Technical test – Java

This test in 2 parts is evaluated on 20 points (8 points for the questions and 12 points for the code exercise).
Please have an IDE configured for Java and a Github account ready.

Questions

Please answer the following questions, choosing one and only one answer each time. No negative points are applied for wrong answers.

1. What type would you typically use to store the value 3.14?

   A. int
   B. String
   C. double
   D. boolean

2. What is an appropriate type for a variable named isAdmin?

   A. int
   B. String
   C. double
   D. boolean

3. Given the declaration: int a[] = { 1, 2, 3, 4, 5 }; what is the length of the array a?

   A. 4
   B. 5
   C. 6
   D. 7

4. Given the declaration: int a[] = { 1, 2, 3, 4, 5 }; what is the value of a[3]?

   A. 2
   B. 3
   C. 4
   D. 5

5. What is the value of i at the end of the following code?

```
int i; for (i = 1; i <= 4; i++) {}
```

   A. 2
   B. 3
   C. 4
   D. 5

6. What is the value of x at the end of the following code?

```
int x = 4; for (int i = 0; i < x; i++) { x--; }
```

   A. 0
   B. 2
   C. 4
   D. x has no value

7. Class B inherits from Class A, all propositions are correct, except?

   A. B is a sub-class of A
   B. A is a super-class of B
   C. B has access to private members of A
   D. B has access to protected members of A

8. In a subclass method, what is the keyword used to reference the parent instance?

   A. `super`
   B. `this`
   C. `parent`
   D. None of the above

9. What is the output of the following code?

```
public class A {
    public static void main(String args[]) {
        try {
            throw new IOException();
        } catch (IOException e) {
            System.out.println("Caught an exception");
        } finally {
            System.out.println("Got into the finally block");
        }
    }
}
```

   A. (Nothing)
   B. Caught an exception
   C. Got into the finally block
   D. Caught an exception
      Got into the finally block

10. Which proposition is true about collections `java.util.List` and `java.util.Set`?

    A. a `Set` can contain a `null` reference, not a `List`
    B. a `Set` can contain the same element twice, not a `List`
    C. a `List` can contain the same element twice, not a `Set`
    D. a `Set` is always ordered, not a List

11. An object that is no more referenced:

    A. is immediately destroyed by the JVM
    B. is kept in memory until the end of the program
    C. can be destroyed or not, as per the JVM will
    D. is serialized to disk for later inspection

12. Which of the following propositions is true about a class static member?

    A. Its value cannot change
    B. Its value is shared by all instances of the class
    C. It makes all the methods in the class static as well
    D. None of the above

13. What will the following code result in?

```
class A {
    int x = 1;

    public static void main(String[] args) {
        System.out.println("x is " + x);
    }
}
```

A. Runtime Error
B. Runtime Exception
C. Output of `x is 1`
D. Compilation error

14. The keyword `final` before a variable causes

A. the variable to be made a constant
B. prepares it for garbage collection
C. hides it from other classes
D. makes it non-inheritable

15. What will the following code result in?

```
public class A {

    public static void callA(int x) {
        x += 2;
    }

    public static void callB(int x[]) {
        x[0] += 2;
    }

    public static void main(String[] args) {
        int a = 10;
        int b[] = { 10 };

        callA(a);
        callB(b);

        System.out.println("Output: " + a + " " + b[0]);
    }
}
```

A. Output: `10 10`
B. Output: `10 12`
C. Output: `12 12`
D. Runtime error

16. In multi-threading, which keyword can be used to acquire a lock?

A. `static`
B. `synchronized`
C. `volatile`
D. `lock`

Code

Instructions:

- Write Java code implementing the following description.
- Make sure your code is readable and can be executed easily.
- **Deliver a Maven or Gradle build file**
- **Deliver on GitHub** (https://github.com/).

Time duration

Description:

Write a class `TimeDuration` which represents a duration:

- with a constructor taking as argument a number of seconds as an int
- throwing an exception of class `BadBadValueException` when given a negative number
- with a `toString()` method displaying the result under the format `{hours}h {minutes}m {seconds}s`, with zero values omitted at start. Formatting is free as long as the following examples are met:
  - `new TimeDuration(0).toString()` should output "`0s`"
  - `new TimeDuration(732).toString()` should output "`12m 12s`"
  - `new TimeDuration(7242).toString()` should output "`2h 0m 42s`"
- write at least 2 unit tests using the above examples (bonus points for more)

Race results

Description:

You are designing the system responsible for storing and displaying the results of a "race against time" stage at the Tour de France. In that kind of race, competitors use the same route but start at different times. Each contestant is wearing a RFID tag which allows recording its exact start time and finish time (measured when he crosses the finish line). Your system will receive an event with a RFID tag code (a `String`) and the race time (a `TimeDuration`) when the contestant crosses the finish line. Once all contestants are finished, the results are printed, and the winner declared: #1 one the list.

To implement the basic system, please:

- create a class `RaceResults`
- write its constructor, initializing the inner structures as needed
- write the method `void onNewResult(String tagNumber, TimeDuration resultTime)` that will receive and store the results
- write a method `void printResults()` that prints the result board on the console, i.e. the tag numbers and corresponding time results, ordered by increasing result time
- write a main method that simulates a bunch of arrivals and prints the results
- what can go wrong with the system? does the code handle it properly? (please write your answer as a comment in the main method)