University of Oum El Bouaghi

Faculty of Exact Sciences, Natural, and Life Sciences

Department of Mathematics and Computer Science

Level: 1st year(Mathematics+MCS(MI)) **Date:** 18/01/2024

Module: Algorithmic and Data Structures 1 **Duration**: 1h30m

Exam n°1

Answer keys

Exercise n°1

```
Algorithm cartesian_polar;
Const pi=3.14 ;   (0.5 p)
Variables x,y,r,t : real ;
Begin
write (" Give the values of  x and y:") ;
read (x,y) ;    (0.5 p)
r ← sqrt((x*x)+(y*y)) ;   (0.5 p)
if (x=0) then   (1.5 p)
      if(y>0) then
              write (" r= ", r , "and t= ", pi/2) ;
      else
             if (y<0) then
                  write (" r= ", r , "and t= ", -pi/2) ;
              else
                   write (" r= ", r , " and t does not exist ") ;
           endif
       endif
  else      (1 p)
        t ← arctg(y/x) ;
        if (x<0) then
            t ← t+pi ;
            write (" r= ", r , " and t= ", t) ;
```

```
   endif
endif
End.
```

2. Translate the algorithm into a C program. (2 p)

Exercise n°2

```
Algorithm odds_evens;
Variables N,T,r,So,Se: integer; (1 p)
Begin
Write(" Give a number:");
Read (N); (0.5 p)
T ← N;
So ← 0;
Se ← 0; (0.5 p)

While ( T!=0)       (3 p)
       r ← T mod 10;
      If (r mod 2=0) then
           Se ← Se+1;
      Else
           So ← So+1;
     End if
     T ← T div 10;
Endwhile
Write (" there are”, Se ,”even numbers and”, So ,”odd numbers in the number “,N); (1 p)

END
```

Exercise n°3

```
Algorithm Matrix;
Variables  i , j, n, m, X, Nbp: integer;
              Exists : boolean ;
              M: array [1..30, 1..50 ] integer; (0.5 p)
Begin
Repeat
    Read(n);
Until (n>0) and (n≤30); (0.5 p)
Repeat
    Read(m);
Until (m>0) and (m≤50); (0.5 p)
For i ←1 to n do
  For j ←1 to m do
      Read (M[ i ,j ]); (1 p)
  Endfor
Endfor
   Write (“Give a number to search for:”);
   Read (X); (0.5 p)
   Exists ← False; i← 1;
While  (i ≤n and Exists=False) do
              j←1;
    while  (j ≤m and Exists=False) do
       If  (M[ i ,j ]=X) then
              Exists ←True;
       End if
          j←j+1 ;
    Endwhile
        i←i+1 ;
Endwhile(1 p)
```

```
 If (Exists=True) then
      Write (X, "Exists")
else
       Write ( X, "Does not exist")
End if(1 p)
/* number of perfect numbers belonging to the matrix M (Nbp)
Nbp←0 ;
For i ←1 to n do
 For j ←1 to m do
          S←0 ;
           For k ←1 to M[ i ,j ]div2 do
                  If (M[ i ,j ]mod k=0) then
                    S←S+k ;
                  End if
           Endfor
           If (S=M[ i ,j ]) then
              Nbp ← Nbp +1 ;
           End if
    Endfor
Endfor(2.5 p)
Write (“number of perfect numbers belonging to the matrix M is: “, Nbp ); (0.5 p)
END
```