

Functions + Scope



- **What is a function in Python?**
- **Types of Functions**
- **Defining a Function:**
 - Defining a function without any parameters
 - Defining a function without parameters and return value
 - Defining a function with parameters
 - Defining a function with parameters and return value
- **Passing Arguments with Key and Value**
- **How to call a function in python?**
- **Docstrings**
- **Global, Local Variables**

Functions

Why functions?

- Maximize code reuse and minimize redundancy
- Procedural decomposition
 - Break big task into smaller tasks
 - Makes code less buggy – can test each function individually

Types of Functions

Python support two types of functions

1. **Built-in** function
2. **User-defined** function

1. Built-in function

The functions which are come along with Python itself are called a built-in function or predefined function. Some of them are: **range()**, **print()**, **input()**, **type()**, **id()**, **eval()** etc.

Example: Python **range()** function generates the immutable sequence of numbers starting from the given start integer to the stop integer.

```
>>> for i in range(1, 10):  
>>>     print(i, end=' ')
```

```
1 2 3 4 5 6 7 8 9
```

2. User-defined function

Functions which are created by programmer explicitly according to the requirement are called a user-defined function.

Syntax:

```
def function_name(parameter1, parameter2):  
    """docstring"""  
    # function body  
    # write some action  
  
    return value
```

Functions

Create function
(required)

Function inputs: here there are
two and order matters. (optional)

```
def times(x,y):  
    product = x*y  
    return product
```

Object that function gives back. (optional)

Functions

Create function
(required)

Function inputs: here there are
two and order matters. (optional)

```
def times(x,y):
```

```
    product = x*y
```

```
    return product
```


Inside the function
(local scope)

Object that function gives back. (optional)


The code inside the function is never executed unless you call the function!

Functions

```
def times(x,y):  
    product = x*y  
    return product  
  
times(5,6)
```



30

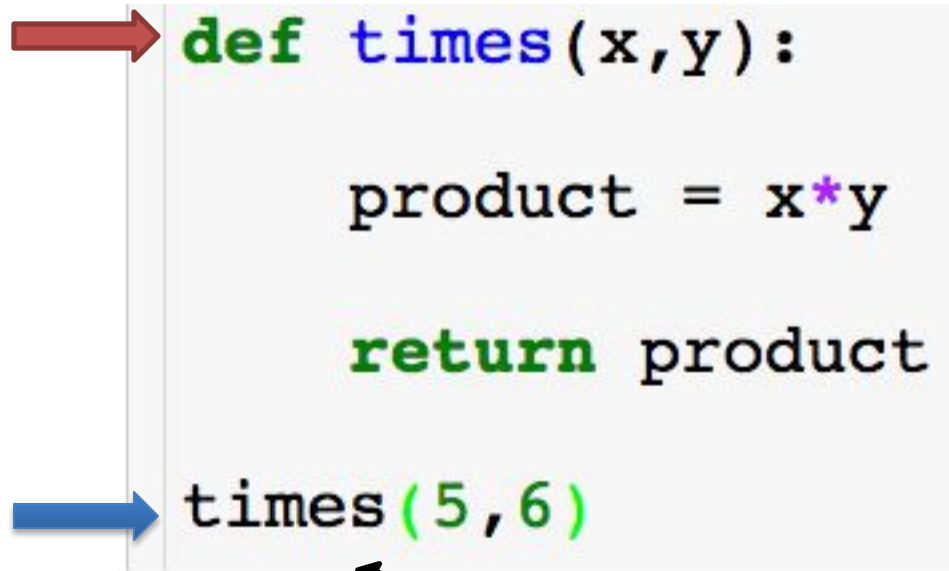


To call a function type the name and give the inputs required.

Functions

x = 5

y = 6



```
def times(x,y):  
    product = x*y  
    return product  
  
times(5,6)
```

The diagram shows a code editor with a light gray background. A red arrow points to the `def` keyword in the function definition. A blue arrow points to the `times` function call. A black arrow points to the opening parenthesis of the function call.

30

To call a function type the name and give the inputs required.

