bucles_listas

Informática 2015-2016

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Part I

Bucles y Listas

Un poco de motivación

Queremos hacer la media de unos números reales, cada uno en una variable. ¿qué ocurre si no se sabe cuántos numeros hay?

In [1]:
```
numberlst = [4.0, 6.0, 7.0, 3.0, 2.0]
```

In [2]:
```
s = 0.0
s = s + numberlst[0]
s = s + numberlst[1]
s = s + numberlst[2]
s = s + numberlst[3]
s = s + numberlst[4]
mean = s / len(numberlst)
mean
```

Out [2]:
```
4.4
```

Eso no es generalizable. Necesitamos un bucle

In [3]:
```
def mean(numberlst):
    """This function returns the mean of a list of numbers

    Parameters
    ----------
    numberlst : [float]
        List of float numbers

    Returns
    -------
    float
        Mean of the list

    Example
    -------
    >>> mean([4.0, 6.0, 7.0, 3.0, 2.0])
    4.4
    """
    s = 0.0
    i = 0
    while i < len(numberlst):
        s = s + numberlst[i]
        i = i + 1
```

```
    return s / len(numberlst)
mean(numberlst)
```

In [4]:
```
4.4
```

Out [4]:

Queremos hacer funciones con polinomios

poly —-> $3x^3$ - 6x + 2

Como representamos este polinomio, ¿con 4 reales? ¿y si el polinomio tiene grado n? Necesitamos algo que nos permita representar n reales: 3, 0, -6, 2

In [5]:
```
poly = [2.0, -6.0, 0, 3.0]
poly[0], poly[1], poly[2], poly[3]
```

Out [5]:
```
(2.0, -6.0, 0, 3.0)
```

Trabajar con listas

La longitud de una lista

In [6]:
```
len(poly)
```

Out [6]:
```
4
```

Las posiciones de la lista poly van desde 0 hasta len(poly). Ojo a los accesos ilegales

In [7]:
```
poly[4]
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)

<ipython-input-7-a085d43b506f> in <module>()
----> 1 poly[4]

IndexError: list index out of range
```

Se puede cambiar el contenido de una posición de una lista

In [8]:
```
poly[3] = -7.0
poly
```

Out [8]:
```
[2.0, -6.0, 0, -7.0]
```

In [9]:
```
poly[4] = 9.0
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
```

```
    <ipython-input-9-d742d21044b4> in <module>()
----> 1 poly[4] = 9.0


IndexError: list assignment index out of range
```

Los elementos de una lista se pueden usar en cualquier contexto

In [10]:
```
a = poly[2] + 1 # expresión
abs(poly[3])    #llamada a función
```

Out [10]:
```
7.0
```

Se pueden añadir más elementos a una lista

In [11]:
```
poly.append(9.0)
poly
```

Out [11]:
```
[2.0, -6.0, 0, -7.0, 9.0]
```

Ejemplos de bucles con listas

Vamos a hacer una función que evalúe el polinomio en el punto x

In [12]:
```
x = 2
result = 0.0
power = 1
result = result + power * poly[0]
power = power * x
result = result + power * poly[1]
power = power * x
result = result + power * poly[2]
power = power * x
result = result + power * poly[3]
result
```

Out [12]:
```
-66.0
```

¿y si el polinomio tiene grado n?

In [18]:
```
x = 2
result = 0.0
power = 1
degree = 4
i = 0
while i <= degree:
    result = result + power * poly[i]
    power = power * x
    i = i + 1
result
```

Out [18]:
```
78.0
```

In [13]:
```
def eval_poly(poly, x):
    """This function evaluates the polynomial poly at point x.
    Poly is a list of floats containing the coeficients of the polynomial
    poly[i] -> coeficient of degree i

    Parameters
    ----------
    poly: [float]
        Coefficients of the polynomial, where poly[i] -> coeficient of degree i
    x : float
```

```
        Point

    Returns
    -------
    float
        Value of the polynomial at point x

    Example
    -------
    >>> eval_poly( [1.0, 1.0], 2)
    3.0
    """
    result = 0.0
    power = 1
    degree = len(poly) - 1
    i = 0
    while i <= degree:
        result = result + poly[i] * power
        power = power * x
        i = i + 1
    return result
```

In [14]:
```
eval_poly(poly, 2.0), eval_poly( [1.0, 1.0], 2)
```

Out [14]:
```
(78.0, 3.0)
```

Ejercicio propuesto: Descomposición en factores primos de un número.

Ejemplos:

60 = 2, 2, 3, 5

15 = 3, 5

Seguimos el algoritmo 'clásico' de descomposición, se comienza dividiendo el número original entre el divisor más pequeño posible, se acumula el dividendo y se continua con el divisor.

```
60|2 30|2 15|3 5|5 1
```

In [15]:
```
def factors(n):
    """
    This function computes the list of factors of n

    Parameters
    ----------
    n : int
        Integer number to decompose, n > 1

    Returns
    -------
    [int]
        Factors of n

    Example
    -------
    >>> factors(256)
    [2, 2, 2, 2, 2, 2, 2, 2]
    """
    fct = 2 # 2 is the first prime number
    factors = [] #This is an empty list
    while n > 1:
        if n % fct == 0: # if fct divides n, it is a prime number
            factors.append(fct)
            n = n // fct
        else:
            fct += 1
    return factors
```

In [16]:
```
factors(392000), factors(256)
```

Out [16]:
```
([2, 2, 2, 2, 2, 2, 5, 5, 5, 7, 7], [2, 2, 2, 2, 2, 2, 2, 2])
```

Si queremos calcular la multiplicidad podemos hacer que devuelva una lista de tuplas

In [17]:
```
def factors_exp(n):
    """
    This function returns the list of factors of n,
    together with their exponents. The function returns
    a list of tuples, the first element of the tuple is the factor and the
    second one is the exponent.

    Parameters
    ----------
    n : int
        Integer number to decompose, n > 1

    Returns
    -------
    [(int, int)]
        Factors (factor, exponene) of n

    Example
    -------
    >>> factors_exp(256)
    [(2, 8)]
    """
    fct = 2
    factors = []
    while n > 1:
        if n % fct == 0: #if it is a divisor, we compute its multiplicity.
            exp = 1
            n = n // fct
            while (n % fct) == 0:
                exp += 1
                n = n // fct
            factors.append((fct,exp))
        # at this point n % fct != 0, so we increase fct in any case.
        fct += 1
    return factors
```

In [18]:
```
factors_exp(60), factors_exp(256)
```

Out [18]:
```
([(2, 2), (3, 1), (5, 1)], [(2, 8)])
```

In []: