National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

Department of Computing

CS 212: Object Oriented Programming

Class: BSCS-6ABC

Lab 08: Interfaces

Date: April 17, 2017

Instructor:

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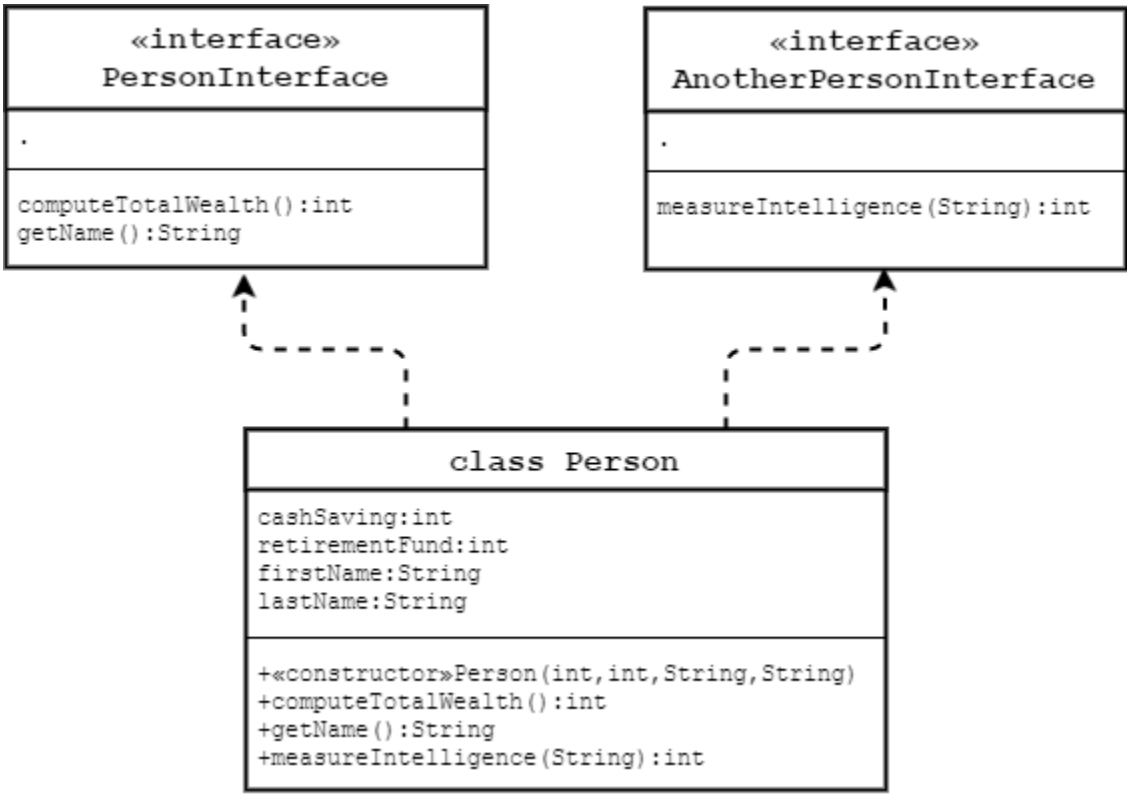
Learning Objectives

The learning objective of this lab is to understand and practice the concept of polymorphic behavior using interfaces.

Task #1.

Write a class Person.java followed implementing two interfaces, PersonInterface.java and AnotherPersonInterface.java.



