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

DIRECTED WORK SERIES NO. 5

Module: Algorithmic and data structures1 — Academic year: 2023/2024

Exercise1 :

Write an algorithm that displays the following numbers:

- 1 2 3 4 5 6 7 8 9
- 9 8 7 6 5 4 3 2 1
- 1 2 3 4 6 7 8 9
- 2 4 6 8 10 12 14 16 18
- -1 2 -3 4 -5 6 -7 8 -9

Exercise 2:

Write an algorithm that calculates the product of two positive integer numbers **X** and **Y** without using the multiplication operator (*).

Exercise 3:

Write an algorithm that calculates the power $\mathbf{x}^{\mathbf{y}}$, where x and y are integers (All possible cases must be considered).

Exercise 4:

Consider the following algorithm :

```
Algorithm exo5
   N,i,j,S,P : integer ;
begin
  read (N) ;
  if (N<0) then
    write (''error'') ;
  else
    S ← 0 ;
    for i going from 1 to N do
       P← 1;
       for j going from 1 to i do
           P← P * j;
       End for
       S ← S + P;
    End for
  End if
  write (S) ;
end.
```

Questions :

1) Provide the execution results for: N = -3, N = 0, N = 5?

2) What does this algorithm do (provide the general form of the sum S = ...)?

3) Rewrite the algorithm using a single loop.

4) Is there another method to ensure that the entered value of N is positive, which one?

Exercise 5

Write algorithms that allow to :

1) Calculate and display the sum **S**= $x + x^2 + x^3 + \dots x^n$.
2) Calculate and display the sum **S**= $x - x^2 + x^3 - \dots x^n$.
3) Calculate and display the approximate value of $\mathbf{e^x}$ given by Taylor Formula**.**

Let's consider the mathematical Taylor formula (1715) that allows for the approximate calculation of the exponential function, e^x :

$$\boldsymbol{e^x} = \sum_{i=0}^{n} \frac{\boldsymbol{x^i}}{\boldsymbol{i}!} = 1 + \frac{\boldsymbol{x}}{1!} + \frac{\boldsymbol{x}^2}{2!} + \frac{\boldsymbol{x}^3}{3!} + \cdots \frac{\boldsymbol{x^n}}{\boldsymbol{n}!}$$

where : { x: is a real number; n : is a positive integer number.

Exercise 6: (supplementary)

1) Write an algorithm that reads a positive integer N and displays the number of digits it contains.
2) Write an algorithm that determines whether a read positive integer N is prime or not.
3) Write an algorithm that displays all prime numbers less than 100.