

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 also 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