Exercises - Unit 2
Primitive and reference variables

Group I1E

Year 2017/2018

1. What shows on the screen the following Java program?

```
public class Test {
     public static void main(String [] args) {
          double x, y;
          x = 5.0;
          y = 7/9 * (x+1);
          System.out.println( "x = " + x + " y = " + y );
     }
}
```

2. Write the trace (see slide 2.25) of the following Java program:

```
public class Test {
     public static void main(String [] args) {
          char a, b, c;

          a='a';
          b='A';
          c=' '+'A';
          a=(char) (c-b);
          a=(char) (a+'K');
     }
}
```

3. Write the trace (see slide 2.25) of the following Java program:

```
public class Test {
     public static void main(String [] args) {
          double x=0.0, y;
          int k, l;

          x=3.14159;
          k=8;
          y=k+x;
          k=k*3;
          l=k+8;
          l=l+5;
          y=y/x;
     }
}
```

4. Write the trace (see slide 2.25) of the following Java program:

```
public class Test {
     public static void main(String [] args) {
       int a, b, c;
```

```
        a=10;
        b=3;
        c=a/b;
        a=c+3;
        c=a/b;
        b=c+5;
      }
}
```

5. Write a Java instruction that, suposing variables `x`, `y`, and `z` are declared as `double`, assigns to `z` the value given by the following formula:

$$z = \frac{1 + \frac{x^2}{y}}{\frac{x^3}{1+y}}$$

6. Write the results of the following expressions:

Number	Expression	Number	Expression
1	123456/10	5	123456 %10
2	123456/100	6	123456 %100
3	123456/1000	7	123456 %1000
4	123456/10000	8	123456 %10000

   What can you conclude from the results?

7. Given the following expressions, where `a` and `b` are integer variables with values 5 and 3 respectively, indicate:
   (a) The actual result they evaluate to
   (b) How to modify the expression to obtain the result given as desired in the table

Number	Expression	Desired result
1	`3/4 * (a * a - b)`	16.5
2	`a/b * 1000 + 304`	1970.6666666666667
3	`(100/a + b/2) * 5`	107.5

8. Write a Java assignment that transforms into euros (`double` datatype) an amount introduced in pesetas (`int` datatype, supposed to be a positive value), where 1 euros is equal to 166.386 pesetas

9. What is shown on the screen after executing the following program?

```
public class OperatorTest{
     public static void main (String [] args){
          int a = 12, b = 8, c = 6;
          System.out.println(a + " " + b + " " + c);
          a = c;
          System.out.println(a + " " + b + " " + c);
          c += b;
          System.out.println(a + " " + b + " " + c);
          a = b + c;
          System.out.println(a + " " + b + " " + c);
          a++;
          b++;
          System.out.println(a + " " + b + " " + c);
          c = a++ + ++b;
          System.out.println(a + " " + b + " " + c);
     } // of main
} // of OperatorTest
```

10. Write a Java program to transform a value of temperature in Celsius degrees to Farenheit degrees by using the formula F=(9/5)*°C + 32. The program must ask for the Celsius value and show the Farenheit value.

11. Write a Java program to transform a value of temperature in Farenheit degrees to Celsius degrees by using the inverse of the formula presented in the previous exercise. The program must ask for the Farenheit value and show the Celsius value.

12. Write a Java program that asks for an amount without taxes of a bill and the percent of VAT (real number between 0 and 100) to be applied and shows on the screen the total amount to be paid.

13. Write a Java program class that asks for an amount of money (debt), an interest rate, and the number of months to return the loan, and calculates how much must be paid each month. Suppose the interest rate is applied in an absolute manner to the initial debt.

    For example, for a debt of 1000, interest rate of 20%, in 12 months, the total amount to be returned is $\frac{1000 \cdot (100+20)}{100} = 1200$; thus, each month $\frac{1200}{12} = 100$ must be returned.

14. Write a Java program class that asks for the initial time (hour and minutes) and the final time of a lecture and shows on the screen how long, in minutes, is the lecture. E.g., for 10:30-12:15, it is 105 minutes long. You can suppose that final time is always later than initial time.

15. Write a Java program class that asks for the initial time (hour and minutes) and the final time of a lecture and shows on the screen how long, in hour and minutes, is the lecture. E.g., for 10:30-12:15, it is 1 hour and 45 minutes long. You can suppose that final time is always later than initial time.

