Python-Loops, Functions

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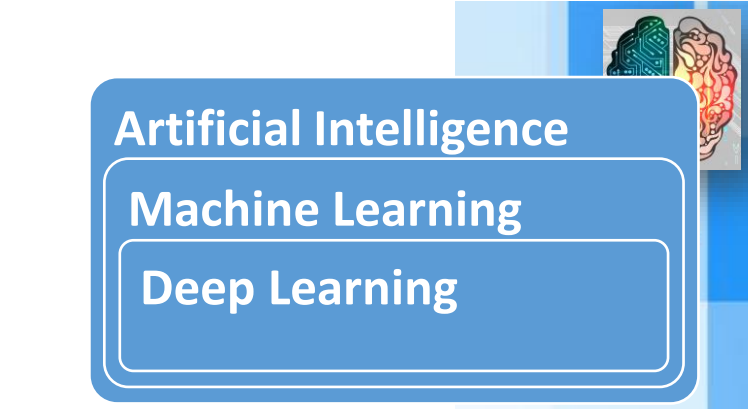
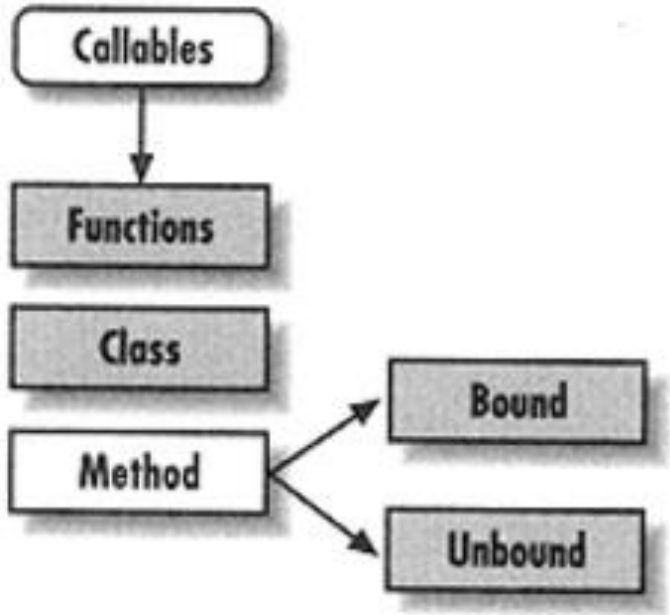
"Success is more a function of consistent common sense than it is of genius"

(An Wang, Computer engineer and inventor, 1920 - 1990)

Agenda

- Decision making
- Loops-while, for
- Strings
- Functions – arguments
- Call by reference/value





One guiding principle of Python code is that

"explicit is better than implicit"

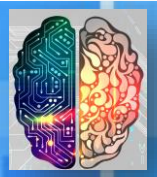
Decision making

```
x = int( input('enter marks'))
if (x>50) : print('pass')
else : print('fail')
```

Or

```
x = int( input('enter marks'))
if (x>50) :
    print('pass')
else :
    print('fail')
```

```
if expression1:
        statement(s)
        if expression2:
                statement(s)
        elif expression3:
                statement(s)
        elif expression4:
                statement(s)
        else:
                statement(s)
  else:
        statement(s)
```



```
# single line code
print("A") if a > b else print("=") if a == b else print("B")
or
if a > b
        print("A")
else  if a == b
                print("=")
         else
                print("B")
```

Exercise

1. Write command to check whether input number is even or odd.
2. Write a command/program to accept marks from user and print the division.
3. Write command/s to return sum of digits of given number.

loops

```
while expression :
        statements()
```

```
while expression :
        statements()
else :
        statements()
```

```
i=0
while (i<5) :
    print (i, 'Jai Ho')
    i=i+1
```

```
0 Jai Ho
1 Jai Ho
2 Jai Ho
3 Jai Ho
4 Jai Ho
```

```
i=0
while (i<5) :
    print (i, 'Jai Ho')
    i=i+1
else :
    print (i, ' Its over now')
```

```
0 Jai Ho
1 Jai Ho
2 Jai Ho
3 Jai Ho
4 Jai Ho
5  Its over now
```

for loop

for iteratingVariable in sequence

    statement/s

```
In [3]: states=['J&K', 'HimachalPradesh','Punjab','Delhi']
        for st in states:
            print (st)
```

```
J&K
HimachalPradesh
Punjab
Delhi
```

```
In [4]: for st in range(len(states)):
            print (states[st])
```

```
J&K
HimachalPradesh
Punjab
Delhi
```

```
In [5]: for alpha in 'India':
            print(alpha)
```

```
I
n
d
i
a
```

for iteratingVariable in sequence

    statement/s

else:

    statement/s

```
In [7]: for st in range(len(states)):
            print (states[st])
        else :
            print('------Its over ------ ')
```

```
J&K
HimachalPradesh
Punjab
Delhi
------Its over ------
```

For loop: Example

1.
```
for n in range(21, 0, -3):
        print(n, '', end='')
```

Output: 21 18 15 12 9 6 3

2.
```
for n in range(1000) :
    print(n, end=‘ ‘)
```

Output: 0, 1, 2, . . . , 999.