Functions

x = 5

y = 6

product = 30

```
def times(x,y):
```

```
    → product = x*y
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```
    return product
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→ times(5,6)
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↖

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Functions

```
def times(x,y):  
    product = x*y  
    return product  
  
times(5,6)  
print(product)
```

```
-----  
NameError                                Traceback (most recent call last)  
<ipython-input-1-aea8a152219b> in <module>()  
      6  
      7 times(5,6)  
----> 8 print(product)  
  
NameError: name 'product' is not defined
```

The variables product doesn't exist outside of the function...but we can store the object returned by the function!


Functions

We can store the result returned from the function in a variables

```
def times(x,y):
```

```
    product = x*y
```

```
    return product
```



```
product = times(5,6)  
"5 times 6 is %d" %product
```

```
'5 times 6 is 30'
```

Functions

We can store the result returned from the function in a variables

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→ def times(x,y):  
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```

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    → product = x*y
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    return product
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    product = x*y
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    → return product
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We can store the result returned from the function in a variables


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def times(x,y):  
    product = x*y  
    return product  
→ product = times(5,6)  
"5 times 6 is %d" %product  
  
'5 times 6 is 30'
```

We did not have to name this variable product, we could have names it anything.

Functions

We can store the result returned from the function in a variables

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def times(x,y):  
    product = x*y  
    return product  
  
product = times(5,6)  
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Functions

We can store the result returned from the function in a variables

```
def times(x,y):  
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print(result)
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- What will happen if I try to print product? Or x?

Functions

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print(result)
```

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- What will happen if I try to print product? Or x?
 - Where does each variables “live”?

Scope

- Python scopes are the places where variables are defined and looked up.
- Local Scope
 - Variables created with a function, i.e., inside of a def.
 - Variables inside of a def will not clash with variables outside even if they have the same name.
- Global Scope
 - Variable created outside of a function.

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When outside of a function, python **only sees variables in the global scope.**

Scope

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When inside of a function, python **first searches the local scope and then searches the global.**

Scope

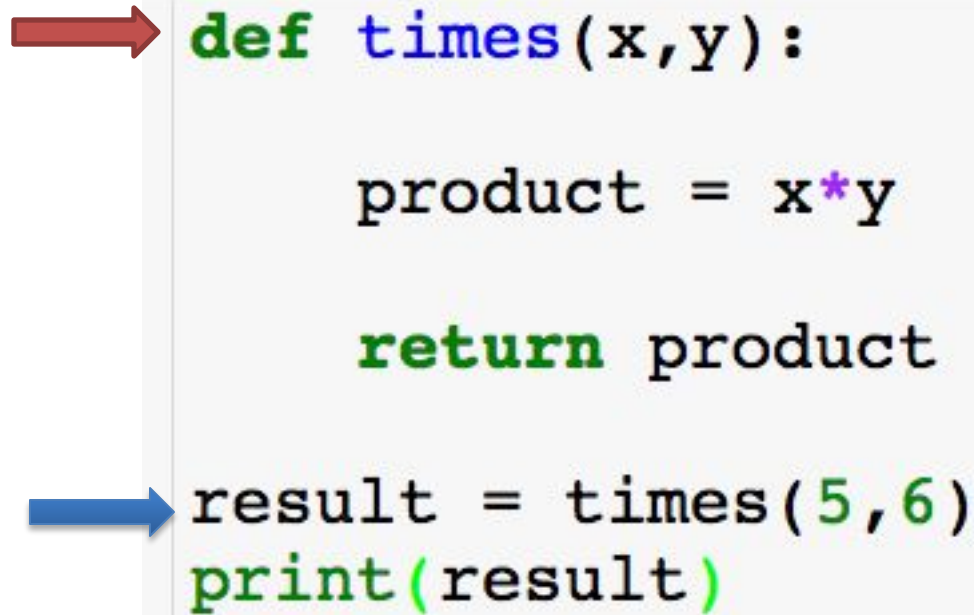
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def times(x,y):  
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→ result = times(5,6)  
print(result)
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Local scope:

Global scope:

Scope



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Local scope:

x = 5
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Global scope:

Scope

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Local scope:

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Global scope:

Scope

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```
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print(result)
```

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Local scope:


x = 5
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Global scope:

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Scope

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def times(x,y):  
    product = x*y  
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```



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Local scope:

x = 5
y = 6
product = 30

Global scope:

result = 30

Scope

```
def intersect(seq1, seq2):  
    res = []  
    for x in seq1:  
        if x in seq2:  
            res.append(x)  
    return res
```



```
S1="Spam"  
S2 = "Scan"  
intersect(S1,S2)
```

['S', 'a']

Local scope:

Global scope:

S1 = "Spam"

Scope

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def intersect(seq1, seq2):  
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Local scope:

Global scope:

S1 = "Spam"

S2 = "Scan"

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Global scope:


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Local scope:

seq1 = "Spam"
seq2 = "Scan"

Global scope:

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Local scope:

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x= "S"
```

Global scope:

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S1 = "Spam"  
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Local scope:

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Global scope:

```
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Local scope:

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seq1 = "Spam"  
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res = ["S"]  
x= "p"
```

Global scope:

```
S1 = "Spam"  
S2 = "Scan"
```

And so on ...

Stringing Functions Together


```
def Add(x,y):  
    return x+y
```

```
def Check_Mult_Two(x):  
    if x %2==0:  
        print("Yes, %d is a mulitple of 2" %x)  
    else:  
        print("No, %d is not mulitple of 2" %x)
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```
num_one = 10  
num_two = 15  
  
sum_one_two = Add(num_one,num_two)  
Check_Mult_Two(sum_one_two)
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No, 25 is not mulitple of 2

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Nested Functions

Functions can call other functions!

Nested Functions

```
def Count_Vowels(name):  
    total=0  
    vowels = ['a','e','i','o','u']  
    for i in name.lower():  
        if i in vowels:  
            total+=1  
    return total
```

Count number of
vowels in name

```
def Percent_Vowels(name):  
  
    num_vowels = Count_Vowels(name)  
    percent = num_vowels/len(name)  
    return percent
```

Computes percentage of
vowels in name

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```
Percent_Vowels("jake")
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Computes percentage of
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```
Percent_Vowels("jake")  
0.5
```

Nested Functions

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```

Computes percentage of
vowels in name

```
first_names = ["Jake", "Joe", "Tarik"]  
D = {}  
for name in first_names:  
    D[name] = Percent_Vowels(name)
```

D

```
{'Jake': 0.5, 'Joe': 0.6666666666666666, 'Tarik': 0.4}
```

Function Exercises

Function Exercises

1. Area of a circle is calculated as follows: **area** = $\pi \times r \times r$ and **perimeter** = $2 \times \pi \times r$. Write a function that calculates `area_of_circle` and `perimeter_of_circle`.

[]:

2. Declare a function named `sum_of_numbers`. It takes a number parameter and it adds all the numbers in that range.



```
print(sum_of_numbers(5)) # 15
print(sum_all_numbers(10)) # 55
print(sum_all_numbers(100)) # 5050
```

[]:

3. Declare a function named `evens_and_odds`. It takes a positive integer as parameter and it counts number of evens and odds in the number.

```
print(evens_and_odds(100))
#The number of odds are 50.
#The number of evens are 51.
```


Function Exercises

4. Write a function `calculate_mean()` that takes a list of numbers and returns the mean (average).

[]:

5. Write a function called `sum_all()` that accepts any number of arguments and returns their total.

[]:

6. Write a function called `get_sum_avg()` that returns both the sum and the average of any number of arguments passed.

[]:

7. Write a function `analyze_list(lst)` that returns below as a tuple:

- the average of the list
- the maximum number
- and the length of the list

[]:

Function Exercises

▼ 8: `calculate_median(list)`

Write a function called `calculate_median()` that takes a list of numbers and returns the **median** value.

The **median** is the middle number in a sorted list:

- If the list has **odd** length → return the middle number.
- If the list has **even** length → return the average of the two middle numbers.

💡 Hint:

- Use the `sorted()` function to sort the list.
- Use `len()` to get the list length.
- Use integer division (`//`) to find the middle index.

✅ Example Output:

```
calculate_median([4, 1, 9])           # Output: 4
calculate_median([1, 2, 3, 4])        # Output: 2.5
```