Topics

- Functions
- Positional argument
- Name space
- Advanced functions
- Error handling

Functions

- Functions are an extremely important programming concept for structuring your code and avoiding repetitions

1. Keyword **def** marks the start of function header.
2. A function name to **uniquely identify** it. Function naming follows the same rule s of writing identifiers in Python.
3. Arguments through which we pass values to a function. They are optional.
4. A colon (:) to mark the end of function header.
5. Optional documentation string (docstring) to describe what the function does.
6. One or more valid python statements that make up the function body. Statements must have same indentation level (**usually 4 spaces**).
7. An optional **return statement** to return a value from the function.

```
def Hello():
    print('hello')
```

Functions

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7. An optional **return statement** to return a value from the function.

```
def my_add(arg1, arg2):
    print(arg1+arg2)
    return arg1+arg2
```

Return values

- return the summation of arg1 and arg2
- return ‘True’ if the two arguments are equal

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
def my_add(arg1, arg2):
```

```
>>> my_add(3, 4)
>>>
```

Return values

- return the summation of arg1 and arg2
- return ‘True’ if the two arguments are equal

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
def my_add(arg1, arg2):
    if arg1 == arg2:
        return arg1+arg2, True
    else:
        return arg1+arg2, False
```

```
>>> my_add(3, 4)
>>> a, b = my_add(3, 4)
```

Positional Arguments

- The most familiar types of arguments are *positional arguments*, whose values are copied to their corresponding parameters in order.

```
def my_print(str1, str2):
    print(str2, str1)
```

```
>>> my_print('hello', 'student')
…
>>> my_print('hello', 'student', 'welcome')
…
```

```
def my_print(str1, str2, str3 = ''):
    print(str2, str1, str3)
```

Specify Default Parameter Values

The default is used if the caller does not provide a corresponding argument.

Positional Arguments

- The most familiar types of arguments are *positional argum ents*, whose values are copied to their corresponding para meters in order.

```
def menu(arg1, arg2, arg3):
    return {'wine': arg1, 'entree': arg2, 'dessert': arg3}
```

```
>>> menu('chardonnay', 'chicken', 'cake')
{'wine': 'chardonnay', 'entree': 'chicken', 'dessert': 'cake'}
>>> menu('beef', 'bagel', 'bordeaux')
{'wine': 'beef', 'entree': 'bagel', 'dessert': 'bordeaux'}

>>> menu(entree='beef', dessert='bagel', wine='bordeaux')
{'wine': 'bordeaux', 'dessert': 'bagel', 'entree': 'beef'}
>>> menu('frontenac', dessert='flan', entree='fish')
{'entree': 'fish', 'dessert': 'flan', 'wine': 'frontenac'}
```

Gather Positional Arguments with *

- An asterisk * groups variables into a tuple of parameter values

```
def print_args(*argments):
    print('Positional argument tuple:', argments)
```

```
>>> print_args()
Positional argument tuple: ()
```

```
def print_more(required1, required2, * argments):
    print(required1, required2, argments)
```

```
>>> print_more('cap', 'gloves', 'scarf', 'monocle','mustache wax')
cap gloves ('scarf', 'monocle', 'mustache wax')
```

Gather Positional Arguments with *

- An asterisk * is useful.

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
>>> my_add(3, 4)
7
```

```
>>> my_add(3, 4, 2, 4, 5, 6, 7, 8, 8, …)
…
```

```
def my_add(arg1, arg2, *arg3):
    return …
```

Docstrings

- You can attach documentation to a function definition by including a string at the beginning of the function body

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
def my_add(arg1, arg2):
    '''
    Adding two numbers
    >>> my_add(4, 5)
    '''
    return arg1+arg2
```

```
>>> help(my_add)
```

False, True, and None

- None is a special Python value that holds a place when there is nothing to say
- zero-valued integers or floats, empty strings (''), lists ([]), t uples **((,)),** dictionaries ({}), and sets(set()) are all false

```
>>> def do_nothing():
        pass

>>> a = do_nothing()
>>> type(a)
```

```
>>> def aa(arg1):
        if arg1 == True:
            print('True')
        elif arg1 == False:
            print('False')
        elif arg1 == None:
            print('None')
```

Exercise

- write a code to merge four mathematic functions into one function by using third argument

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
def my_mul(arg1, arg2):
    return arg1*arg2
```

```
def my_pow(arg1, arg2):
    return arg1**arg2
```

```
def my_div(arg1, arg2):
    return arg1/arg2
```

```
def my_cal(arg1, arg2, arg3):
    if arg3 == '+':
```

Exercise

- takes a variable (string, list, or tuple) and eliminate duplicated elements in the variable
- returns the variable as the same type of input variable

```
def mydup(c):
    tm = []
    for num in c:
        if num not in tm:
            tm.append(num)
    return tm
```

```
>>> mydup('ekeieislslkejjeite222')
ekislkjt2
>>> mydup(['a', 'a', 'b', '1', '1'])
['a', 'b', '1']
>>> mydup({'a', 'a', 'b', '1', '1‘})
{'a', 'b', '1‘}
```

Functions can be argument

- In Python, parentheses () mean *call this function*
- With no parentheses, Python just treats the function like any other object.

```
def my_add(arg1, arg2):
    return arg1+arg2
```

```
def my_mul(arg1, arg2):
    return arg1*arg2
```

```
def run_this_functions(some_fun, arg1, arg2):
    some_fun(arg1, arg2)
```

```
>>> type(my_add)
>>> run_this_functions(my_add, 5, 6)
>>> run_this_functions(my_mul, 5, 6)
```

Inner functions

- You can define a function within another function
- An inner function can be useful when performing some complex task more than once within another function

```
def outer(a, b):
    def inner(c, d):
        return c + d
    return inner(a, b)
```

```
>>> outer(4, 7)
11
>>> inner(4,5)  # ??
```

```
def knights(saying):
    def inner(quote):
        return "We are the knights who say: '%s'" % quote
    return inner(saying)
```

```
>>> knights('Ni!')
"We are the knights who say: 'Ni!'"
```

Closure

- This is a function that is dynamically generated by another function
- Remember the values of variables that were created outsid e the function

```
def knights2(saying):
    def inner2():
        return "My country is: '%s'" % saying
    return inner2
```

```
>>> a = knights2('Kazakhstan')
>>> type(a)
<function __main__.knights2.<locals>.inner2>
>>> b = knights2('Korea')
>>> a()
"My country: 'Kazakhstan'"
>>> b()
"My country: 'Korea'"
```

Global variable : 'global' keyword

- Share a global variable across all Python Modules

```
c = 1 # global variable
def add():
    print(c)
```

```
c = 1 # global variable
def add():
    c = c + 2 # or c = 4
    print(c)
```

```
c = 0 # global variable
def add():
    global c
    c = c + 2
    print("Inside add():", c)

add()
print("In main:", c)
```

```
c = 1 # global variable
def add():
    c = 4
print(c)
```

Anonymous Functions: lambda() Function

- An anonymous function expressed as a single statement. You can use it instead of a normal tiny function.
- The lambda takes one argument. Everything between the colon and t he terminating parenthesis is the definition of the function.
- Temporal function/remove, no **return** keyword

```
stairs = ['thud', 'meow', 'thud', 'hiss']

def edit_story(words, func):
    for word in words:
        print(func(word))

def enliven(word): # give that prose more punch
    return word.capitalize() + '!'
```

```
>>> edit_story(stairs, enliven)

>>> edit_story(stairs, lambda word: word.capitalize() + '!')
```

Anonymous Functions: lambda() Function

- Often, using real functions such as enliven() is much clearer than usin g lambdas
- Lambdas are useful for cases in which you would otherwise need to define many tiny functions and remember what you called them all

```
g = lambda x: x**2
f = lambda x, y: x + y

def inc(n):
    return lambda x: x + n
```

```
>>> g(8)
>>> f(4, 4)
>>> f = inc(2)
>>> g = inc(4)
>>> f(12)
>>> g(12)
>>> inc(2)((12))
```

```
n = 10
def inc2(x, *arg):
    print(len(arg))
    if not arg:
        global n
        return x + n
    else:
        n = arg[0]
        print(n)
        return x + n
```

```
>>> inc2(3)
>>> inc2(3, 5)
```

Decorator

- Sometimes, you want to modify an existing function without changing its source code
- Example is adding a debugging statement to see what arguments were passed in.

```
def add_ints(a, b):
    return a + b
```

```
>>> add_ints(4,5)
9
```

```
def add_ints(a, b):
    print('Running....')
    print('Positional....')
    print('Positional....')
    print('Positional....')
    return a + b
```

```
>>> add_ints(4,5)
Running function: add_ints
Positional arguments: (4, 5)
Keyword arguments: {}
Result: 9
```

Decorator

- A *decorator* is a function that takes one function as input and returns another function
  - *args and **kwargs
  - Inner functions
  - Functions as arguments

```
def document_it(func):
    def new_function(*args, **kwargs):
        print('Running function:', func.__name__)
        print('Positional arguments:', args)
        print('Keyword arguments:', kwargs)
        result = func(*args, **kwargs)
        print('Result:', result)
        return result
    return new_function
```

```
>>> better_add_ints = document_it(add_ints)
>>> better_add_ints(4, 5)
```

Decorator

```
def document_it(func):
    def new_function(*args, **kwargs):
        print('Running function:', func.__name__)
        print('Positional arguments:', args)
        print('Keyword arguments:', kwargs)
        result = func(*args, **kwargs)
        print('Result:', result)
        return result
    return new_function

## decorator
def add_ints(a, b):
    return a + b

def mul_ints(a, b):
    return a * b
```

```
@document_it
def add_ints(a, b):
    return a + b

@document_it
def mul_ints(a, b):
    return a + b
```

```
>>> add_ints(4, 5)

>>> mul_ints(4, 5)
```

Decorator

- **Tracking the changes of arguments**

```
def print_it(func):
    def new_function(*args, **kwargs):
        result = func(*args, **kwargs)
        print('Result:', args)
        return result
    return new_function

@print_it
def add_ints(a, b):
    return a + b

a = 3; b = 6
for i in range(1, 10):
    a, b = add_ints(a, b), add_ints(b, a)/2
```

Global variable : 'global' keyword

- Each function defines its own namespace
- If you define a variable called x in a main program and another variable called x in a function, they refer to different things
- The main part of a program defines the *global* namespace

```
x = 4
y = 6
def adding():
    return x+y
>>> adding()

def adding():
    x = 10; y = 15
    return x+y
>>> adding()
>>> print(x, y)
```

Name space

- The main part of a program defines the *global* namespace; thus, the v ariables in that namespace are *global variables*
- You can get the value of a global variable from within a function:

```
animal = 'fruitbat'

def print_global():
    print('inside print_global:', animal)
```

```
def change_and_print_global():
    print('inside change_and_print_global:', animal)
    animal = 'wombat'
    print('after the change:', animal)
```

If you try to get the value of the global variable and change it within the function, you get an error:

Name space

- The change_local() function also has a variable named animal, but th at's in its local namespace
- To access the global variable rather than the local one within a functio n, you need to be explicit and use the global keyword
- Local variable goes away (removed from the memory) after the function completes (no return value)

```
animal = 'fruitbat'

def change_local():
    animal = 'wombat'
    print('inside change_local:', animal, id(animal))
```

```
>>> change_local()
1651386275800
>>> id(animal))
1651386174128
```

Name space

- Python provides two functions to access the contents of your namespaces:

✓ locals() returns a dictionary of the contents of the local namespace.

✓ globals() returns a dictionary of the contents of the global namespace.

```
animal = 'fruitbat'
def change_local():
    a = 4; b = 6; c = 'hello'
    animal = 'wombat' # local variable
    print('locals:', locals())
    tm = locals()
    return tm
```

```
>>> l_var = change_local()
>>> g_var = globals()
```

Use of ‘_’ and ‘__’

- Names that begin and end with two underscores (__) are reserved
- It seemed unlikely to be selected by application developers

```
def amazing():
    '''This is the amazing function.
    Want to see it again?'''
    print('This function is named:', amazing.__name__)
    print('And its docstring is:', amazing.__doc__)
```

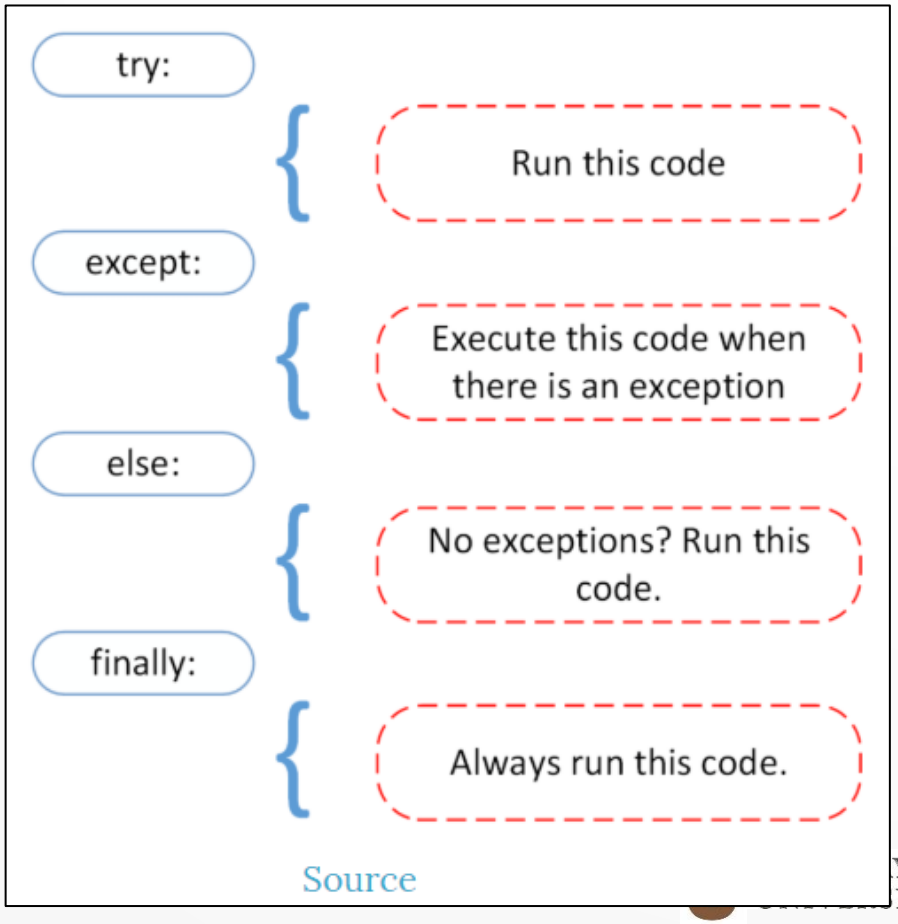
```
>>> amazing()
This function is named: amazing
And its docstring is: This is the amazing function.
    Want to see it again?
```

Error handling : try, except

- Python uses *exceptions*: code that is executed when an associated error occurs.
- The finally block consists of statements which should be processed reg ardless of an exception occurring in the try block or not.

```
try :
    #statements in try block
except :
    #executed when error in try block
```

```
Try :
    #statements in try block
except :
    #executed when error in try block
else :
    #executed if try block is error-free
finally :
    #executed irrespective of exception
     occurred or not
```



Error handling : try, except

```
try:
    print("try block")
    x=int(input('Enter a number: '))
    y=int(input('Enter another number: '))
    z=x/y
except ZeroDivisionError:
    print("except ZeroDivisionError block")
    print("Division by 0 not accepted")
else:
    print("else block")
    print("Division = ", z)
finally:
    print("finally block")
    x=0
    y=0
print ("Out of try, except, else and finally blocks." )
```

Type of errors

- **IndexError** is thrown when trying to access an item at an invalid index.
- **ModuleNotFoundError** is thrown when a module could not be found.
- **KeyError** is thrown when a key is not found.
- **ImportError** is thrown when a specified function can not be found.
- **TypeError** is thrown when an operation or function is applied to an obje ct of an inappropriate type.
- **ValueError** is thrown when a function's argument is of an inappropriate type.
- **NameError** is thrown when an object could not be found.
- **KeyboardInterrupt** is thrown when the user hits the interrupt key (norm ally Control-C) during the execution of the program.

https://www.tutorialsteacher.com/python/error-types-in-python