Python: Functions

Functions

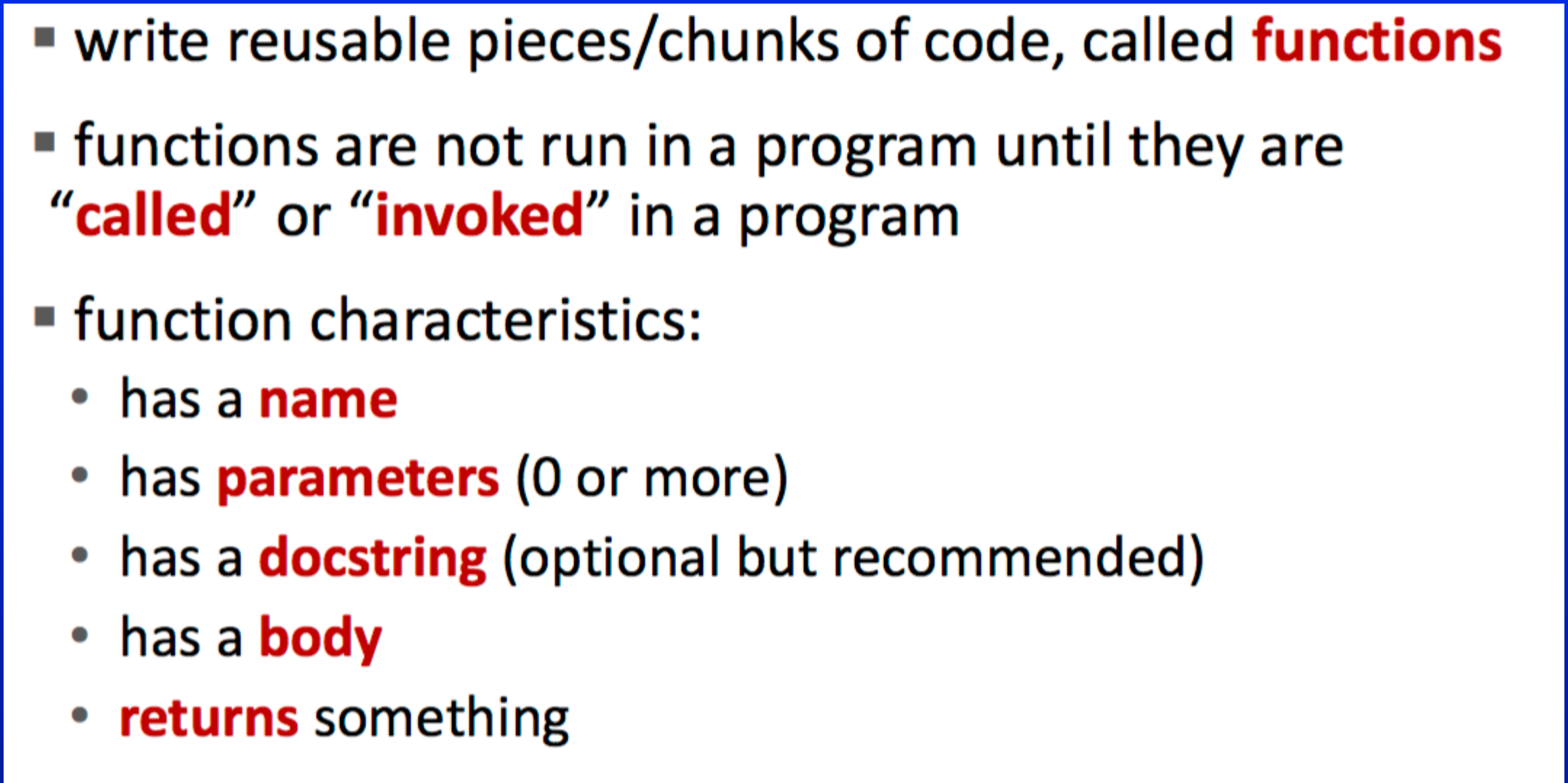
Mathematical functions

$f(x) = x^2$

$f(x,y) = x^2 + y^2$

In programming functions also help creating better structure with decomposition

Functions



- write reusable pieces/chunks of code, called **functions**
- functions are not run in a program until they are "**called**" or "**invoked**" in a program
- function characteristics:
  - has a **name**
  - has **parameters** (0 or more)
  - has a **docstring** (optional but recommended)
  - has a **body**
  - **returns** something

