Programme Code: TU857
Module Code: CMPU 2016

TECHNOLOGICAL UNIVERSITY DUBLIN

Grangegorman

TU857 – BSc in Computer Science (Infrastructure)

Year 2

SEMESTER 2 EXAMINATIONS 2022/23

CMPU2016 Object Oriented Programming

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Instructions To Candidates:
There are two parts to this exam. Please answer 2 out of 3 questions from Part A Python, and two out of three questions from Part B Java.

Exam Duration: 3 hours

Special Instructions /Handouts/ Materials Required: None.

Part A – Python

1. (a) Briefly describe the key principles of object-oriented programming. **(4 marks)**

(b) (i) Briefly explain the difference between a **class** and an **object** in object-oriented programming. **(3 marks)**

(ii) Create an example in Python code that illustrates the difference between a class and an object in Python. Explain your code choices. **(7 marks)**

(c) (i) In your own words describe what is meant by inheritance in object-oriented programming? **(3 marks)**

(ii) Provide a Python code example to demonstrate how to use inheritance in Python on the use case of Vehicles. Explain all your code choices. **(8 marks)**

2. Listing 1 provides Python code for a `Fruit` class.

```
1: class Fruit:
2:    def __init__(self, name):
3:       self.name = name
```

Listing1: Python Fruit Class

(a) Provide the Python code that will create an instance of the `Fruit` class and print the name of the fruit to standard output. **(5 marks)**

Question 2) continues on the next page. →

(b) Change the `Fruit` class provided in Listing 1 to fulfil the following requirements: **(10 marks)**

1. Make the name instance variable private.
2. Use encapsulation on the name instance variable. Provide an appropriate getter and setter Python property using a decorator.
3. Create a new instance method of fruit that is called `aging`. The `aging` method should increase a new public instance variable called `age` by 1 every time it is called. No getter/setters are required for this new instance variable. The new instance variable `age` should be created when a fruit object is created and be initialised with the value of 1.
4. Provide the code to demo the usage of this new code.

(c) Explain the difference between method overloading and method overriding, keeping in mind that Python only supports one of them. Provide a suggestion for a workaround of the missing functionality. **(10 marks)**

3. (a) Given the following two Python instance variables in Listing 2 that have been defined inside the `__init__` method: **(5 marks)**

```
1: self.__colour = 'blue'
2: self.make = 'mercedes'
```

Listing 2: Two Python Instance Variables

Discuss what is the same and what is different between these two variables.

Question 3) continues on the next page. →

(b) Figure 1 is an illustration describing an inheritance relationship among 7 classes in Python. **(10 marks)**

Where a class inherits from more than one class, you can assume that the left most class in the chart is the first mentioned in the list of inheritance of that class, for example Y(C, D).

Discuss the full method resolution order for class Z in Python, and explain why certain classes appear before others.

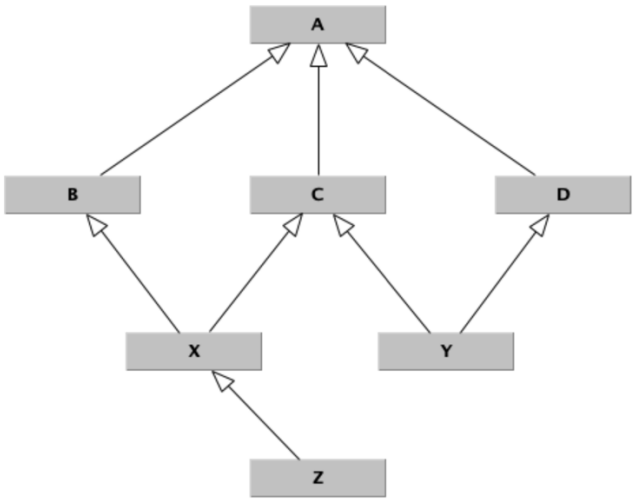

Figure 1: Chart of Inheritance Relationship of 7 Classes

(c) **(i)** Create a simple Python class that illustrates how one class can have an instance variable and a class variable. Explain your code choices. **(4 marks)**

(ii) Demonstrate the use of the Python class created in 3)c)i) showing the difference between an instance variable and a class variable. Explain your code choices. **(6 marks)**

Part B – Java

1. Write the java code to implement a graphical user interface (GUI) in Java that looks and behaves as follows:

(a) **(15 marks)**

- The GUI contains one button and one text field.
- When the button is clicked, the text entered in the text field is printed on the console and displayed in a message.

(b) Explain clearly in your own words what changes are needed to your code to add a *second* button that has the following behaviour: The text field value is verified to see if it is an integer. If it is not, an error message is printed on the console. **(5 marks)**

(c) Explain clearly in your own words how to run (display) the GUI. **(5 marks)**

2. (a) Explain the purpose of interfaces in java, and how to verify that an object has interface behaviours. **(5 marks)**

(b) A java interface called `PolygonInfo` consists of the following code: **(10 marks)**

```
public interface PolygonInfo
{
   public double getArea();
   public double getPerimeter();
}
```

Write a java code and explain in your own words how the `PolygonInfo` interface would be implemented in a class.

(c) Explain the effect of the Java keywords `protected` and `static` as applied in the following Java statement: **(10 marks)**

```
protected static int  Account;
```

3. **(a)** Write a java code for a class named 'Member' having the following data members: **(10 marks)**

1 - Name
2 - Age
3 - Phone number
4 - Address
5 – Salary

It also has methods

1. A constructor to set the attributes to initial values
2. 'printSalary' which prints the salary of the member.
3. 'getAge' which returns the age of the member.
4. ‘setName’ which set a name to the member
5. ‘toString’ that returns the values of all attributes as one string.

(b) Create two classes `'Employee'` and `'Manager'` inherits the `'Member'` class. **(10 marks)**

The `'Employee'` and `'Manager'` classes have data members 'specialization' and 'department' respectively.

Override the function 'printSalary' such that a salary increase of 10% for those in management positions

(c) Assign a name, age, phone number, address and salary to an employee and a manager by making an object of both of these classes and print this information. **(5 marks)**