16. A transport company recently acquired new trucks that are faster than the previous in service. They want to know how can this affect to the time length of the trips. We can suppose that the average time reduction is of 15%. Write a Java program class that asks for the values of the previous departure (`departHour`, `departMin`) and arrival (`arrivalHour`, `arrivalMin`) hour and minutes (we suppose that departure hour is previous to arrival hour, and that hours and minutes are given in the correct range, i.e., 0-23 and 0-59 respectively), for trips made in the same day, compute the new arrival time and shows on the screen the new trip duration and the new arrival hour. An example of execution can be:

```
Tell me original depart hour: 10
Tell me original depart minutes: 40
Tell me original arrival hour: 12
Tell me original arrival minutes: 15
Initial duration: 95 minutes
New arrival hour: 12
New arrival minutes: 0
New duration: 80 minutes
```

17. Write the evaluation to `true` or `false` of the following logical expressions, assuming that the vars `count` and `limit` (`int` datatype) have a value of 10 and 20, respectively.

    (a) `(count == 0) && (limit < 20)`

    (b) `(limit >= 20) || (count < 5)`

    (c) `((limit/(count-10)) > 7) || (limit < 20)`

    (d) `(limit<=20) || ((limit/(count-10)) > 7)`

    (e) `((limit/(count-10)) > 7) && (limit < 0)`

    (f) `(limit < 0) && ((limit/(count-10)) > 7)`

18. What is shown on the screen in the following program when `-10` is inputted? And when `45` is inputted? And when `0` is inputted?

```
import java.util.*;

public class NegativeTest {
   public static void main(String [] args) {
     Scanner kbd = new Scanner(System.in).useLocale(Locale.US);
```

```
      int n;

      System.out.print("Input integer number: ");
      n=kbd.nextInt();
      System.out.print("Is it negative? ");
      System.out.println(n<0);
   }
}
```

19. When the following instructions are executed, is division by zero error raised?

```
int j = -2;
boolean b = (j > 0) && (1/(j+2) > 10);
```

20. Write a Java program class that asks for your age and writes `true` if you are an adult (you are 18 or older) and `false` otherwise.

21. Write a Java program class that asks for your age and shows on the screen `true` if you are eligible for a youth card (your age is between 14 and 30, both included) and `false` otherwise.

22. Write a Java program class that asks for your height (in meters) and weight (in kilos) and writes `true` if you are in a healthy condition (i.e., your weight divided by the square of your height is between 20 and 25, both included) and `false` otherwise.

23. Write a Java program class that asks for an integer number and writes `true` when it is a positive even number and `false` otherwise.

24. Write a Java program class that tells you if you are able to get a grant for your studies. The program must ask your family income (in euros), the number of members of your family, and your average grade. The program must write on the screen `true` if you can be a grant candidate (the income by family member is lower than 10,000 euros and your average grade is greater than 5), or `false` otherwise.

25. Write a Java program class that asks for a character and writes `true` if it is a capital letter and `false` otherwise.

26. Write a Java program class that asks you for a `String` representing a NIF identifier and verifies if it is correct (its length is 9 and the last character is capital letter). The program must ask for the NIF and write on the screen `true` if it is valid or `false` otherwise.

27. Write a Java program class that asks for a character and writes `true` when the character can be interpreted as a roman number (I, V, X, L, C, D, M) and `false` otherwise.

28. What is shown on the screen when the following program class, that uses the `Point` class (`https://docs.oracle.com/javase/7/docs/api/java/awt/Point.html`), is executed?

```
import java.awt.*;

public class XPoint {
  public static void main(String[] args) {
     Point p1 = new Point();
     Point p2 = new Point();
     Point p3 = new Point();
     p1.x = 1;
     p1.y = 1;
     p2 = p1;
     p2.x = 2 * p1.x;
     p2.y = -2 * p1.y;
     p3 = p1;
     System.out.println("(" +p2.x+ "," +p2.y+")");
     System.out.println("(" +p3.x+ "," +p3.y+")");
  }
}
```

29. What is shown on the screen when the following program class, that uses the `Point` class, is executed?

```
import java.awt.*;

class XPoint2 {
  public static void main(String[] args) {
    Point p1 = new Point();
    Point p2 = new Point();
    Point p3 = new Point();
    p1.x = 1;
    p1.y = 1;
    p2 = p1;
    p2.x = 2 * p1.x;
    p2.y = -2 * p1.y;
    p3.x = p1.x;
    p3.y = p1.y;
    System.out.println(p1 == p2);
    System.out.println(p1 == p3);
    System.out.println(p2 == p3);
  }
}
```

30. Given the `Point` class, write a program class that creates a default `Point` object (using `new Point()` constructor) and asks the user for the new position of the point, and moves the point to that location.

31. Given the `Point` class, write a program class that asks for the coordinates of a `Point` object, creates it, increments its X coordinate in 10 and its Y coordinate in -5 (using the `translate(dx,dy)` method), and writes `true` if the moved `Point` pertains to the first quadrant (i.e., both coordinates are positive) and `false` otherwise.

