Practical worksheet N°2. Declaration, assignment, reading, writing

1) Objectifs

The aim of this practical worksheet is to learn the structure and basic elements of a C language program. By the end of this worksheet, you should be able to write a complete program in the C language and manipulate variables, constants, and basic instructions correctly.

Students are encouraged to refer to section number 9 of Chapter 2 titled "Translation into C language" before starting to solve this worksheet. This section provides detailed explanations of the concepts necessary to accomplish this practical worksheet.

2) Declaration and assignment

Consider the following program:

```
#include <stdio.h>          // Use the standard input/output library
int main(){                 // The main program
    #define x 4             // Declare a constant named x with a value of 4
    int a,b,c,d,t1,t2;      // Declare 6 integer variables
    a = 5;                  // Assign the value 5 to variable a
    b = 3;                  // Assign the value 3 to variable b
    c = 1;                  // Assign the value 1 to variable c
    t1 = b * b;             // Store the result of b*b in variable t1
    t2 = x * a * c;         // Store the result of x*a*c in variable t2
    d = t1 - t2;            // Store the result of t1-t2 in variable d
    printf("The result is %d", d);   // Display the result
}
```

- Create a new project and type the program above. Note that the sentences after "//" are comments, so there is no need to write them.
- What does this program do?
- Replace **`int`** with **`float`** then compile and execute. What do you notice?
- Make the necessary corrections for the program to work correctly.

3) Reading instruction

The following program is supposed to calculate the result of dividing two integers entered by the user.

```
#include <stdio.h>
main(){
    int x,y,r;
    printf("Enter 2 integer numbers: ");
    scanf("%d%d",&x,&y);
    r=x/y;
    printf("%d / %d = %d",x,y,r);
}
```

- Create a new project and type the program above.
- Compile and run the program. Is the result correct?
- Change the type of the variable **`r`** to **`float`**, then compile and run it. Is the issue resolved?
- If not, replace the last "**`%d`**" in the **`printf`** with by "**`%f`**," then compile and run it. Is the provided result correct?
- As a final attempt, add **`(float)`** before **`x`** in the instruction **`r=x/y`**, making it **`r=(float)x/y`**. Compile and run it. Is the program correct now?
- What do you conclude from what happened?

4) Application exercises

In all the following exercises, you are not required to ensure the validity of the entered data.

1. Write a program that reads the radius *R* of a circle and calculates and displays its perimeter and area.
2. Write a program that allows you to enter 2 integers from the keyboard and calculates and displays their sum, difference, product, quotient, and remainder of division.
3. Write an algorithm that allows entering the grades for the "Algorithmics and Data Structures" course of a first-year Mathematics student, and calculates and displays his average, knowing that the latter is calculated using the following formula:

$$Avg = \frac{TW + PW}{2} \times 0.4 + Exam \times 0.6$$

4. Write a program that allows you to enter the values of 2 character variables from the keyboard and swaps their content.
5. A magician asks a spectator to think of a number and write it on a slate. He invites the spectator to hide this slate for the duration of the act. He then asks him to add 3 and multiply this sum by the number he initially thought of. He

insists: do not forget this result. Then calculates the square of the initial number. Finally, he asks the spectator to subtract this result from the previous one. The magician requests the spectator to say the final result out loud.

Establish the program corresponding to this statement.

6. The torr (Torr) is a unit of pressure measurement. It is defined as the pressure exerted at 0°C by a column of 1 millimeter of mercury. It was later indexed to atmospheric pressure: 1 standard atmosphere corresponds to 760 torrs and is equal to 101325 Pascals.

   Write an program that reads a pressure in torrs and converts it to pascals.

7. The selling price of a new car includes the sum of the base price, a dealer's profit, and a sales tax. The dealer's profit percentage is 10%, and the sales tax is 9% of the base price.

   Write a program allows entering the base price of a car and calculates and displays its selling price.

5) Additional exercises

Les exercices de cette section sont des exercices supplémentaires de travail personnel.

8. To convert Fahrenheit degrees to Kelvins, the following formula is used:

$$K = \frac{F + 459{,}67}{1{,}8}$$

   Where *K* is the degree in Kelvin and *F* is the degree in Fahrenheit.

   Write a program that allows entering a temperature in Fahrenheit from the keyboard and converts it to Kelvins.

9. Write a program that allows reading the coordinates of two points in the plane and calculates and displays the distance between them.
   Recall that the distance between two points $A(x1,y1)$ and $B(x2,y2)$ is given by the following formula:

$$d = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

10. Write a program that asks the user for an integer smaller than 8 and displays the corresponding binary number.
11. Write an algorithm that asks the user for a duration value expressed in seconds and displays its equivalent in hours, minutes, and seconds.

    Example: 3800 seconds → 1 hour 3 minutes 20 seconds.