Once done defining classes use the following client class to test it.

```
package mypersoninterfaceproject;

public class Main {

  public static void main(String[] args) {

    // Create an object instance of Person class.
    Person person1 = new Person(10000, 20000, "Quintin", "Tarantino");

    // You can assign the object instance to
    // PersonInterface type.
    PersonInterface personinterface1 = person1;

    // Display data from person1 and personinterface1.
    // Observe that they refer to the same object instance.
    System.out.println(
      "person1.getName() = " + person1.getName() + "," +
      " person1.computeTotalWealth() = " +
      person1.computeTotalWealth() + "," +
      " person1.measureIntelligence() = " +
      person1.measureIntelligence(person1.getName()));

    System.out.println(
      "personinterface1.getName() = " + personinterface1.getName() + "," +
      " personinterface1.computeTotalWealth() = " +
      personinterface1.computeTotalWealth());

    // You can assign the object instance to
    // AnotherPersonInterface type.
    AnotherPersonInterfaceExample anotherpersoninterface1 = person1;

    // Check of object instance that is referred by personinterface1 and
    // anotherpersoninterface1 is the same object instance.
    boolean b1 = (personinterface1 == anotherpersoninterface1);
    System.out.println("Do personinterface1 and anotherpersoninterface1
point to the same object instance? " + b1);

  }
}
```

Running the test should result in the following output.

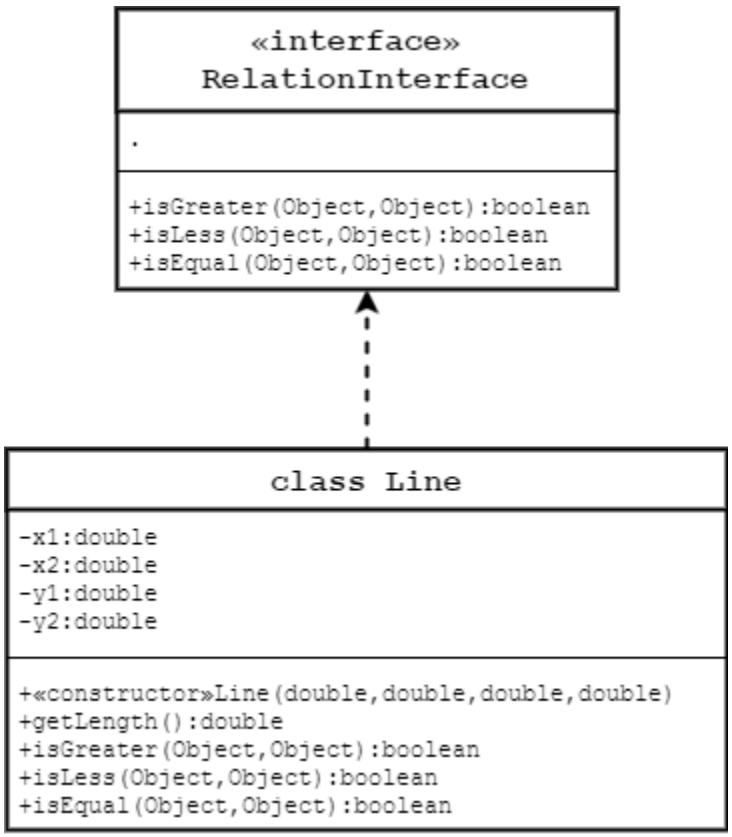
```
person1.getName() = Quintin Tarantino, person1.computeTotalWealth() =
30000, person1.measureIntelligence() = 50
personinterface1.getName() = Quintin Tarantino,
personinterface1.computeTotalWealth() = 30000
Do personinterface1 and anotherpersoninterface1 point to the same object
instance? true
```

Bonus. Compile error is expected on the following line of code. What could be causing it?

```
personinterface1.measureIntelligence(personinterface1.getName());
```

Task #2.

Your task is to write MyRelation program by referring to the UML class diagram below.



