



**Level:** 1<sup>st</sup> year(Mathematics+MCS (MI))

**Date:** 18/01/2024

**Module:** Algorithmic and Data Structures 1

**Duration:** 1h30m

## Exam n° 1

### Exercise n°1

(6 points)

1. Write an algorithm that allows you to perform the coordinate transformation Cartesian coordinates  $(x,y)$  in polar coordinates  $(r,t)$ . This transformation is done by formulas:

$$r^2 = x^2 + y^2$$

If  $x=0$

$t = \pi/2$  if  $y > 0$  ;

$t = -\pi/2$  if  $y < 0$  ;

$t$  does not exist if  $y=0$  ;

Else  $t = \arctg(y/x)$  to which must be added  $\pi$  if  $x < 0$

2. Translate the algorithm into a C program.

### Exercise n°2

(6 points)

Write an algorithm that displays the number of even values and the number of odd values in an integer given by the user.

Example: there are 2 even numbers and 5 odd numbers in the number 2138579.

### Exercise n°3

(8 points)

Consider a matrix  $M$   $(n, m)$  of integers ( $n \leq 30$  and  $m \leq 50$ ). Write an algorithm (or C program) that:

- Searches for an element in the matrix  $M$ .
- Calculates the number of perfect numbers belonging to the matrix  $M$ .

**Good luck**