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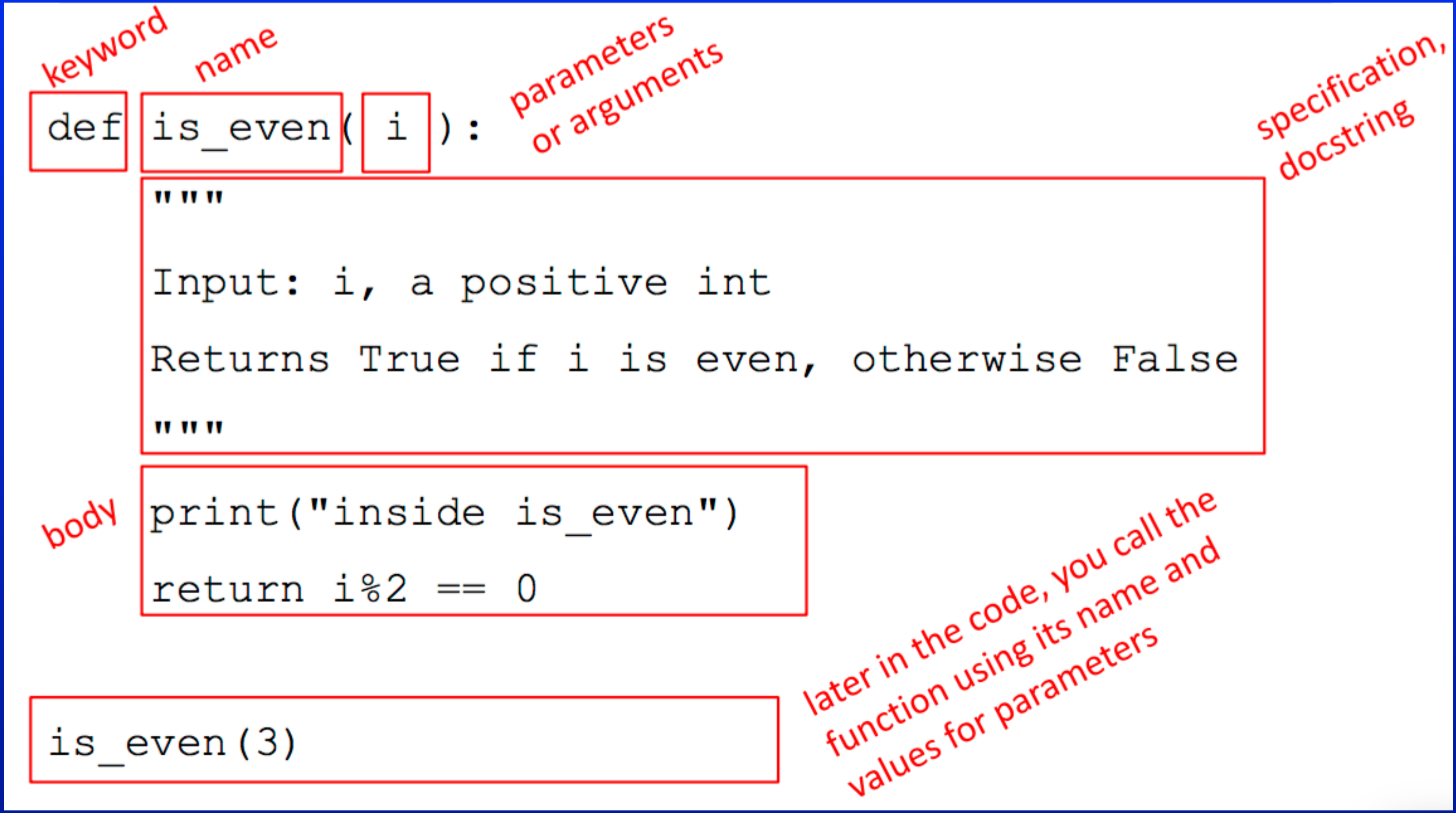
Defining and invoking a function



```
def is_even( i ):
    """
    Input: i, a positive int
    Returns True if i is even, otherwise False
    """
    print("inside is_even")
    return i%2 == 0

is_even(3)
```

later in the code, you call the function using its name and values for parameters

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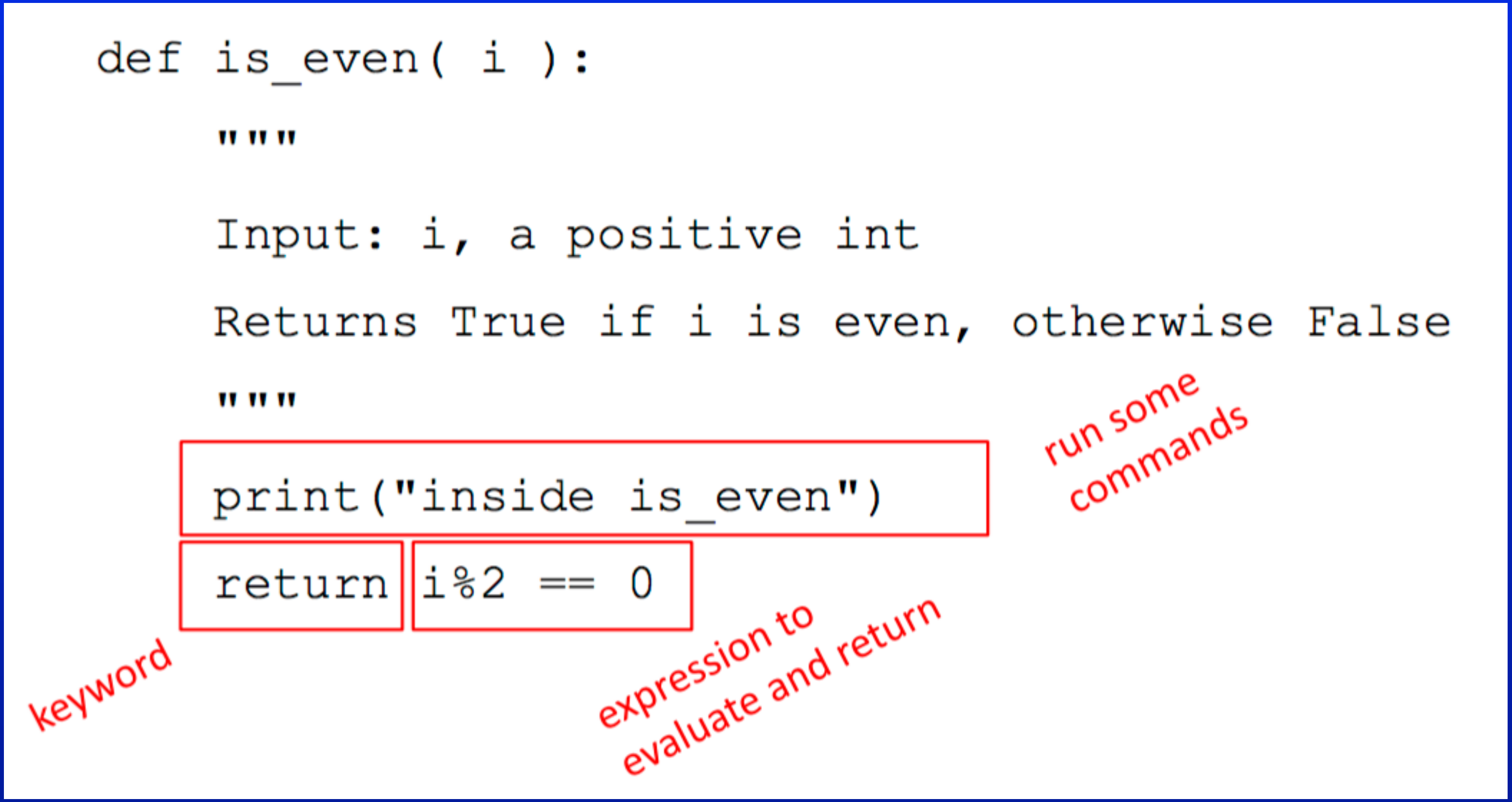
Defining and invoking a function