Once done with the class definitions use the following tester class to confirm its working.

```
package myrelationinterfaceproject;

public class Main {

  public static void main(String[] args) {

    // Create two Line object instances.
    Line line1 = new Line(1.0, 2.0, 3.0, 4.0);
    Line line2 = new Line(2.0, 3.0, 7.0, 5.0);

    boolean b1 = line1.isGreater(line1, line2);
    System.out.println("line1 is greater than line2: " + b1);
    boolean b2 = line1.isEqual(line1, line2);
    System.out.println("line1 is equal with line2: " + b2);

    // Note that the line3 is object instance of Line type.
    // Because the Line type is also a type of RelationInterface,
    // the line3 variable can be declared as RelationInterface type.
    // This is a very very important concept you need to understand.
    RelationInterface line3 = new Line(1.0, 5.0, 7.0, 9.0);
    boolean b3 = line3.isEqual(line1, line3);
    System.out.println("line1 is equal with line3: " + b3);

    System.out.println("Length of line1 is " + line1.getLength());
    System.out.println("Length of line2 is " + line2.getLength());
  }
}
```

The test should result in the output that resembles the following.

```
line1 is greater than line2: <true/false>
line1 is equal with line2: <true/false>
line1 is equal with line3: <true/false>
Length of line1 is <length>
Length of line2 is <length>
```

Bonus. a) What happens when the following line is added to the Main class? Identify the reason.

```
System.out.println("Length of line3 is " + line3.getLength());
```

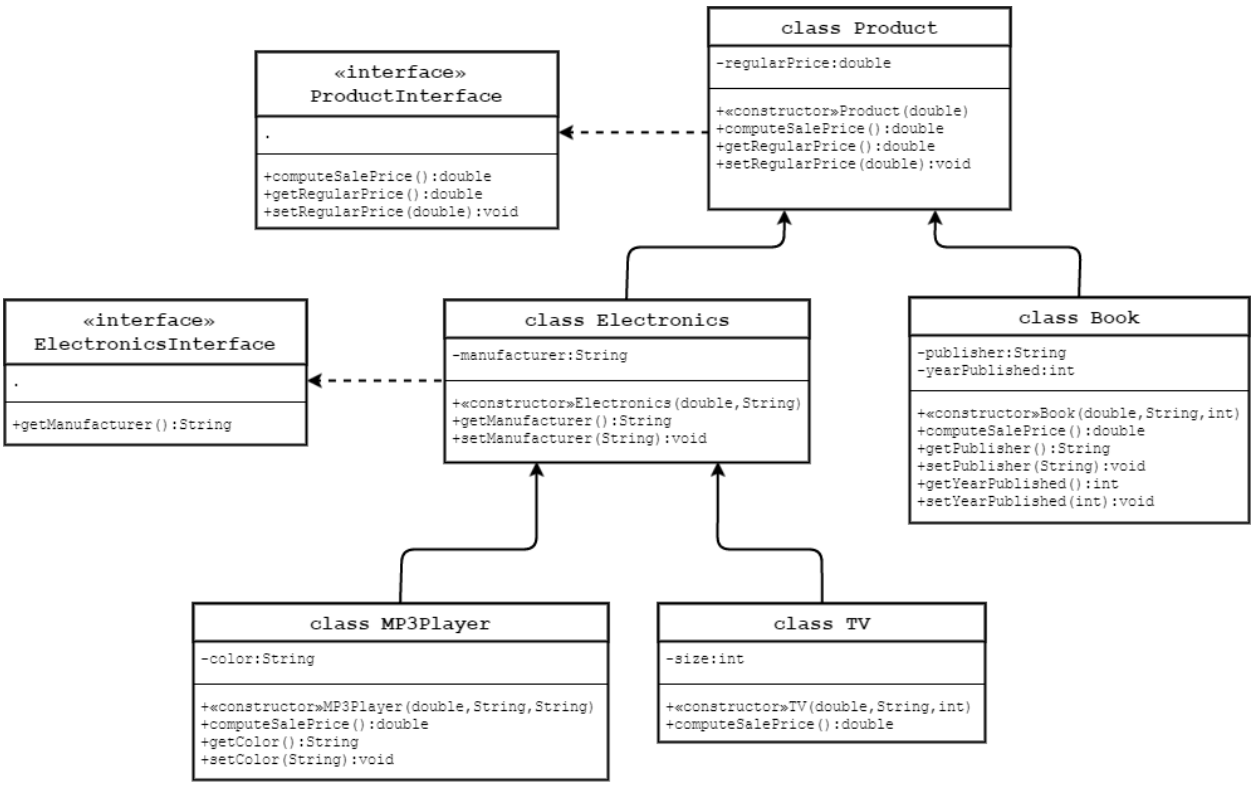
b) Have a look at the Comparable Interface example given at the following link:

https://www.javatpoint.com/Comparable-interface-in-collection-framework

and implement the Comparable Interface for the Line class.

