Mila University Center
Institute of Science and Technology
Department of Mathematics and Computer Science
1st Year LMD MI

Series No. 1 (Functions and procedure)

Algorithmic and Data Structures **2** – 2022/2023 –

Exercise 1

Consider the following algorithm:

```
Algorithm Exo1
  N, S: integer;
  Function Sum (Nbr : integer): integer
    R, i: integer;
  Begin
    R ← 0;
     For i ← 1 to Nbr TO DO
       R ← R + i;
     EndFour
        Return(R);
  END

Begin //main program
   Read (N);
   S ← Sum (N);
   Write ("The sum of the first N integers is :", S);
END
```

a) Determine the input and output variables for the Sum function.

b) Determine the formal and effective parameters.

c) What are global variables and local variables?

d) What does this algorithm do?

Exercise 2

Consider the following algorithm:

```
Algorithm EXO2
  procedure SPM (X ,Y ,S,P,M: real): integer
  Begin
      S ←X+Y ;
      P ←X*Y ;
      M ←S/2;
  END
    X ,Y ,S,P,M: real;
Begin //main program
   S ←0 ; P ←0 ; M ←0 ;
   Read (X, Y );
   SPM (X, Y, S, P, M );
   Write ("S=" ,S ,"P=",P,"M",M);
END.
```

1. Run this algorithm for X = 10 and Y = 20. Justify the displayed result.

2. Make the necessary modifications so that the algorithm can display the expected results.

Exercise 3

Let's consider the following functions:
- $F(x) = 2x^2 + 1$
- $G(x) = 3x / (x-1)$
- $H(x) = F(x) + G(x)$

Write an algorithm that read a real number z and then calculate and display: F(z), G(z) and H(z).

Exercise 4

We define a *bi-prime* number as being a prime number whose inverse (or mirror) is a prime number. For example the number 17 is bi-prime because it is a prime number and its inverse 71 is also a prime number. We want to display all bi-prime numbers less than an integer A.

Questions :
1) Make the corresponding modular division.
2) Write the algorithm (main program + modules).

Exercise 5

Write an algorithm (after having done the modular division) which allows you to read a vector V1 of N real numbers and check whether it is sorted in crossing order or not.

Exercise 6

Write an algorithm (after having done the modular division) which allows you to read a matrix, calculate its transpose and then display it.

Exercise 7

We consider the Student type defined in the previous series. The administration of the MI department wants to automate the management of its students and entrusts you with this task.

1. Write an algorithm (after having done the modular division) which allows you to:

   a. Read an array of N students.

   b. Display the average of a student searched by their number.

Additional questions

2. Write a procedure *Admitted* that displays the information of admitted students.

3. Write a function *Top* that returns the student with the best average.