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Defining and invoking a function

Consider $f(x) = x^2$

```
def square(x):      #defining function
  return   x*x


square(4)      #invoking function

16             # output
```

Defining and invoking a function

Example: Functions may not have arguments, and return statement

```
def myprint():      #defining function
  print (“Hello world”)


myprint()      #invoking function

Hello world    # output
```

Defining and invoking a function

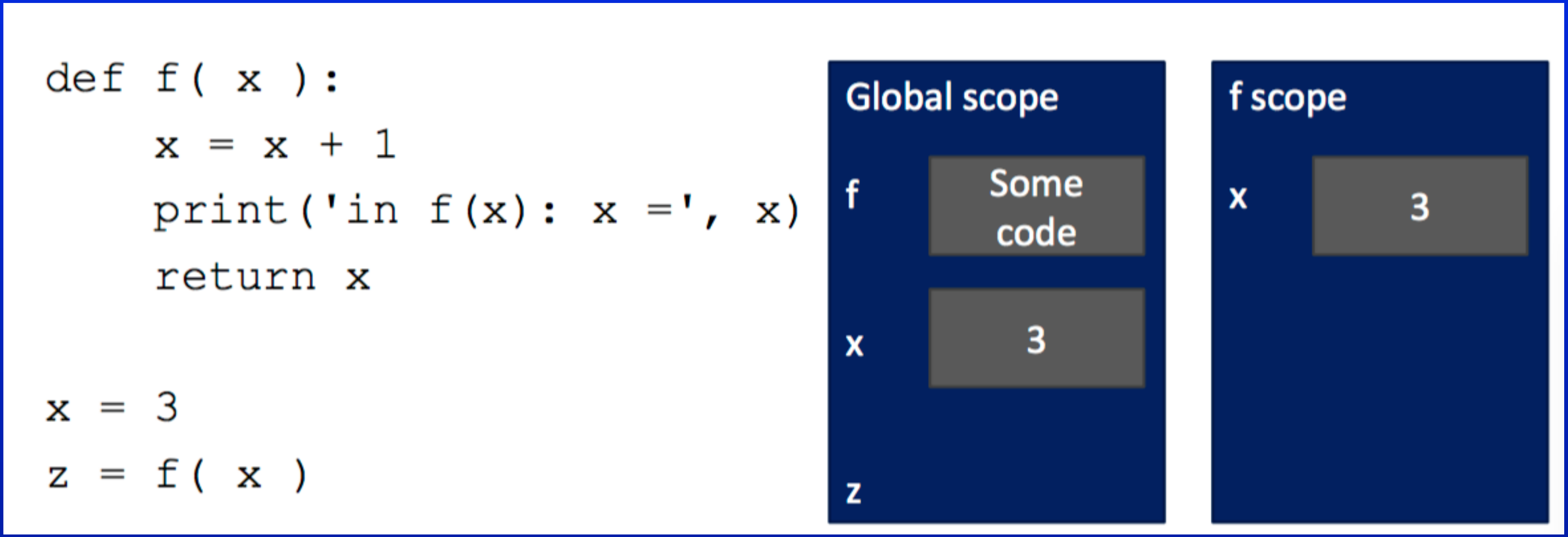
Example: Function calling another function

```
def repeatmyprint():
     myprint()
     myprint()

repeatmyprint()     #invoking function

Hello world    # output
Hello world
```

Scope of a Variable



```
def f( x ):
    x = x + 1
    print('in f(x): x =', x)
    return x

x = 3
z = f( x )
```

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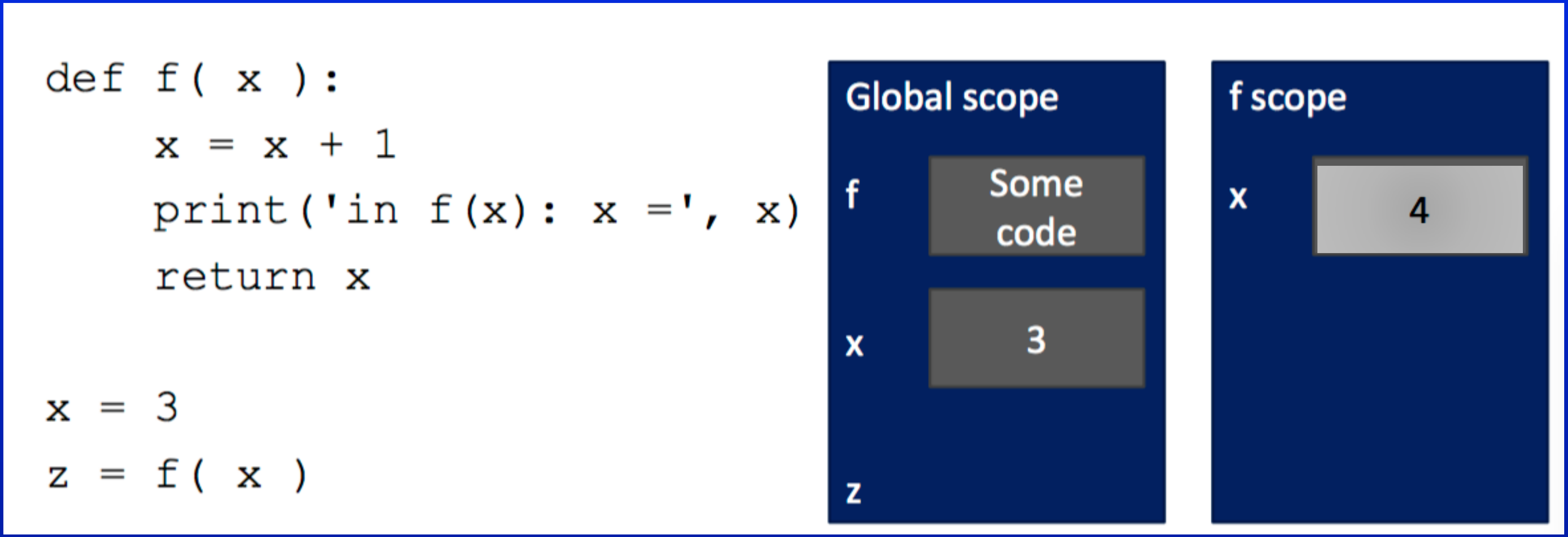
Scope of a Variable



