

## **DIRECTED WORK SERIES NO. 2 (RECURSION)**

Module: Algorithmic and data structures 2

Academic year: 2024/2025

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### **Exercise 1**

Write **recursive** modules that allow you to:

- 1) Calculate the sum:  $1+2+ \dots + (N-1) +N$
- 2) Calculate the power:  $X^N$

### **Exercise 2**

The calculation of the GCD (Greatest Common Divisor) of two positive integers **a** and **b** can be done following Euclid's algorithm. This algorithm is based on Euclid's theorem:

- If  $a > b$  and if we carry out the Euclidean division of  $a$  by  $b$ :  $a = q b + r$  with  $0 \leq r < b$  then the GCD of **a** and **b** is equal to the GCD of **b** and **r**.
- To calculate GCD of  $a$  and  $b$ , simply iterate this technique: we obtain a zero remainder in a finite number of steps. The **last non-zero remainder** is then the gcd of  $a$  and  $b$ .

Write an algorithm to calculate the greatest common divisor of two integers **Nbr1** and **Nbr2** in a **recursive** manner.

### **Exercise 3**

Let **V** be a vector of integers, write the following recursive modules:

- 1) The **FillVE procedure** allows you to fill in V.
- 2) The **ShowVE procedure** allows you to display the values of V.
- 3) The **Sum function** which returns the sum of the elements of the vector.
- 4) The **Max function** which returns the maximum of the vector.
- 5) The **exist function** allows you to check if an element exists in the vector or not.

### **Exercise 4 (additional)**

The dichotomy search for an element in an ordered vector is carried out as follows:

- We divide the table into two approximately equal parts,
- We compare the value to be sought with the middle element,
- If they are not equal, we only focus on the part containing the desired elements and we neglect the other part.
- We repeat these 3 steps until we have a single element to compare.

Write a recursive function that dichotomy searches for a **Val value** . The function returns the rank of this value if it exists and -1 otherwise?