Task #3.

Your task is to revise the MyOnlineShop program done in the previous lab using the UML class diagram below.



Once done with the class definitions use the following tester class to confirm its working.

```
package myonlineshopusinginterface;

public class Main {

  public Main() {}

  public static void main(String[] args) {

    // Declare and create Product array of size 5
    ProductInterface[] pa = new Product[5];

    // Create object instances and assign them to the type of Product.
    pa[0] = new TV(1000, "Samsung", 30);
    pa[1] = new TV(2000, "Sony", 50);
    pa[2] = new MP3Player(250, "Apple", "blue");
    pa[3] = new Book(34, "Sun press", 1992);
    pa[4] = new Book(15, "Korea press", 1986);
```

```
    // Compute total regular price and total sale price.
    double totalRegularPrice = 0;
    double totalSalePrice = 0;

    for (int i=0; i<pa.length; i++){

      // Call a method of the super class to get the regular price.
      totalRegularPrice += pa[i].getRegularPrice();

      // Since the sale price is computed differently
      // depending on the product type, overriding (implementation)
      // method of the object instance of the sub-class
      // gets invoked.  This is runtime polymorphic behavior.
      totalSalePrice += pa[i].computeSalePrice();

      System.out.println("Item number " + i +
        ": Type = " + pa[i].getClass().getName() +
        ", Regular price = " + pa[i].getRegularPrice() +
        ", Sale price = " + pa[i].computeSalePrice());
    }
    System.out.println("totalRegularPrice = " + totalRegularPrice);
    System.out.println("totalSalePrice = " + totalSalePrice);
  }
}
```

The test should result in the following output.

```
Item number 0: Type = myonlineshopusinginterface.TV, Regular price = 1000.0, Sale price = 800.0
Item number 1: Type = myonlineshopusinginterface.TV, Regular price = 2000.0, Sale price = 1600.0
Item number 2: Type = myonlineshopusinginterface.MP3Player, Regular price = 250.0, Sale price = 225.0
Item number 3: Type = myonlineshopusinginterface.Book, Regular price = 34.0, Sale price = 17.0
Item number 4: Type = myonlineshopusinginterface.Book, Regular price = 15.0, Sale price = 7.5
totalRegularPrice = 3299.0
totalSalePrice = 2649.5
```

Hand in

Hand in the source code from this lab at the appropriate location on the LMS system. You should hand in a single compressed/archived file named Lab_8_<Your CMS_ID. Your_NAME >.zip (without angle brackets) that contains ONLY the following files.

1) All completed java source files representing the work accomplished for this lab: PersonInterface.java; AnotherPersonInterface.java; Person.java; RelationInterface.java; Line.java; ProductInterface.java; Product.java; ElectronicsInterface.java; Electronics.java; MP3Player.java; TV.java; and Book.java. The files should contain author in the comments at the top.
2) A plain text file named **README.TXT** that includes a) author information at the beginning, b) a brief explanation of the lab, and c) any comments, or suggestions.

To Receive Credit

1. By showing up on time for lab, working on the lab solution, and staying to the end of the class period, only then you can receive full credit for the lab assignment.
2. Comment your program heavily. Intelligent comments and a clean, readable formatting of your code account for 20% of your grade.
3. The lab time is not intended as free time for working on your programming/other assignments. Only if you have completely solved the lab assignment, including all challenges, and have had your work checked off for completeness by your TA/Lab Engineer should you begin the programming/other assignments.