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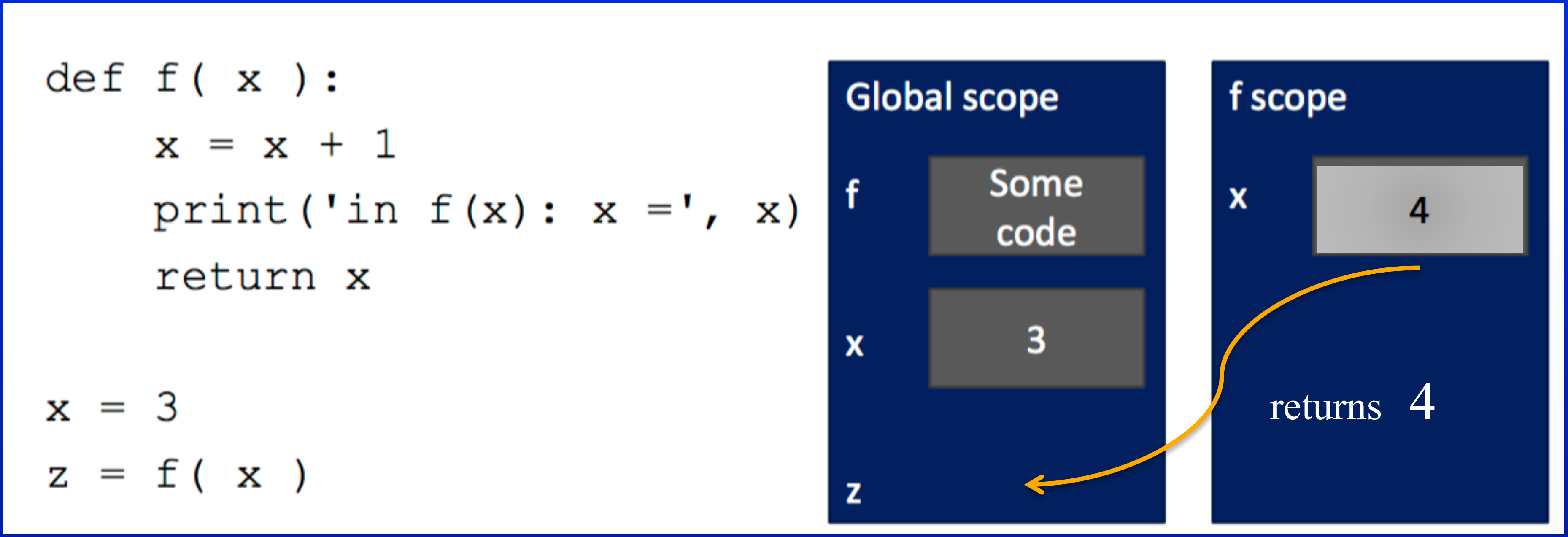

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    print('in f(x): x =', x)
    return x

x = 3
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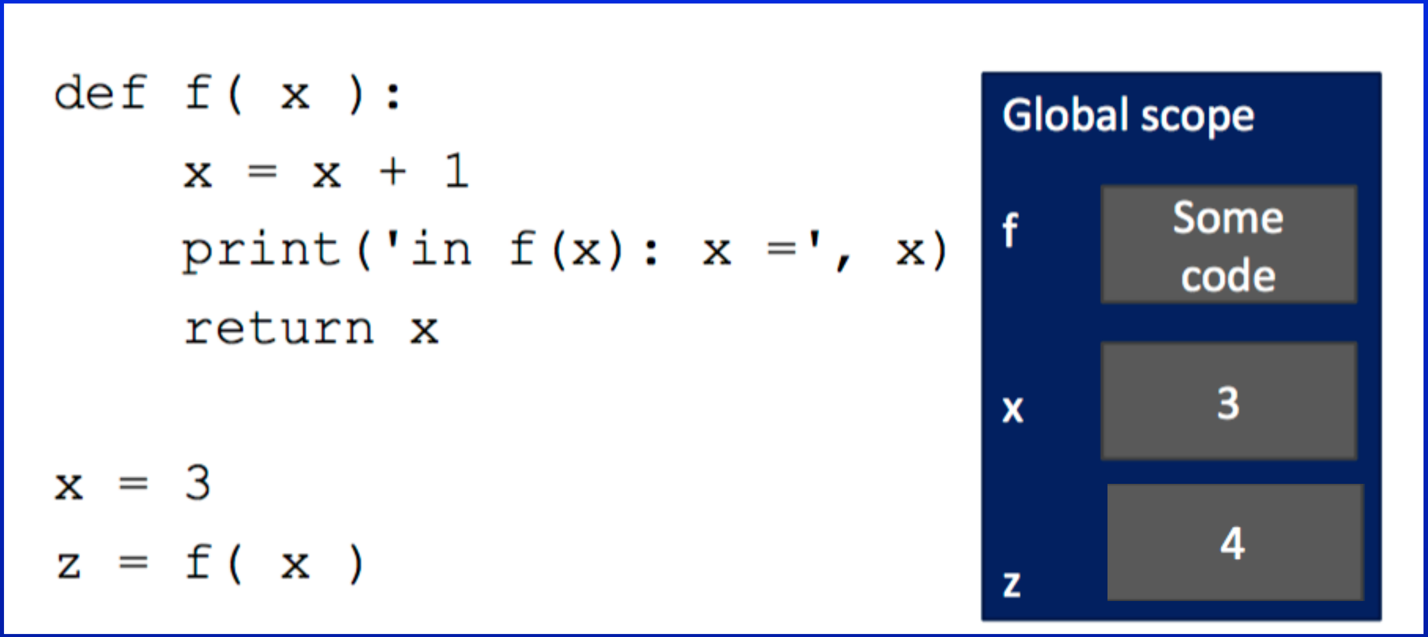
Scope of a Variable



