Object-Oriented programming

Lab #6 – **Generic classes and methods**

I. Get familiar with generic types

Given the following class

```
public class MyPair<T, U> {
      public final T Fst;
      public final U Snd;

      public MyPair(T fst, U snd) {
            this.Fst = fst;
            this.Snd = snd;
      }

      public String toString() {
            return "(" + Fst + ", " + Snd + ")";
      }

}
```

a. In a new source file, write a Java program that includes this declaration and a class with an empty Main method. Compile it to check that the program is well-formed.
b. Declare a variable of type `MyPair<String, Integer>` and create some values, for instance new `MyPair<String, Integer>("Anders", 13)`, and assign them to the variable.
c. Declare a variable of type `MyPair<String, Double>`. Create a value such as new `MyPair<String, Double>("Phoenix", 39.7)` and assign it to the variable.
d. Can you assign a value of type `MyPair<String, Double>` to a variable of type `MyPair<String, Integer>`? Should this be allowed?
e. Declare a variable grades of type `MyPair<String, Integer>[]`, create an array of length 5 with element type `MyPair` and assign it to the variable. Create a few `MyPairs` and store them into grades[0], grades[1] and grades[2].
f. Use the `foreach` statement to iterate over `grades` and print all its elements. What are the values of those array elements you did not assign anything to?
g. Declare a variable `appointment` of type
   `MyPair<MyPair<Integer, Integer>, String>`
   and create a value of this type and assign it to the variable.
   What is the type of `appointment.Fst.Snd`? This shows that a type-argument may itself be a constructed type.
h. Declare a method `Swap()` in `MyPair<T, U>` that returns a new value of type `MyPair` in which the components have been swapped.

II. Differences between Object, generic and generic raw types

In JAVA, there is a Map data structure that helps developers to link a key to a value.
Read about Map in

- https://www.geeksforgeeks.org/map-interface-java-examples/
- https://www.geeksforgeeks.org/java-util-hashmap-in-java/
- https://www.tutorialspoint.com/java/java_hashmap_class.htm

As we want to reimplement the Map class, implement a class named MyMap to manage (store and get back) any object by its ID.

- User can put an object ***obj*** to a Map ***m*** by calling

m.put(obj.getID(), obj);

- User can get back an object from the map ***m*** by invoking

m.get(id);

1. Implement the MyMap in two different ways:
   a. Use Object as the type for both the Key and the Value parameters of the ***put*** and ***get*** methods
   b. Use generic type

2. With your implementations, write a main function to
   a. Test these two implementations
   b. To show advantage of generic type over Object
   c. To show advantage of parameterized type over generic raw type

Reference: textbook “Java How to Program”, chapter 20