TUTORIAL N°3 : LOOPS (IN ALGORITHMIC LANGUAGE AND IN C)

Note: For every algorithm exercise provided, implement it as a program using the C programming language.

Exercise 01 : Dividers of a number

- Write an algorithm to read an integer N, greater than 1 and display all its dividers.

Exercise 02 : Perfect, Deficient or Abundant (Examen 2022/2023)

A number is perfect if it is equal to the sum of its proper dividers (different from itself). A number is deficient if it is strictly greater than the sum of its proper dividers. A number is abundant if it is strictly less than the sum of its proper dividers.

- Write an algorithm to display whether a given number N is perfect, deficient or abundant.

Example: N = 28 --------> 28 is perfect
N = 16 --------> 16 is deficient
N = 18 --------> 28 is abundant

Exercise 03 : Maximum

Write an algorithm that successively asks the user for 20 numbers, and then tells him which was the largest among these 20 numbers.

Exercise 04 : Division by subtraction

Write an algorithm allowing you to divide an integer A (positive or zero) by the positive integer B.

Example : we want to divide 20 by 3.

20 – 3 = 17	1
17 – 3 = 14	2
14 – 3 = 11	3
11 – 3 = 8	4
8 – 3 = 5	5
5 – 3 = 2	6

2 is the rest.
The quotient is the number of times we were able to subtract 3 from 20 (6 times)

Dividing A by B involves finding Q and R positive or zero such that: A = B*Q + R with R < B.

Exercise 05 : Average calculation

Write an algorithm that asks the user for a series of numbers, representing measurements that can only be strictly positive. The user does not count the number of measurements to enter, but signals that he is finished by entering a negative or a null number.

- The algorithm then displays the number of measurements entered, and their arithmetic average.

Exercise 06 : Never satisfied (Examen 2014/2015)

Write an algorithm that asks for a number between 10 and 20, until the answer matches. In the event of a response greater than 20, a message will appear: “Smaller! ”, and conversely, “Bigger!” » if the number is less than 10.

Exercise 07 : Population (ADS-1 Exam 2021-2022)

The population of city Alpha is 1,000,000 and it is growing by 50,000 per year. The population of city Beta is 500,000 and it is growing by 4% per year.

1. Write an algorithm that determine and display *how many years* the population of city Beta will exceed that of city Alpha.

Exercise 08 : Syracuse sequence (Examen 2014/2015)

The Syracuse sequence is defined by $u_0 \in \mathbb{N}$ and

$$for\ each\ n \in \mathbb{N}, \quad u_{n+1} = \begin{cases} \frac{u_n}{2}, & if\ u_n\ is\ even \\ 3u_n + 1, & if\ u_n\ is\ odd \end{cases}$$

Write an algorithm asking the user for a number n and displaying all the values $u_1, u_2, \ldots, u_n$; with $u_0 = 3$.

Exercise 09 : The FIBONACCI sequence

Construct the algorithm which calculates the N^{th} (with N>2) term of the FIBONACCI sequence which is defined by : $U_0 = U_1 = 1$

$U_n = U_{n-1} + U_{n-2}$ for every n ≥2

FIBONACCI sequence: 1, 1, 2, 3, 5, 8, 13, ...
Example : if N=5 then we display : 8

Exercise 10 : Convert from decimal to binary

Construct the algorithm for converting an integer N into binary (base 2).

Example : $(29)_{10} = (11101)_2$

Exercise 11 : Divisibility by 3 (Examen 2020/2021)

An integer is divisible by 3 if the sum of its digits is divisible by 3.

Write an algorithm that allows you to say whether an integer N is divisible by 3 or not.

Example : N = 903 => Sum of digits = 3+0+9 = 12 is divided by 3; then, 903 can be divided by 3;

Exercise 12 : the approximation of Sin(x) (Examen 2013/2014)

Write an algorithm that calculates the approximation of Sin(x), such that :

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots + (-1)^n \frac{x^{2n+1}}{(2n+1)!}$$

With x given real and n positive integer.