Exercises - Unit 3
Introduction to control structures

Group I1E

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1. What is the output of the following code when x of datatype int is equal to 0? And when it is equal to 1?

```
if (x==0)
   System.out.print("x is 0");
else System.out.print("x is ");
   System.out.print(x);
```

2. What value is assigned to consumption in the following if sentence when speed is 120?

```
if (speed > 80)
    consumption = 10.00;
else if (speed > 100)
    consumption = 12.00;
else if (speed > 120)
    consumption = 15.00;
```

3. For the four following blocks of Java code with conditional instructions, infer the final value of x when its initial value is 0:

```
1)                  2)            3)            4)
if (x >= 0)         if (x >= 0)   if (x < 0)    if (x > 0)
    x++;                x++;          x = x+2;      if (x <= 1)
else if (x >= 1)    if (x >= 1)   else x++;             x++;
         x = x+2;       x = x+2;  x--;              else x--;
```

4. Given the following loops:

```
int i=3;                           int i=0;
while (i<=n)                       while (i<n)
{ System.out.println(i);           { i=i+3;
  i=i+3;                             System.out.println(i);
}                                  }
```

Which of them writes values that are divided by 3, from 3 to n included?

(a) both

(b) only that on the left

(c) only that on the right

5. Write manually the result of executing the following loops for n equal to 5:

```
int i=n;                           int i=n+1;
while (i>=0)                       while (i>0)
{ System.out.println(i*i);         { i--;
  i--;                               System.out.println(i*i);
}                                  }
```

```
int i=0;
while (i<=n)
{ System.out.println(i*i);
  i++;
}
```

```
int i=0;
while (i<=n)
{ System.out.println((n-i)*(n-i));
  i++;
}
```

6. What is the output for the following loop?

```
int sum=0;
while (sum<100) sum+=5;
System.out.println(sum);
```

7. What prints on the screen this `while` loop?

```
int num=10;
while(num<=100)
{   System.out.println(num);
    num+=10;
}
```

8. Describe what would be the final value of `result` for the following Java code segment according to the value `n`, which is an `int` variable with a specific value assigned.

```
double result;
int i;
if (n < 0) i = -n;
else i = n;
result = 0.0;
while (i >= 1) {
    result += (1 / i);
    i--;
}
```

9. A home electronics store is closing and selling its stock with different discounts depending on the total amount of the acquired goods:

   - When total lower than 500 euros, no discount is applied
   - When total is greater than or equal to 500 euros and lower than or equal to 2000 euros, a discount of 30% is applied
   - When total is greater than 2000 euros, a discount of 50% is applied

   Implement the Java program class to obtain the final amount to be paid. Suppose that an only `double` variable (`total`) is asked to the user; `total` will initially store the original amount and, after the calculations, the final amount (i.e., `total` stores initially the data and finally the result). The problem must be solved using an only conditional instruction (nested conditional). Complete the needed conditions supposing that the initial condition is `(total>=500)` or `(total<=2000)`.

10. Write a Java program class in whose `main` method two integer values are read and shown ordered from lower to higher. Employ decision structures, no `Math` methods.

11. Write a Java program class in whose `main` method three integer values are read and shown ordered from lower to higher. Employ decision structures, no `Math` methods.

12. Write a Java program class that reads two real coordinates of a plane that shows on the screen if that coordinate is situated on:

    - The first quadrant ($x > 0$, $y > 0$)
    - The second quadrant ($x < 0$, $y > 0$)
    - The third quadrant ($x < 0$, $y < 0$)
    - The fourth quadrant ($x > 0$, $y > 0$)

- The abscissa axis ($x \neq 0$, $y = 0$)
- The ordinate axis ($x = 0$, $y \neq 0$)
- The origin of coordinates ($x = 0$, $y = 0$)

13. Write a Java program class that asks for the number of the month and, in case it is valid, writes the number of days of the month (suppose we are not in a leap year).

14. Write a Java program class that asks for a date (day, month, and year) and shows on the screen the date in the format `dd/mm/yyyy` (i.e., day and month with two digits, year with four digits). For example, for May 7th 2014, it must write `07/05/2014`, for Oct 13th 2011, `13/10/2011`, for Jan 17th 2008, `17/01/2008`. You can supose that input data is always valid and it is in numerical format (i.e., Jan 17th 2008 would be inputted as 17 1 2008).

15. Write a Java program class that reads in two integer attributes the hour and minutes in 24 hours notation (from 00:00 to 23:59) and shows on the screen the equivalent hour in 12 hours notation (00:00 is midnight, from 00:01 to 11:59 is AM, 12:00 is noon, and 12:01 to 23:59 is PM). Examples:

Input	0 0	0 15	11 25	12 0	12 10	13 35
Output	12:00 midnight	12:15 AM	11:25 AM	12:00 noon	12:10 PM	1:35 PM

When the initial hour is not valid, an error message must be shown.

16. Write a Java program class whose `main` method reads two integer numbers, `num1` and `num2`, and writes the message “Product positive or zero” or “Product negative”. It is forbidden to calculate the product.

17. Write a Java program class whose `main` method simulates a calculator. Consider that the possible calculations are of type “`num1 operator num2`”, where `num1` and `num2` are any two real numbers and `operator` is one of `+`, `-`, `*`, `/`. The program will ask the user for `num1`, then for `operator` and finally for `num2`, and then will show on the screen the result. For division by zero it will show an error message.

18. Write a Java program class to determine the sum of the n first natural numbers ($n \geq 0$, given by the user), i.e., to calculate $\sum_{k=0}^{n} k$.