3.
```
sum = 0
for i in range(1, 100):
        sum += i
print(sum)
```

Output: adds nos from 1 to 99

Iteration : for

range(10) → 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

range(1, 10) → 1, 2, 3, 4, 5, 6, 7, 8, 9

range(1, 10, 2) → 1, 3, 5, 7, 9

range(10, 0, -1) → 10, 9, 8, 7, 6, 5, 4, 3, 2, 1

range(10, 0, -2) → 10, 8, 6, 4, 2

range(2, 11, 2) → 2, 4, 6, 8, 10

range(-5, 5) → −5, −4, −3, −2, −1, 0, 1, 2, 3, 4

range(1, 2) → 1

range(1, 1) → (empty)

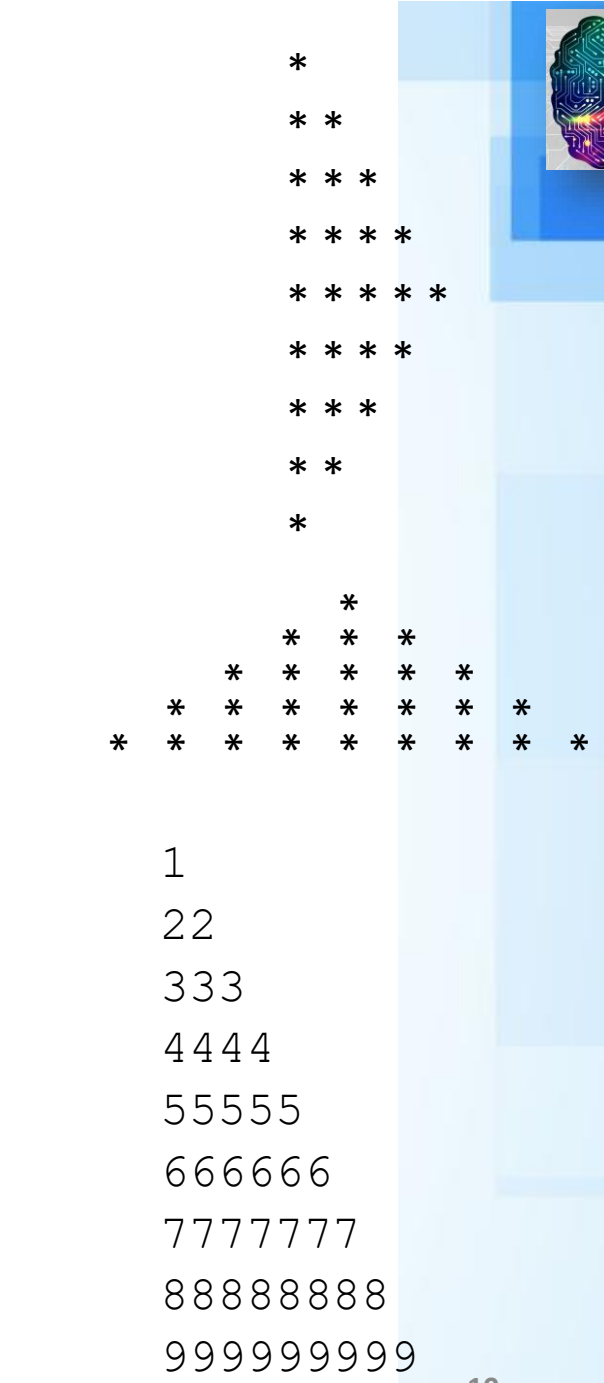
range(1, -1) → (empty)

range(1, -1, -1) → 1, 0

range(0) → (empty)

Exercise

1. Write program to check whether given number is prime or not
2. Write a program to find those numbers which are divisible by 7 and multiple of 5, between 1500 and 2700 (both included).
3. Write a Python program to get the Fibonacci series between 0 to 50.
4. Write a program to construct the pattern, using a nested for loop.