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def f( x ):
    x = x + 1
    print('in f(x): x =', x)
    return x

x = 3
z = f( x )
```

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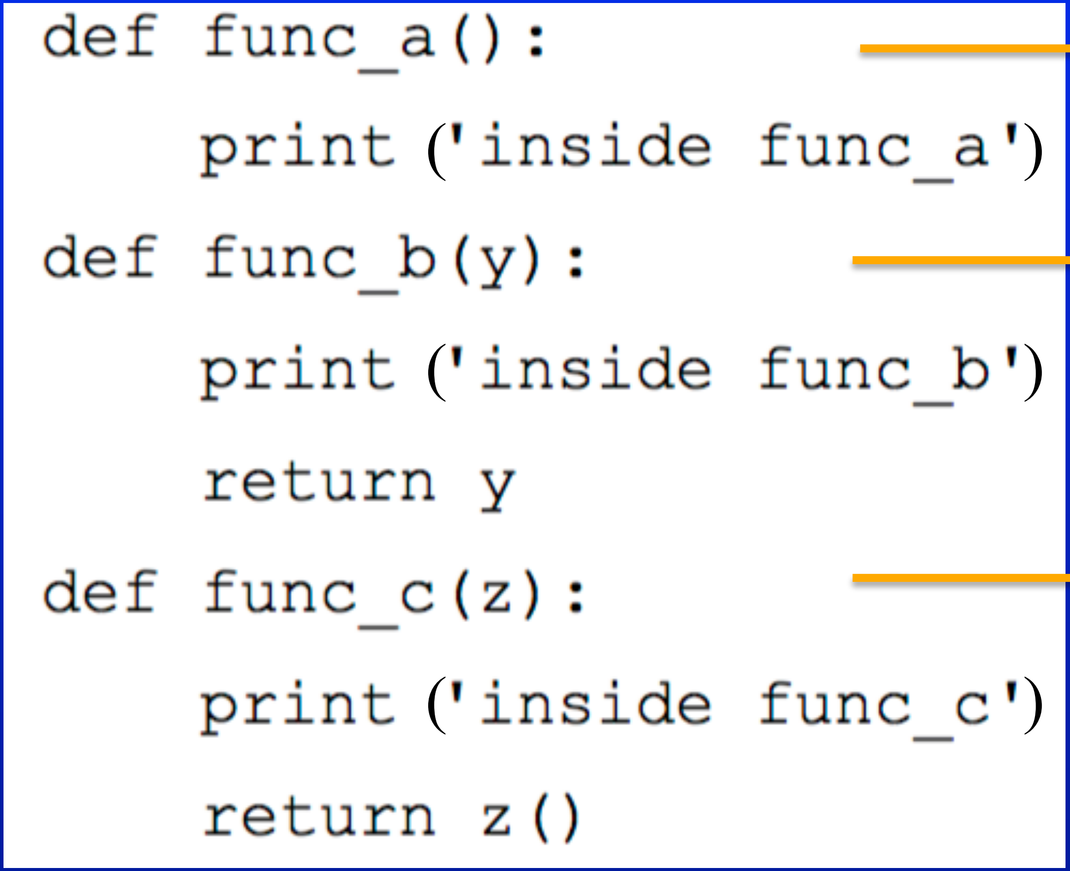
Function: Arguments