19. Solve the previous problem but using a descendant generation of the numbers ($n, n-1, n-2, \ldots, 0$).

20. Consider the succession of integer numbers expressed by the recurrence $a_n = a_{n-1} * 2 + 1$ ($n \geq 1$), with $a_0 = 0$. Write an iteration in Java such that from a certain n value, $n \geq 0$, the program calculates a_n.

21. Write a Java program class that, based on an iteration, calculates and prints on the screen a^n, with $a > 0$ real number and $n \geq 0$ integer. Values of a and n would be asked to the user. Remember that:

$$\begin{aligned} a^n &= \underbrace{a \cdot a \cdot a \cdot \ldots \cdot a}_{n \text{ times}} && \text{if} \quad n > 0 \\ a^0 &= 1 && \text{if} \quad n = 0 \end{aligned}$$

22. Write a Java program class that ask the user for an integer number $n > 0$, and counts (by using an iteration) and prints the number of digits of n. E.g., 387 has 3 digits, 14809 has 5 digits. Remember that the number of digits of 0 is 1.

23. Write a Java program class that asks for an integer number and shows it with its digits inverted (e.g., `1234` must be shown as `4321`). Do it by using `int` operations, not `String` methods.

24. Write a Java program class that asks the user for an integer $n > 0$, and calculates and prints $\lfloor \sqrt{n} \rfloor$, which is the minimal integer number $m > 0$ that accomplishes that $m \cdot m \leq n$. Do not use `Math.sqrt`, but only iterations and integer numbers.

25. Write in Java program class whose `main` method reads a word from the keyboard and writes its characters on the standard output by using the `charAt(int index)` method of the `String` class. The characters must be written in sequential lines, each character a different line. For example, for string “Java” the output will be:

```
J
a
v
a
```

In case of having the empty string, nothing must be written. Remember that in a non-empty `String` object, the characters start at position 0 and end at position $n-1$, where n is the length of the string.

26. Write a Java program class that reads positive integer numbers until a negative number is inputted, and then shows the sum of all the positive numbers that were inputted. In case the first number is negative, the sum would be 0.

27. Write a Java program class that asks for an amount of numbers (supposed to be greater than 0), reads that amount of real numbers, and shows the average of the inputted numbers.

28. Write a Java program class that reads a sentence and writes each word of the sentence in one different line; you can consider that no punctuation marks appear and that only one space is between two consecutive words.

29. Write a Java program class that reads a sentence and writes how many words appear in the sentence. You can consider that only one space is between two consecutive words.

30. Write a Java program class that reads a sentence and writes the sentence without letters 'a'. E.g., "A big man came from the sea" will be written as "A big mn cme from the se".

31. Write a Java static method that receives three real numbers and returns the maximum value of the three numbers.

32. Write a Java static method that receives two integer numbers that represent a time instant in hour and minutes and returns the `String` "AM" for times between 00:01 and 11:59, "PM" for times between 12:01 and 23:59, "midnight" for 00:00, "noon" for 12:00, and the empty string for an invalid time.

33. Write a Java static method that receives two integers and a `char` (that represents a arithmetic operation, `'+'`, `'-'`, `'*'`, `'/'`, `%`) and returns the result of the operation (integer). In case division by zero appears, 0 will be returned.

34. Write a Java static method that receives two `String` and returns the shortest one. In case the two are of the same length, the first passed `String` must be returned.

35. Write a Java static method that returns the ordinal for an integer number (given as parameter) that represents a day number, i.e., for 1 must return `"1st"`, for 2 must return `"2nd"`, etc. You can suppose that the parameter is a correct value (between 1 and 31).

36. A telephone company offers two types of contracts; contract 1 facturates 15 cents for each call and 2 cents for each minute of the call; contract 2 facturates 10 cents for each call and 8 cents for each minute. The 21% of VAT must be added to the total call cost. Write a method that, given the type of contract, the number of calls, and the total call minutes, returns the total cost. Write a Java program class that includes that method and in whose `main` method, the type of contract, the number of calls, and the total minutes are asked, and then the total cost is shown.

37. Write a Java static method that receives a `String` and returns the inverted `String`.

38. Write a Java program class whose `main` method reads a word inputed on the keyboard, and uses a method which writes on the standard output sequentially in the same line the n characters of the word, but separated by `'-'`. Thus, if the word is not the empty word, the first character will be printed and after that all the rest of characters will be printed preceded by `'-'`.

    For example, for "Java", the output must be `J-a-v-a`.

39. Write a Java static method that receives a `String` as parameter that represents a sentence and returns the number of words of the sentence. You may assume that a word starts when an alphabetical character (lowercase or uppercase letter) appears and the previous character is not alphabetical. Tip: you can implement an auxiliar `boolean` method that, given a `char` as parameter, returns if it is alphabetical or not.

40. Write a Java static method that receives a `String` as parameter and returns how many times appear in that string its first character (e.g., for "who thinks the wombat allows a wide vision is wrong" will return 5).

41. Write a Java static method that, given two chars, shows on the screen the different characters that are between the two given chars, both included. For example, given 'a' and 'e', the characters to be shown on the screen are 'a', 'b', 'c', 'd', and 'e'.

42. Write a Java static method that returns a `String` formed by two characters of a given `String`; the method must receive as parameters the original `String` and two integer numbers that tell the positions of the characters that will form the result `String`; in case any position is invalid, the empty `String` must be returned. For example, for `("Programming",6,0)` it will return `"mP"`.

43. Write a Java static method that returns the position of the first two repeated consecutive characters in the `String` given as parameter. E.g., for `"scissors"` will return 3 (`"ss"`). In case there are not two consecutive equal characters, it will return -1.