University of BATNA 2
Faculty: Mathematics and Computer
Department: Common Core in Mathematics and Computer Science
1st Year CC-MCS *2023-2024 academic year*
Module : Algorithms and data structures 2 *Semester : S2*

TD Series N°7

Sub-algorithms (Functions and Procedures)

Exercise 1

Let N be a positive integer.

- Write a function that calculates the sum of the first N integers.
- Write a procedure that displays the sum of the first 100 integers.
- Write a function or procedure that determines the absolute value of the difference between two integers A and B.

Exercise 2

- Let N be a positive integer.
- - Write a function to calculate the number of divisors of "N".
- - Using the previous function, write an ALGExo2 algorithm to display all prime numbers less than or equal to 10000.

  - *An integer is prime if it has two divisors 1 and itself.*
- Give the execution trace of the algorithm ALGExo2.

Exercise 3

Let N be a positive integer.

- Write a function to calculate the sum of divisors of "N".
- Using the previous function, write an algorithm to display all perfect numbers less than or equal to 10000.

  - *An integer Y is perfect if the sum of its divisors is equal to 2*Y.*

Exercice 4

Let be the following algorithm :

```
Algorithm Exo4
Variable
T1, T2, T3, T4 : array of [1..50] of integer
i , N : intger
Function Som_Prod ( a : integer , b : real , var P : real ) : real
Variable
S : real
BeginF
    S ⟵ a + b
    P ⟵ a * b
    Return( S )
EndF
Begin
    Repeat
        Read(N)
    Until ( N ≥ 1) and ( N ≤ 50)
    For ( i from 1 to N do )
        Read T1[i]
    Endfor
    For ( i from 1 to N do )
        Read T2[i]
    Endfor
    For ( i from 1 to N do )
        T3[i] ⟵ Som_Prod(T1[i] , T2[i] , T4[i])
    Endfor
    For ( i from 1 to N do )
        write (T1[i]; write T2[i]; write T3[i]; write T4[i])
    Endfor

End.
```

1. Trace the execution of the algorithm and deduce what it does
2. Determine global and local variables
3. Determine which variables are passed by value and which are passed by address
4. Deduce the difference between the pass by value and the pass by address
5. Repeat the same algorithm using a procedure instead of a function

Exercice 5

Let T be an array of "M" real numbers (M≤35).

Write procedures or functions to :

1. Read the values in T.
2. Display the values in T.
3. Determine the index of the maximum value in the array T.
4. Determine the index of the maximum value in a part of the array T.
5. Exchange the values of two cells in array T.
6. Sort array T in ascending order.

Using the necessary functions and procedures, write an algorithm to read the grades of a group of "N" students (N≤35), sort them in ascending order and then display them.