```
def func_a():
    print ('inside func_a')
def func_b(y):
    print ('inside func_b')
    return y
def func_c(z):
    print ('inside func_c')
    return z()
```

No argument

One argument

One argument (function)

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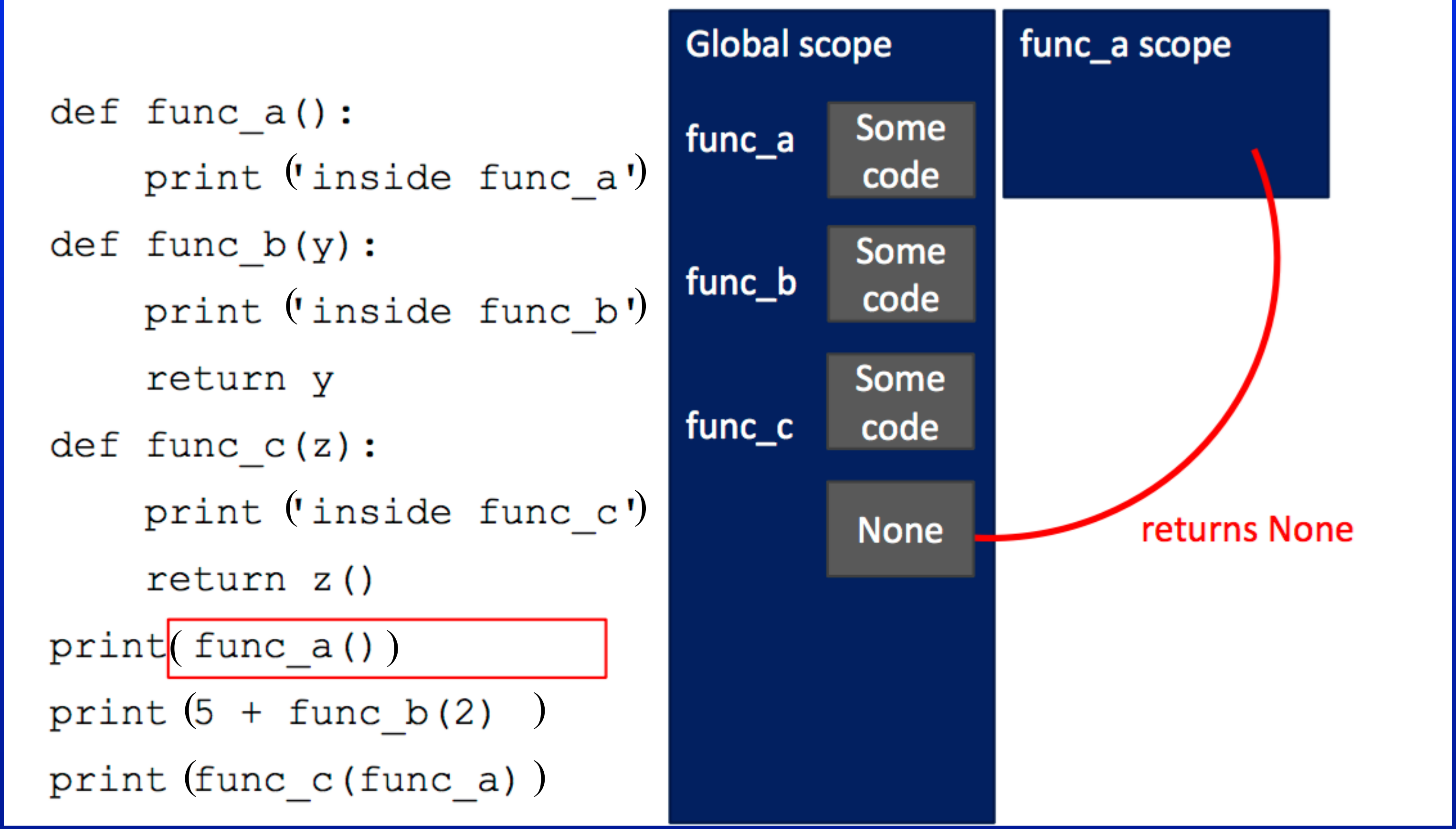
Function: Arguments



```
def func_a():
    print ('inside func_a')
def func_b(y):
    print ('inside func_b')
    return y
def func_c(z):
    print ('inside func_c')
    return z()
print( func_a() )
print (5 + func_b(2)  )
print (func_c(func_a) )
```

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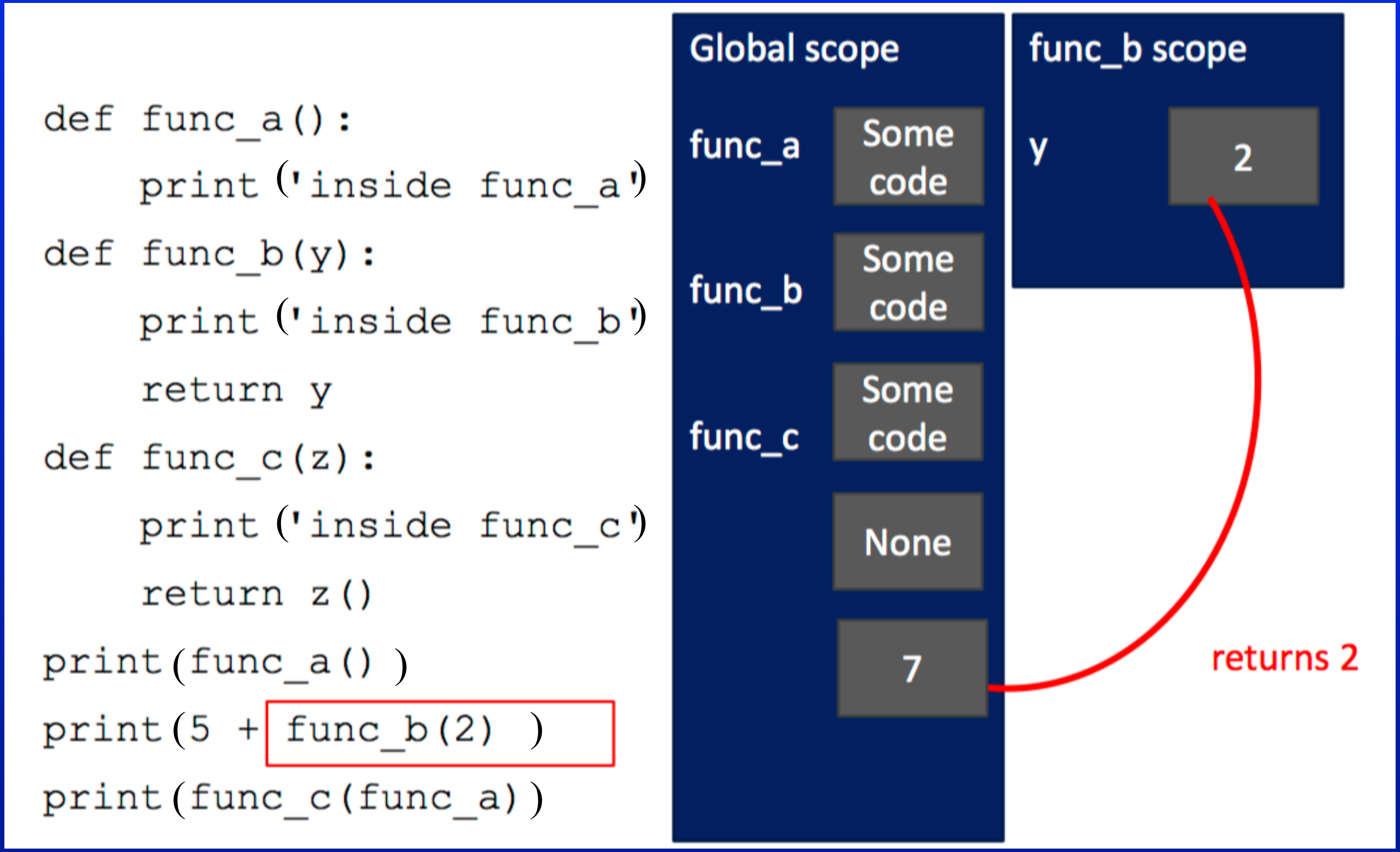
Function: Arguments



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    print ('inside func_b')
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def func_c(z):
    print ('inside func_c')
    return z()
print(func_a() )
print(5 + func_b(2) )
print(func_c(func_a))
```

