

04JCJLZ - COMPUTER SCIENCES - 2015/2016

Laboratory 3

Objectives:

- To resolve the input-output problems

Technical content:

- To use *scanf* and *printf* functions
 - To use *#define* directive
 - To use basic arithmetic expressions
 - To use relational operators
 - To use logical operators
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Preferably to be solved in the laboratory:

Exercise 1. Write a program following the guidelines below:

- a) Define two integer variables: *int_1* and *int_2*
- b) Define two real variables: *float_1* and *float_2*
- c) Use the *scanf* function to acquire two real numbers and two integer numbers from the keyboard
- d) Assign the real numbers to the real variables and the integer numbers to the integer variables, respectively
- e) Use the *printf* function to output the values of the 4 variables on the screen in the following format:
 - i. *int_1* and *int_2* on the same line, each one occupying 5 spaces,
 - ii. *float_1* occupies at least 5 spaces and has 2 digits of precision after the decimal point,
 - iii. *float_2* has 3 digits of precision after the decimal point.

For example, if the values acquired from the keyboard are 12, 321, 3.5, and 73.125, the format is:

Variable	Value
<i>int_1</i> <i>int_2</i>	12 321
<i>float_1</i>	3.50
<i>float_2</i>	73.125

- f) Try the program with the following values: -3 and -3.5, 1000 and 1000.4567, 1 and 1.01

Further insight: modify the program to acquire only one real number from the keyboard using the *scanf* function, and assign it to all the 4 variables. Debug the program step-by-step checking what happens using the Watch Windows in Debug mode.

Exercise 2. Define and initialize the integer variables A , B , and C (for example: $A=3$, $B=5$ or $A=7$, $B=7$). If they follow the following instruction:

$$C = (A == B)$$

which is the value of C ? Repeat the experiments using the following relational operators:

$$!=, <=, >=, \text{ instead of } ==$$

Further insight 1: calculate and visualize (using the *printf* function) the value of C in the following equation, for all the combinations of 0 and 1 as the values of A and B ($A=0$, $B=0$, $A=0$ $B=1$, $A=1$ $B=0$, and $A=1$ $B=1$):

$$C = ((A \&\& B) \parallel (!B)) \&\& (!A)$$

Further insight 2: define the integer variables A , B , C , and X and initialize them with appropriate values, so to verify whether the expression

$$C = A < X < B$$

in C language corresponds to the mathematical relation (X is between A and B). Which is the correct way to express the mathematical relation in C language?

Exercise 3. Write a program to determine the solution of the following equation:

$$ax + bcx + dK = 0$$

In particular, follow the guidelines below:

- Define a constant K using *#define* and assign it a value as you prefer (e.g., *#define K 10*) (note: the *#define* does not need neither '=' nor ';' characters)
- Define 4 integer variables called a , b , c , d corresponding to the parameters in the equation, and then define an additional real variable x
- Acquire the values of a , b , c , d from keyboard
- Calculate the value of x
- Print the result on the screen.

To be solved at home

Exercise 4. I want to buy one used cell phone. The amount I want to spend is:

- 100 euro as the base price
- 40 euro extra for each of the features I'm interested
- 20 euro less per month when the phone was possessed by the previous owner.

Realize a C program following the guidelines:

- Define the constant values that generate the price using *#define*
- Define the integer variables *price*, *features*, *months* and *years*
- Acquire from keyboard the amount of features possessed by the phone (*features*) and the years for which the mobile phone was owned (*years*)
- Calculate the numbers of months for which the phone is possessed (*months*)
- Calculate the maximum price expendable for the phone (*price*)
- Print the result on the screen.

- Exercise 5. ¹Design the flow chart of an algorithm to classify a triangle according to the lengths of its sides. The algorithm must perform the following tasks:
- Acquire 3 integers corresponding to the lengths of the 3 sides
 - Determine whether the triangle is valid, degenerate, or non-valid
 - If the lengths of the 3 sides can form a valid triangle, determine whether it is equilateral, isosceles, or scalene.

Tips: a triangle is valid if the length of each side is strictly less than the sum of the other two. It is degenerate if the length of one side is equal to the sum of the other two.

Further insight: determine whether the triangle is also a right triangle, meaning that it respects of Pythagorean Theorem ($\text{Leg}_1^2 + \text{Leg}_2^2 = \text{Hypotenuse}^2$).

- Exercise 6. Write a program that calculates the average value of two integers. The program will:

- Sum the two values (positive or negative) into a properly defined variable
- Calculate the arithmetic mean value
- Print the result on the screen.

Check the results with the following pairs of values: (1,1) (0,8) (2,5) (-5,0) (-3,3).

- Exercise 7. Write a program that acquires 4 integer values, positive and lower than 1000. The program will:
- Verify that the values belong to the defined interval [0, 1000). On the contrary, it must assign 0 to the value and print an error message.
 - Calculate the maximum difference between the acquired values (in absolute value)
 - Print the maximum difference result on the screen.

For example, if the program receives 25, 115, 380, 213, it shall print the value 355, which correspond to the difference between 380 and 25.

¹ This exercise will be solved using a multimedia format, and its solution will be provided in the course site during the following weeks.