32. Make a trace (see slide 2.25) of the following code; indicate in each step the contents of the variables. If necessary, consult the Java API for the `String` class.

```
public class TestString {
    public static void main (String[] args){
        String s1 = "Hello", s2 = "", s3;
        System.out.println("Value of s1: " + s1);
        s3 = s1;
        System.out.println("Value of s3: " + s3);
        s2 = s1 + ", Bye!";
        s2 = s2 + " " + 58;
        System.out.println("Value of s2: " + s2);
        System.out.println("Length of s2: " + s2.length());
        System.out.println("Character 8: " + s2.charAt(8));
        System.out.println(s1.contains("Hello"));
        System.out.println(s2.equals(s1));
        System.out.println("alfred".compareTo("louise"));
    }
}
```

33. Make a trace (see slide 2.25) of the following code; indicate in each instruction the contents of the variables.

```
String st = " A String with  numbers: 632 ";
st = st.trim();
String st2 = st.concat(st);
int beg = st2.indexOf(st);
st2 = st.replace("632","2128");
st2 = st2.toLowerCase().replace("str","Str");
beg = st2.indexOf("21");
```

34. Given two variables `int i, j`, we want to show, along with a short previous description, its sum on the screen. Therefore, we propose the following instruction:

```
System.out.println("Sum is equal to: " + i + j);
```

However, when this instruction is executed, the result is not correct. What happens? How must be rewritten the instruction to obtain the correct output?

35. Write a Java program class that asks for a word and writes on the screen the first and last characters of the word.

36. Write a Java program class that asks for a person first name, middle name, and surname, each one in a different `String`. Given those data items, e.g., Barack Hussein Obama, the program must write the data on the screen in the following formats:

    - Complete name: `Barack Hussein Obama`
    - Initial and surname: `B. Obama`
    - Surname and name: `Obama, Barack Hussein`
    - Initials: `B.H.O.`

37. Write a Java program class that asks for a word and writes `true` if its first and last letter are the same, and `false` otherwise.

38. Write a Java program class that asks for your first name and your parents first name, and writes `true` if you have the same name that one of your parents, and `false` otherwise.

39. Write a Java program that asks for two words and writes `true` when they start with the same letter (ignoring case), and `false` otherwise.

40. Write a Java program that asks for a sentence and replaces all occurrences of `yes` by `not`, showing the result on the screen.

41. Write a Java program that asks for a sentence `s` and a word `w`, and writes on the screen `true` if `w` is a prefix or suffix of `s`, and `false` otherwise.

42. Write a Java program that asks for a sentence and it writes on the screen the first and last word of the sentence. Suppose all the input sentences have at least two words and that an only space separates each word.

43. Write a Java program class that asks for a sentence and writes on the screen how many blank characters are at the beginning and at the end of the sentence (clue: employ `trim`).

44. Write a Java program that asks for a real number and writes its absolute value. Employ methods of the `Math` class.

45. Write a program class in whose `main` you ask for two real coordinates of a point ($p1$) and show on the screen the Euclidean distance ($d(p1, p2) = \sqrt{(x_{p1} - x_{p2})^2 + (y_{p1} - y_{p2})^2}$) of that point to the origin.

46. Write a Java program that asks for three real numbers and writes the maximum number. Employ methods of the `Math` class.

47. Given real values x and y, with $x \geq 0$, one form of calculating x^y is by using the equivalence $x^y = \mathrm{e}^{y \cdot \ln x}$ (where e is the natural logarithm base and $\ln x$ represents logarithm in that base of x). Write a Java program class that asks for x and y and makes that calculation using that equivalence, i.e., without using the method `Math.pow(double,double)`. Compare the results with those obtained by using the method `Math.pow(double,double)`

48. When trying to calculate the cubic root of a real number `x`, why it is not correct the expression `Math.pow(x,1/3)`? What must you change in that expression to make it work correctly?

49. Write a Java program class that asks for a cicle radius and writes its perimeter and area. Employ `Math` constants.

50. Write the necessary Java assignments to calculate:

    (a) the surface area of a sphere ($4\pi r^2$), given its radius (supposed to be a positive value) in a variable `double r`.

    (b) the volume of a sphere ($\frac{4}{3}\pi r^3$), given its radius (supposed to be a positive value) in a variable `double r`.

(c) the volume of a sphere given its surface area in a variable `double a`.

Employ `Math` constants and methods.

51. Write a Java program class that asks for the lengths of the two cathetus of a rectangular triangle and shows on the screen the length of the hypotenuse.

52. Write a Java program class to model the throwing of two dices with 6 sides, and write in the standard output, for each execution, the random value between 2 and 12 that is the sum of the two dices result. Employ `Math.random()` for random value generation.

53. Write a Java program class that asks for a sentence and writes a random substring of the given sentence. Employ the `Math.random()` method.