Exercise

1. Write a program to print the table of given number entered by the user
2. Write a program which can compute the factorial of a given numbers.

```
5 * 1 = 5
5 * 2 = 10
5 * 3 = 15
5 * 4 = 20
5 * 5 = 25
5 * 6 = 30
5 * 7 = 35
5 * 8 = 40
5 * 9 = 45
5 * 10 = 50
```

Loop Control Statements

Break : Terminates loop statement

```
for alpha in 'Greatness':
    if alpha == 'n':
        break
    print ('letter ', alpha)
```

```
letter  G
letter  r
letter  e
letter  a
letter  t
```

continue : returns the control to the beginning of the while/for loop

```
for alpha in 'Greatness':
    if alpha == 'n':
        continue
    print ('letter ', alpha)
```

```
letter  G
letter  r
letter  e
letter  a
letter  t
letter  e
letter  s
letter  s
```

pass : is used when a statement is required syntactically but you do not want any command or code to execute

```
for alpha in 'Greatness':
    if alpha == 'n':
        pass
        print ('Pass block')
    print ('letter ', alpha)
```

```
letter  G
letter  r
letter  e
letter  a
letter  t
Pass block
letter  n
letter  e
letter  s
letter  s
```

String

- Strings Are Immutable : once created cannot be changed.

```
#string concatenation
print (str + ' ' + str1)
#string slicing
print('str ',str)
print('str[1:3]',str[2:8] )
print('str[11:]',str[11:] )
print('str[:11]',str[:11] )
print('str[:-2]',str[:-2] )
print('str[-2]',str[-2] ) #second last str[len(str) -2]
```

```
Incredible India Great
str  Incredible India
str[1:3] credib
str[11:] India
str[:11] Incredible
str[:-2] Incredible Ind
str[-2] i
```

```
print('str1 * 3    ',str1 * 3)
print('str1 * 3    ',str1 * 3)
print('str1 * 3    ',str1 * 3)
```

```
str1 * 3    GreatGreatGreat
```

```
#string length and index
for s in range(len(str1)):
    print(str1[s])
```

```
G
r
e
a
t
```

```
'e' in str1
```

```
True
```

```
for x in str1:
    print (x)
```

```
G
r
e
a
t
```

String methods

```
str.upper()
```

```
'INCREDIBLE INDIA'
```

```
str.capitalize()
```

```
'Incredible india'
```

```
#string.center(width[, fillchar])
print(str.center(40))
print(str.center(40,'-'))
```

```
            Incredible India
------------Incredible India------------
```

```
#str.count(sub, start= 0,end=len(string))
print(str.count('In'))
```

```
2
```

```
#str.find(str, beg=0, end=len(string))
print(str.find('nd'))
```

```
12
```

```
str.join('-*-*')
```

```
'-Incredible India*Incredible India-Incredible India*'
```

```
str.swapcase()
```

```
'iNCREDIBLE iNDIA'
```

```
str.title()
```

```
'Incredible India'
```

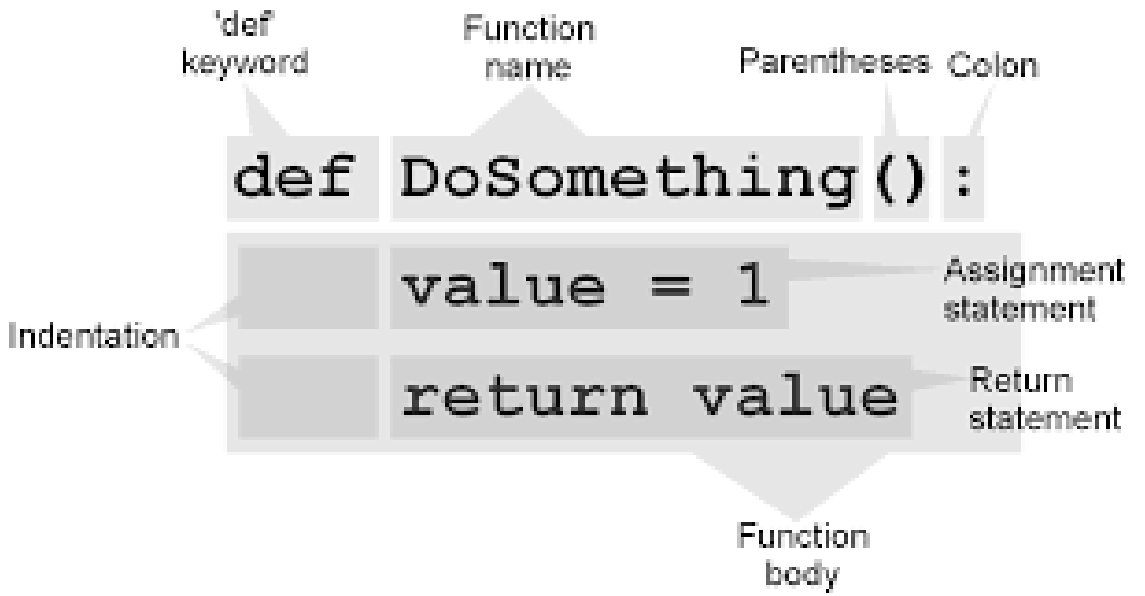
```
str.lower()
```

```
'incredible india'
```

```
about=''' This is multiline
string and it can span across
multiple lines'''
```

```
about
```

```
' This is multiline\nstring and it can span across\nmultiple lines'
```