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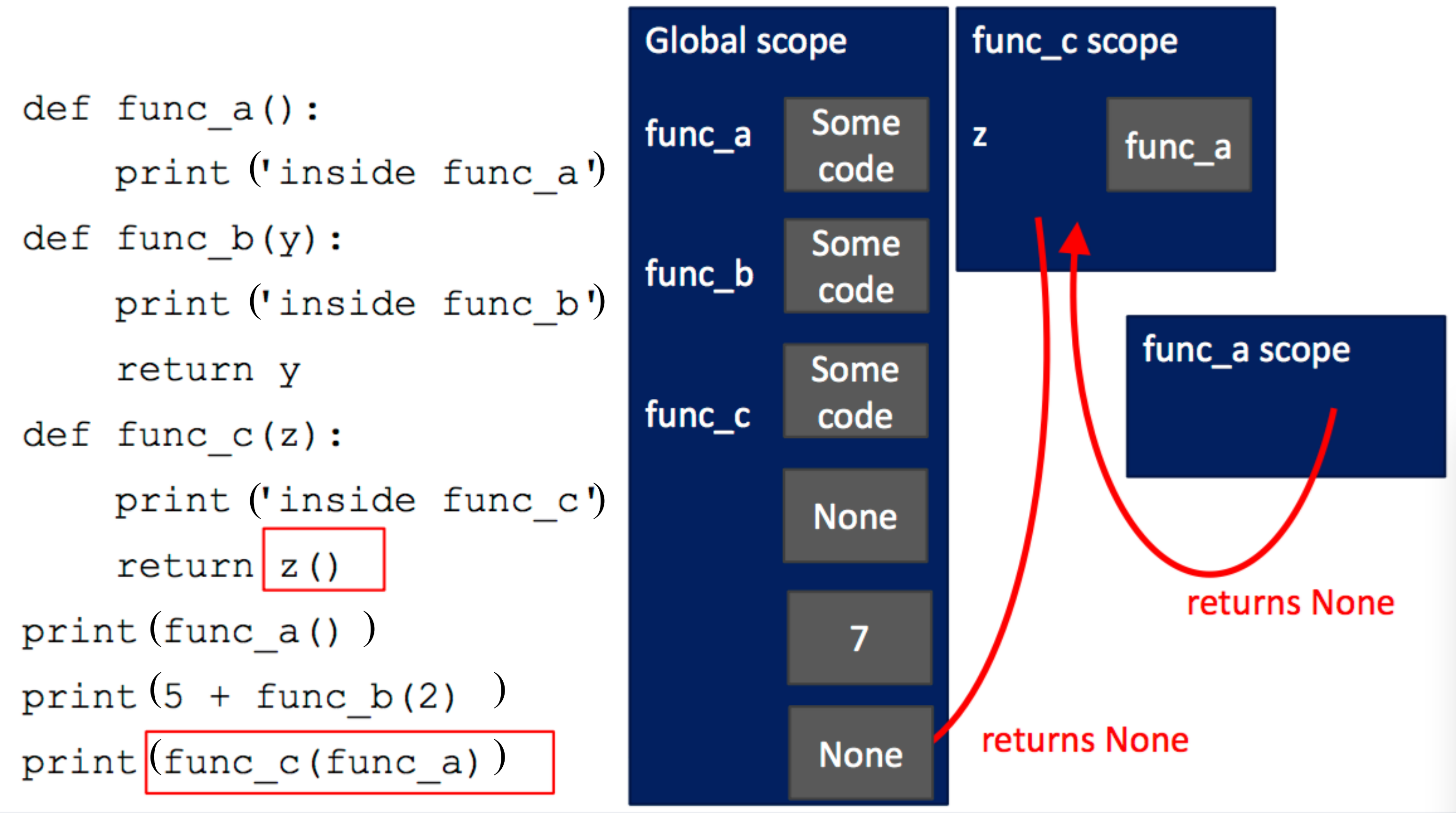
Function: Arguments



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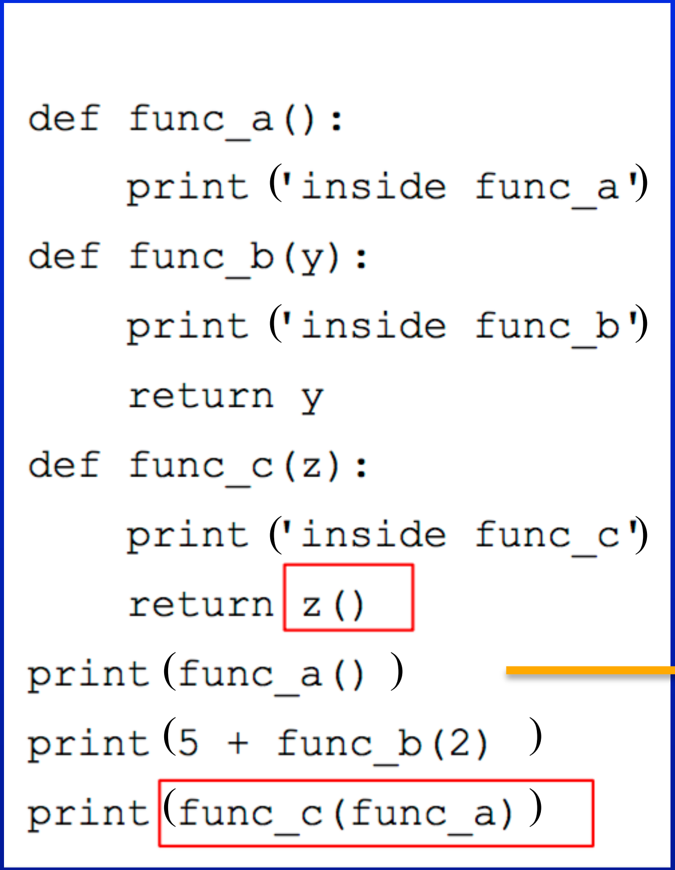
Function: Arguments



