AIMS- Cameroon 2021 - High School Students Mentorship day 2 & 3

DAY 2 & 3 - INTRODUCTION TO PYTHON

What is a Function ?   ¶

A function relates an input to an output.

It is like a machine that has an input and an output.

And the output is related somehow to the input.

Application

Do you remember this equation ?

$$ax^2 + bx + c = 0$$

If yes, what was the objectives behind this equation ? We will write a function which can solve this equation directly.

To define a function in Python, we use the following syntax :

```
In [ ]:  def nameOfTheFunction ( parameters ) :
             instructions
```

To return a result or an output coming from the function, we use the command line:

```
In [ ]:  return value
```

PRACTICAL EXERCISE 1

Write a function which solves the second order equation or quadratic equation.

```
In [12]: def quadratic(a,b,c):
             delta = b**2 - 4*a*c
             if delta > 0 :
                 # First case delta > 0
                 # We have 2 solutions
                 x1 = (-b - (delta**0.5)) / (2*a)
                 x2 = (-b + (delta**0.5)) / (2*a)
                 x=print('The solutions are: x1=', x1,'and x2= ',x2)
             elif delta == 0 :
                 # Second case delta == 0
                 # we have one double solution
                 x0 = (-b/(2*a))
                 x=print('The solution is: x0=', x0)
             else : # delta < 0
                 # Last case delta < 0
                 # No solution in R
                 x=print('No solution')
             return x
```

```
In [13]: quadratic(1,-5,6)
```

```
The solutions are: x1= 2.0 and x2=  3.0
```

```
In [14]: quadratic(1,-4,4)
```

```
The solution is: x0= 2.0
```

```
In [15]: quadratic(1,1,1)
```

```
No solution
```

THE LOOP IN PYTHON

In python we have the for loop and the while loop. During our traning, we will only focus on the for loop which is more easy to handle than the while loop.

The syntax for the for loop is as follows :

```
In [ ]: for i in range (number of iteration):
            instructions
```

COMPUTATION OF SEQUENCES

Let consider the sequence defined by :

$$
\begin{cases}
u_0 = 2 \\
u_{n+1} = u_n + 3
\end{cases}
$$

Compute by hand the 5 first terms of this sequence, then use your computer to write a code using the for loop, in order to compute these terms and confirm.

```
In [18]: u0=2

         for i in range (5):
             u0=u0+3
             print(u0)
```

```
5
8
11
14
17
```

PRACTICAL EXERCISE 2

Compute the value of S using a code that you will write down, defined by :

$$S = U_0 + U_1 + \ldots + U_{10}$$

```
In [25]: u0=2
         S=2                          #We set the initial value of the sum to 2

         for i in range (10):        #i varies from 0 to 9, so 10 terms after u(0)
             u0=u0+3                  #calculation of u(k+1)
             S=S+u0                   #the new sum is equal to the old one + the value of u(k+
         print(S)
```

```
187
```

We also define S by the following formula :

$$S = \sum_{k=0}^{10} U_k$$

```
In [30]: u0=2
         P=2                          #We set the initial value of the product to 2

         for i in range (10):        #i varies from 0 to 9, so 10 terms after u(0)
             u0=u0+3                  #calculation of u(k+1)
             P=P*u0                   #the new product is equal to the old one * the value of
         print(P)
```

```
2324549427200
```

EXERCISE

Let consider the sequence defined by :

$$\begin{cases} W_0 = 1 \\ W_{n+1} = 2W_n, \; n \geqslant 0 \end{cases}$$

Compute using your computer :

$$S = \sum_{k=0}^{10} W_k$$

Solution

```
In [35]: W0=1
         P=1                        #We set the initial value of the product to 1

         for i in range (10):       #i varies from 0 to 9, so 10 terms after u(0)
             W0=2*W0                #calculation of W(k+1)
             P=P*W0                 #the new product is equal to the old one * the value of
         print(P)
```

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ASSIGNMENT

Compute the value of T defined by :

$$T = \prod_{k=1}^{10} 2^k$$

Using your computer.