Functions

* Organises related code in blocks, so that it can be efficiently reused
* Better modularity.

```
def  functionname( arg1 , arg2, arg3,
        arg4=default_Value ) :
    '''function_docstring'''
    statements.....
    return [expression]
```

- Function can be system defined (e.g. print) or user defined
- Function can have variable number of arguments (e.g. print)
- All parameters (arguments) in the Python language are passed by reference.

```
def onePlus(a):
    '''function increments the passed argument by one'''
    return a+1
```

```
onePlus.__doc__
```

```
'function increments the passed argument by one'
```

```
onePlus(10)
```

```
11
```

```
print (onePlus(21))
```

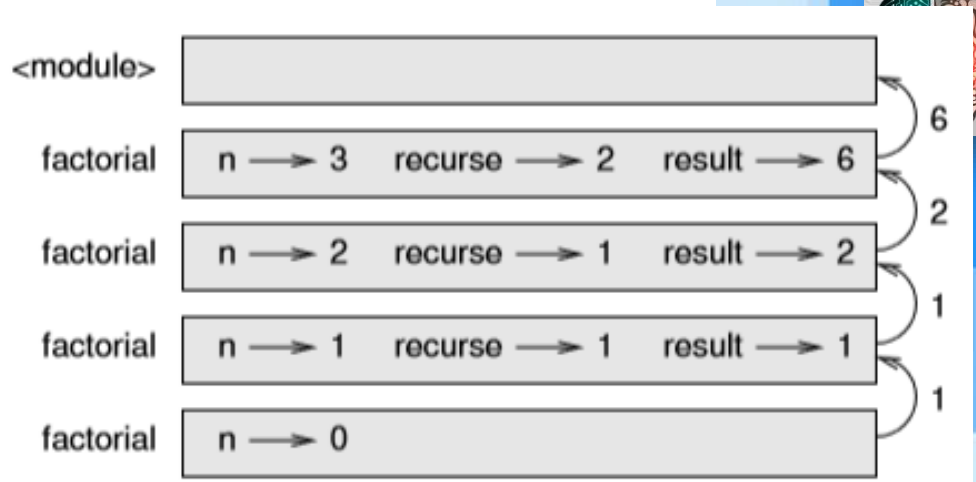
```
22
```

Best practices

- Function should be written keeping in mind process of incremental development.
- Scaffolding : code like print statements used for building the program but is not part of the final product
- Initially write individual statements , later consolidate multiple statements in compound statement
- Composition is ability of to call function from another function

Recursion

```
def factorial(n):
        if n == 0:
                return 1
        else:
                recurse = factorial(n-1)
                result = n * recurse
        return result
```



