Università della Svizzera italiana **Advanced Java Programming**
Assignment 3 **Fall 2022**
Dr. Andrea Rosà, Prof. Walter Binder, Mariano Marciello

Instructions

- This assignment consists of 80 points (+5 bonus points) and counts 8% (+0.5% bonus points) towards your overall grade.
- The deadline of the assignment will be published on iCorsi. The deadline is strict.
- You are supposed to submit a single zip file. The zip should contain both textual and code solutions. Textual solutions should be included in a single PDF. All pages of the PDF must have your group name in the upper right corner. Code solutions must consist of source code (no JARs or compiled classes). Use the following pattern for naming your submission files: $< group - name >$ *.zip*.
- The assignment considers (vanilla) Java version 17. For simplicity, code snippets may not always contain the full code (e.g. imports or called methods might be omitted). If not mentioned otherwise, you can assume that the snippets compile, the hidden code is implemented correctly, and methods do what their name suggests, without throwing any runtime exceptions.
- You will not receive full points for solutions which produce the correct result but don't follow fundamental programming best practices or documented contracts. Further, don't consider any solutions that involve the use of Java reflection.

Exercise A: Variable Capture (4 Points)

Please answer the question below and provide a short and precise explanation.

Consider the following code snippet:

```java
public class LambdaScopeTest {

    public int x = 0;

    class FirstLevel {

        public int x = 1;

        void methodInFirstLevel(int x) {

            int z = 2;

            Consumer<Integer> myConsumer = y -> {
                z = 66;
                System.out.println("x = " + x);
                System.out.println("y = " + y);
                System.out.println("z = " + z);
                System.out.println("this.x = " + this.x);
                System.out.println("LambdaScopeTest.this.x = " +
                   LambdaScopeTest.this.x);
            };

            myConsumer.accept(x);
        }
    }
}
```

1. Will the above code snippet trigger any compile-time warnings or errors?
2. If the code compiles, will it throw any runtime exceptions?

Yes, lambda can use static variables, instance variables, and local variables, but only local variables defined final or effectively final.
In this case, z is not final

Exercise B: Ordered Stream (4 Points)

Please answer the question below and provide a short and precise explanation.

Consider the following code snippet:

```java
public class Test {
   private static void compare(List<Integer> firstList,
                               List<Integer> secondList) throws
                                  AssertionError {

      if (firstList.size() != secondList.size())
         throw new AssertionError();

      for (int i = 0; i < firstList.size(); i++) {
         if (firstList.get(i).intValue() !=
                 secondList.get(i).intValue())
            throw new AssertionError();
      }
   }

   public void firstTest() {
      List<Integer> numbers = Arrays.asList(1, 2, 3, 4);
      Set<Integer> set = new HashSet<>(numbers);
      List<Integer> list = set.stream().
              map(x -> x + 1 ).collect(Collectors.toList());

      try {
         compare(Arrays.asList(2, 3, 4, 5), list);
      } catch (AssertionError e) {
         throw new RuntimeException(e);
      }
   }

   public void secondTest() {
      List<Integer> numbers = Arrays.asList(1, 2, 3, 4);
      Set<Integer> set = new HashSet<>(numbers);
      List<Integer> list = set.stream().parallel().
              map(x -> x + 1 ).collect(Collectors.toList());

      try {
         compare(Arrays.asList(2, 3, 4, 5), list);
      } catch (AssertionError e) {
         throw new RuntimeException(e);
      }   }
}
```

1. May the above method ”firstTest” throw a RuntimeException?

HashSet are not ordered however there could be properties of
Hashcode of integer such that hash code of elem 1 < hash code of elem 2
if elem2 < elem2 but some subset of integers. This method will throw
runtime exception if values are not keept sorted in hashset
wich is a property no guarateed by default.

2. May the above method ”secondTest” throw a RuntimeException?

The usage of parallel stream will not guarantee that
the result of map will keep the order in which
are in the stream and therefore it is going to throw
a runtime exception

Exercise C: Coding (72 Points + 5 Bonus Points)

Please consider the code distributed with this assignment. You are expected to change the following classes (considering them in the following order may help you in solving the exercise):

1. ch.usi.inf.ajp22.Album
2. ch.usi.inf.ajp22.Main

Please do not modify the comments in the sources files. Solution that do not compile will be awarded 0 points.

Your task: Follow the instruction in the TODO comments. Unless otherwise noted, exercises must be implemented using Streams (and Lambda functions where possible).
Hints:

- Read very carefully the comments;
- Be careful there are some TODOs in the main method too;
- Assume that every input parameter is not null;
- If anything is unclear, ask in the course forum on iCorsi;
- The project is build with maven, you can:
    1. compile it from scratch with the command:

       ```
       mvn compile
       ```

    2. import the project in an IDE (e.g., IntelliJ or Eclipse) and then execute it from there.