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TECHNOLOGICAL UNIVERSITY DUBLIN

KEVIN STREET CAMPUS

DT211C-BSc. (Honours) Degree in Computer Science (Infrastructure)

Year 2

SEMESTER 2 EXAMINATIONS 2021/22

Object Oriented Programming

Internal Examiners
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DURATION: 3 HOURS

THERE ARE 2 SECTIONS ON THE PAPER: SECTION A AND SECTION B. CANDIDATES MUST ANSWER ALL QUESTIONS IN EACH SECTION

SECTION A
OO PROGRAMMING THROUGH PYTHON

ANSWER ALL QUESTIONS

Q1. **(a)** In your own words discuss how the flag word `super()` in Python can be used for method overriding.

(5 marks)

(b) Create an example in **Python code** using the topic of **animals** to illustrate the principle of **method overriding**, showcasing the use of `super()`. Every line of your code must be sufficiently code commented. Explain your choices and critically discuss any alternative solutions.

(15 marks)
(Total Q1 20 marks)

Q2. **(a)** While the **instance** attribute in Python has the same characteristics and definition as in other object-oriented languages, the **class** attribute is always mistakenly considered to be the exact equivalent of the static attribute in Java.
Class attributes in Python and static attributes in Java have a lot in common, however, they have behavioural differences.

Create your own example in **Python code** that illustrates the difference between a **class** attribute and an **instance** attribute in **Python** using the context of a **computer game** example. Your code must be accompanied by appropriate code comments to explain your code choices and how they answer the question.

To keep this example simple, you can forego encapsulation.

(20 marks)

(Total Q2 20 marks)

Q3. Listing 1 illustrates Python code that crashes.

```
class Car:
    def __init__(year='', model=''):
        year_str = year
        model_str = model

my_car = Car("1964", "Old")
```

Listing 1: Python Code that crashes

(a) Explain why the Python code in Listing 1 crashes and indicate which interpreter error message would be displayed.

(5 marks)

(b) Write a new **Python code** that addresses and fixes the problem in Listing 1.

(5 marks)
(Total Q3 10 marks)

SECTION B
OO PROGRAMMING THROUGH JAVA

ANSWER ALL QUESTIONS

Q4. (a) Explain the purpose and implementation of *encapsulation* of attributes in Java.

(5 marks)

(b) A Person class has two attributes: age (integer) and name (String). A second class uses the Person class with the following code:

```
Line 1    Person p1 = new Person(25, "Sarah Johnson);
Line 2    p1.age = 24;
```

What will happen when this code executes if encapsulation *has* been implemented in the Person class? Explain the change needed to the code to take account of encapsulation in the Person class.

(5 marks)

(c) Write the Java code for the Person class. Encapsulate the attributes. Include validation to ensure that in a valid age value (0 to 120) is entered, or else an error is printed to the console.

(10 marks)

(Total Q4 20 marks)

Q5. (a) A system includes four Java classes Employee, Book, Program and Student. Each of the classes needs to read data from text files as part of their behaviour. Describe **in your own words** what class structure you would use to incorporate this file functionality into the system, making use of OO principles and code reusability. Include information on how any new class(es) would be used.

(5 marks)

(b) A java interface called `Printable` consists of the following code:

```
public interface Printable
{
   public void printToFile();
   public String printSize();
}
```

Explain the *purpose* of interfaces in java. Also explain in your own words how the Printable interface would be implemented in a class.

(10 marks)

(c) Explain the differences between the two `salary` variables shown:

(1) `double salary = 30.45;`
(2) `Double salary = new Double(30.45);`

(5 marks)

(Total Q5 20 marks)

Q6. (a) Explain the difference between a *Hashset* and an *arrayList* in Java.

(5 marks)

(b) A HashSet object `studentClass` contains elements of type String. Write Java code for iterating over all elements in `studentClass` printing out the element to the console.

(5 marks)

(Total Q6 10 marks)