Ex: write recursive function to generate/print Fibonacci series

Source : *thinkpython*

Call by value / Reference

```
def changeList(x):
    print ('Value received    : ',x, '  id(x)=',id(x))
    x+=[5,6]
    print ('Value changed     : ',x, '  id(x)=',id(x))
    return
```

```
arr=[1,2,3,4]
print ('List before calling :',arr , '  id(a)=',id(arr))
changeList(arr)
print ('List after calling  :',arr , '  id(a)=',id(arr))
```

```
List before calling : [1, 2, 3, 4]   id(a)= 2214105128328
Value received    :  [1, 2, 3, 4]   id(x)= 2214105128328
Value changed     :  [1, 2, 3, 4, 5, 6]   id(x)= 2214105128328
List after calling  : [1, 2, 3, 4, 5, 6]   id(a)= 2214105128328
```

```
def changeMe(x):
    print ('Value received    : ',x, '  id(x)=',id(x))
    x=x+20
    print ('Value changed     : ',x, '  id(x)=',id(x))
    return
```

```
a=20
print ('Value before calling :',a , '  id(a)=',id(a))
changeMe(a)
print ('Value after calling  :',a , '  id(a)=',id(a))
```

```
Value before calling : 20   id(a)= 1629250304
Value received    :  20   id(x)= 1629250304
Value changed     :  40   id(x)= 1629250944
Value after calling  : 20   id(a)= 1629250304
```

```
arr=[1,2,3,4]
print ('List before calling :',arr , '  id(a)=',id(arr))
changeList(arr[:]) #passing a copy ( shallow copy )
print ('List after calling  :',arr , '  id(a)=',id(arr))
```

```
List before calling : [1, 2, 3, 4]   id(a)= 2214105040584
Value received    :  [1, 2, 3, 4]   id(x)= 2214105177096
Value changed     :  [1, 2, 3, 4, 5, 6]   id(x)= 2214105177096
List after calling  : [1, 2, 3, 4]   id(a)= 2214105040584
```

Function arguments

- Keyword argument
- Default argument
- Variable length arguments

```
def functionname([formal_args,] *var_args_tuple ):
        for var in vartuple:
                print var
```

```
def fibSeries(n):
    a, b = 0, 1
    while b < n:
        print (b,)
        a, b = b, a+b
```

```
fibSeries(50)
```

```
1
1
2
3
5
8
13
21
34
```

Variable argument passing

```
def printVariables( arg1, *vararg ):
        print (“Arguments Received: “)
        print (arg1 )
        for v in vararg:
                print v
        return;
```

Function calling

```
printVariables( 10 )
printVariables( 70, 60, 50 )
```

Default arguments

```
def studentInfo( name, fee = 3500 ):
        print ("Name: ", name)
        print ("Fee :  ", fee )
```

Function calling

```
studentInfo(‘Amrit’ )
studentInfo(‘Amrit’ ,2000)
studentInfo( fee=5000, name=“Amrit" )
studentInfo( name=“Amrit" )
```

Anonymous Functions

- anonymous functions are not declared using the *def* keyword
- uses *lambda* keyword
- Syntax : lambda [arg1 [,arg2,.....argn]]:expression
- Example: sum = lambda arg1, arg2 : arg1 + arg2;
- Calling: print "Value of total : ", sum(10, 20)

```
1  def add(a,b):
2      return a+b
3
4  print(add(10,20))
5
6  l=lambda a,b:a+b
7  print(l(10,20))
```

lambda keyword

```
1. lst =  [10,2,3,21,99,4]
2. Result = list ( filter ( lambda x:x%2==0, lst))
3. print(Result)
4. for i in Result : print(i)
```

output

```
[10,2,4]
10
2
4
```

- Lst = [2,3,4,5]
- Result = list (map (lambda n:n*2, Lst))
- print(Result)

[4,6,8,10]

- from functools import reduce
- Lst = [2,3,4,5]
- Result = reduce (lambda x,y : x+y, Lst))
- print(Result)

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- The functools module provides tools for working with functions and other callable objects, to adapt or extend them for new purposes without completely rewriting them.

Callable

- Callable in simple words – *somethings that can be called*
- Returns true if the passed object appears to be callable else false

```
# callable() example
def testCallable():
    return 127

# an object is created of method
tst = testCallable
print(callable(tst)) # returns true

# a test variable
num = 4*4
print(callable(num)) # returns false
```

```
tst = testCallable
if (tst)) : tst ()
```

Exercise

1. Write a function to check the argument passed is part of Fibonacci series or not . isInFibo(x) returns true/false
2. Write a function to check the argument passed is prime number. isPrime(x) returns true/false
3. Write a program to calculate the arithmetic mean of a variable number of values.
4. Write a function to find letter in a word def find(word, letter)
5. Modify above function with third parameter specifying where to start the search def find (word, letter, start)

Exercise

1. *ROT13 is a weak form of encryption that involves "rotating" each letter in a word by 13 places.* Write a function to encrypt-decrypt passed text according to ROT13.

   rotCipher(string, 'e') / rotCipher(string, 'd')

1. Write a function to check whether passed string is palindrome or not *: isPalindrome(word)*

Jupyter Notebook Link

- https://colab.research.google.com/drive/1jUAhD0VvIz23RA8Hr25pDzK__srpTcsm?usp=sharing

Github Repository Link

- https://github.com/sarwansingh/Python/tree/master/ORD