

## Solutions to Exercise Series N°: 05

### Exercise1

Write an algorithm that asks for a starting number A and displays the next n numbers (n entered by the user). For example, if the user enters the number  $a=35$ , and  $n=12$  the program will display the numbers from 35 to 46

| <b>While loop</b>                                                                                                                                                                                                                                                                                                           | <b>For loop</b>                                                                                                                                                                                                                                                                                                            |
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| <b>Algorithm</b> Display_numbers<br><b>Var</b><br>$a, n, i : \text{integer}$<br><b>Begin</b><br>Write (" Enter the starting number: ");<br>Read(a)<br>Write (" Enter n : ");<br>Read(n)<br>$i \leftarrow 0$<br><b>while</b> ( $i < n$ ) <b>do</b><br>write ( $a+i$ )<br>$i \leftarrow i+1$<br><b>endWhile</b><br><b>End</b> | <b>Algorithm</b> Display_numbers<br><b>Var</b><br>$a, n, i : \text{integer}$<br><b>Begin</b><br>Write (" Enter the starting number: ");<br>Read(a)<br>Write (" Enter n : ");<br>Read(n)<br>$i \leftarrow 0$<br><b>for</b> $i \leftarrow a$ <b>to</b> $a+n-1$ <b>step 1 do</b><br>write (i )<br><b>endFor</b><br><b>End</b> |

**Exercise2.** Write an algorithm that calculates the smallest common multiplier PPMC of two positive integers (without calculating the largest common divisor PGCD)

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| <b>Algorithm</b> calcul_PPMC<br><b>Var</b><br>$a, b, i, p : \text{integer}$<br><b>Begin</b> Write (" Enter two integers: ");<br>Read(a,b)<br><b>If</b> ( $a > b$ ) <b>then</b><br>$i \leftarrow a$<br><b>Else</b><br>$i \leftarrow b$<br><b>endIf</b><br><b>while</b> ( $i \bmod a \neq 0$ and $i \bmod b \neq 0$ ) <b>do</b><br>$i \leftarrow i+1$<br><b>endWhile</b><br>Write (" PPMC=",i);<br><b>End</b> | <i>// exit after finding the first common multiple</i> |
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**Exercise3.** Write an algorithm that calculates the number of digits of an integer n.

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| <b>Algorithm</b> calcul_PPMC<br><b>Var</b><br>$n, c, a : \text{integer}$<br><b>Begin</b><br>Write (" Enter an integer number: ");<br>Read(n)<br>$c \leftarrow 0$<br>$a \leftarrow n$<br><b>while</b> ( $a \neq 0$ ) <b>do</b><br>$a \leftarrow a \text{ div } 10$<br>$c \leftarrow c+1$<br><b>endWhile</b><br>Write (" the number of digits of ",n , " is ", c);<br><b>End</b> |
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**Exercise 4.** Write an algorithm that allows you to enter positive and not zero, check if this integer is prime,.

| Algo1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Algo2 (optimized)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| <b>Algorithm</b> Is_prime<br><b>Var</b><br><i>n,i,c : integer</i><br><b>Begin</b><br><b>Do</b><br>Write (" Enter an integer: ");<br>Read(n)<br><b>While</b> ( <i>n</i> ≤0)<br><i>c</i> ←0<br><i>a</i> ←1<br><b>while</b> ( <i>a</i> ≤ <i>n</i> ) <b>do</b><br><b>if</b> ( <i>n</i> mod <i>a</i> =0) <b>then</b><br><i>c</i> ← <i>c</i> +1 // calculate the number of divisors<br><b>endif</b><br><i>a</i> ← <i>a</i> +1<br><b>endWhile</b><br><b>if</b> ( <i>c</i> =2) <b>then</b><br>write ( <i>n</i> , " is prime ")<br><b>else</b><br>write ( <i>n</i> , " is not prime ")<br><b>endIf</b><br><b>End</b> | <b>Algorithm</b> Is_prime<br><b>Var</b><br><i>n,i,c : integer</i><br><b>Begin</b><br><b>Do</b><br>Write (" Enter an integer: ");<br>Read(n)<br><b>While</b> ( <i>n</i> ≤0)<br><i>c</i> ←0<br><i>a</i> ←2<br>// if we find a divisor we stop<br><b>while</b> ( <i>a</i> ≤ <i>n</i> /2 and <i>c</i> =0) <b>do</b><br><b>if</b> ( <i>n</i> mod <i>a</i> =0) <b>then</b><br><i>c</i> ←1<br><b>endif</b><br><i>a</i> ← <i>a</i> +1<br><b>endWhile</b><br><b>if</b> ( <i>c</i> =0) <b>then</b><br>write ( <i>n</i> , " is prime ")<br><b>else</b><br>write ( <i>n</i> , " is not prime ")<br><b>endIf</b><br><b>End</b> |

