define setters/getters for private attributes for Student and Teacher classes.
  Implement the work function to print out
    + For student: "Student NAME at ADDRESS"
    + For teacher: "Teacher NAME at ADDRESS"
  Where NAME and ADDRESS are values of the objects
- (5 marks) Write the main function inside the TestPerson class to create 01 object for the Student class, and 01 object for the Teacher class, and call the work() function.



Question 3: (50 marks)

NOTE: Read the entire question before design and implement.

Design and implement classes for the system with the following requirements:

a. **(30 marks)** we want to model 3 different types of vehicles: car, motorbike, and bicycle. Each vehicle type has a brand name, a size, a speed, a color, and some behaviors where
   - (5 marks) all those attributes must be stored,
   - (5 marks) a brand name, a speed, and a color must be given on creation of a vehicle, (5 marks) but the size is fixed for each type: 4 for a car, 2 for a motorbike and 1 for a bicycle,
   - (5 marks) the brand name and the size are read-only, but the speed and the color of the vehicle can be changed,
   - (5 marks) the speed of a vehicle could be 1 block, 2 blocks, or 4 blocks per turn. On setting the speed, make sure that the input is 1, 2, or 4, otherwise, print an error message,
   - (5 marks) each vehicle has a "showType()" function to print out its type

b. **(10 marks)** we want to model a road (one lane) where
   - (5 marks) a road has a fixed length (in integer), a fixed-width (in integer), and a fixed direction (either West to East, East to West, North to South, or South to North)
   - (5 marks) a road can contain many vehicles (*<u>for this question ignore the position of vehicles on the road</u>*)

c. **(10 marks)** we want to simulate vehicles movement on a road
   - manage the position of each vehicle on a road
   - (5 marks) assume that there is only one vehicle on a road, implement a function to simulate its movement
     + make sure that the vehicle moves in the direction of the road from the initial position
     + when the rear of the vehicle reaches the end of the road, remove it from the road
   - (5 marks) implement a function to simulate the movement of many vehicles (with different speeds and different sizes) on a road. Note that a vehicle can be blocked by another.

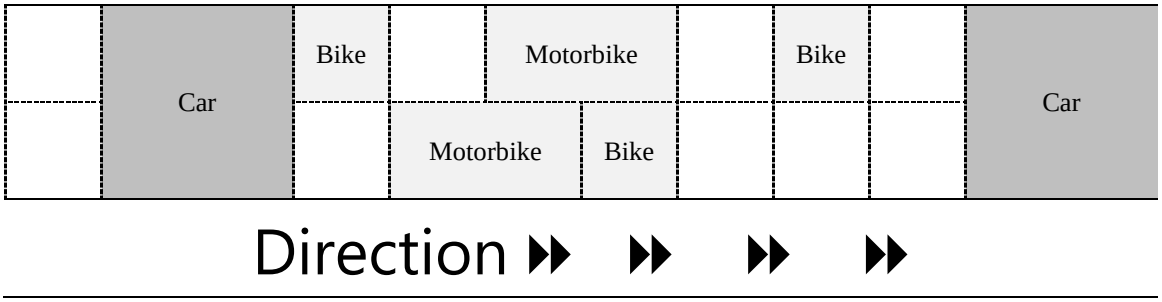


Figure 1: Example of a road of size 2 x 12 containing many vehicles moving from West to East

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