**Exercise 5.** Write a C program that calculates the sum  $S = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} \dots \pm \frac{1}{n}$  (n entered by the user)

| Algorithm                                                                                                                                                                                                                                                                                                                                                                           | C Program                                                                                                                                                                                                                                                                                                                |
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| <b>Algorithm</b> Sum<br><b>Var</b><br><i>n,i,j : integer</i><br><i>s:real</i><br><b>Begin</b><br>Write (" Enter an integer: ");<br>Read(n)<br><i>j</i> ←1<br><i>i</i> ←1<br><i>s</i> ←0<br><b>for</b> <i>i</i> ←1 <b>a</b> <i>n</i> <b>do</b><br><i>s</i> ← <i>s</i> + <i>j</i> *1/ <i>i</i><br><i>j</i> ←- <i>j</i><br><b>endFor</b><br>write ( " som= ", <i>s</i> )<br><b>End</b> | <pre>#include&lt;stdio.h&gt; int main ( ) {     int n, i, j ;     float s;     printf ( "enter an integer : " );     scanf ( "%d" , &amp;n) ;     j=i=1;     s=0;     for (i=1;i&lt;=n; i++)         { s =s +j*1./i; //one is real to have real division           j =-j;         }     Printf ("som= %.2f ",s); }</pre> |

**Exercise6.** Write an algorithm that displays the number of divisors of each integer less than n

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| <b>Algorithm</b> Number_of_divisors<br><b>Var</b> <i>n,i,j,nbrdiv : integer</i><br><b>Begin</b> Write (" Enter an integer: ");<br>Read(n)<br><b>for</b> <i>i</i> ←1 <b>to</b> <i>n</i> <b>do</b><br><i>nbrdiv</i> ←0<br><b>for</b> <i>j</i> ←1 <b>to</b> <i>i</i> <b>do</b><br><b>if</b> ( <i>i</i> mod <i>j</i> =0) <b>then</b><br><i>nbrdiv</i> ← <i>nbrdiv</i> +1 // calculate the number of divisors<br><b>endif</b><br><b>endFor</b><br>printf ( " number of divisor of %d is : %d\n ", <i>i</i> , <i>nbrdiv</i> );<br><b>endFor</b><br><b>End</b> |
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## Practical work

**Ex1.** Write a program that reads two integers and then displays the quotient of the first divided by the second, without using the division operator (/ or div). (Division is repeated subtraction).

```
#include <stdio.h>
int main()
{
    int x, y, q, r ;
    printf("enter 2 nbrs \n") ;
    scanf("%d%d", &x, &y) ;
    q=0 ;
    r=x ;
    while ( r>y )
    {
        r-=y ;
        q++ ;
    }
    printf("the quotient of %d over %d is %d the remainder is %d\n",x, y, q, r) ;
}
```

**Ex2.** A program 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.

```
#include<stdio.h>
int main ( )
{
    int n;
    do { printf ( "enter an integer:  " ) ;
        scanf ( "%d" , &n) ;
        if (n>20)
            printf("smaller \n  ");
        else if (n<10)
            printf("Bigger \n  ");
        else printf("the number is between 10 &nd 20 .... \n ");
    }
    while (n<10 && n>20);
}
```

**Ex3:** program that reads a positive integer n then calculates the sum:  $S = \frac{1}{2} + \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \dots + \frac{n-2}{n-1} + \frac{n-1}{n}$

```
#include<stdio.h>
int main ( )
{
    int n, i, j ;
    float s;
    printf ( "enter an integer :  " ) ;
    scanf ( "%d" , &n) ;
    i=1;
    s=0;
    for (i=1;i<=n; i++)
        s =s +(float)i/(i+1);
    Printf ("som= %.2f  ",s);
}
```

**Ex4.** Write an algorithm that prints a right isosceles triangle with right side length n (n entered by user)

```
#include <stdio.h>
int main()
{
    int n, i, j ;
    printf("enter no. of lines") ;
    scanf("%d", &n) ;
    for ( i=1 ;i<=n ;i++ )
    {
        for ( j=1 ;j<=i ;j++ )
            printf("*") ;
        printf("\n") ;
    }
}
```