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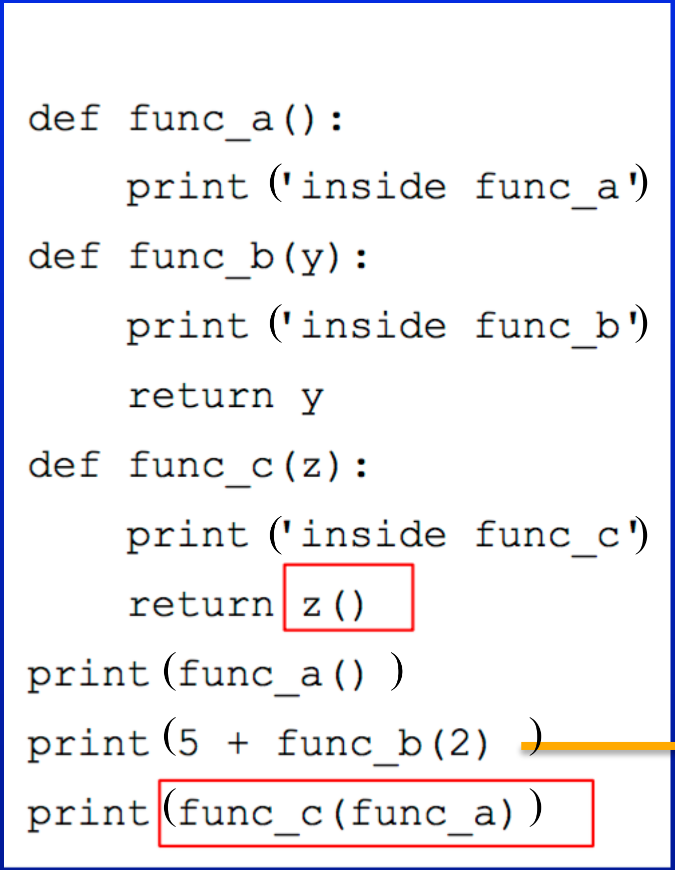
    print ('inside func_a')
def func_b(y):
    print ('inside func_b')
    return y
def func_c(z):
    print ('inside func_c')
    return z()
print(func_a() )
print(5 + func_b(2) )
print(func_c(func_a) )
```

Output

```
inside func_a
None
```

Source:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/lecture-slides-code/

Function: Arguments



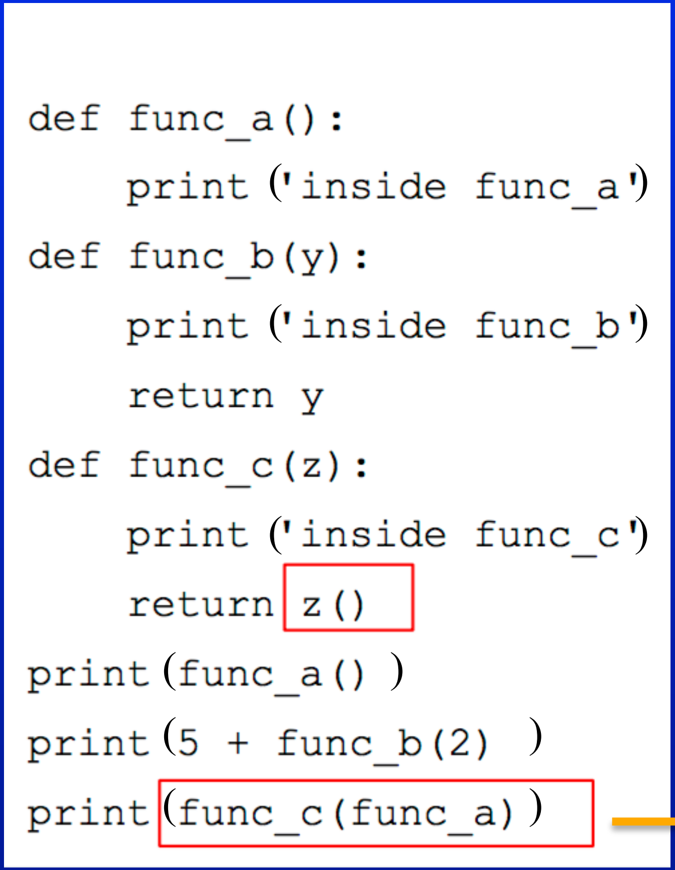
```
def func_a():
    print ('inside func_a')
def func_b(y):
    print ('inside func_b')
    return y
def func_c(z):
    print ('inside func_c')
    return z()
print(func_a() )
print(5 + func_b(2) )
print(func_c(func_a) )
```

Output

```
inside func_b
7
```

Source:https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/lecture-slides-code/

Function: Arguments



```
def func_a():
    print ('inside func_a')
def func_b(y):
    print ('inside func_b')
    return y
def func_c(z):
    print ('inside func_c')
    return z()
print(func_a() )
print(5 + func_b(2)  )
print(func_c(func_a) )
```

Output

```
inside func_c
inside func_a
None
```

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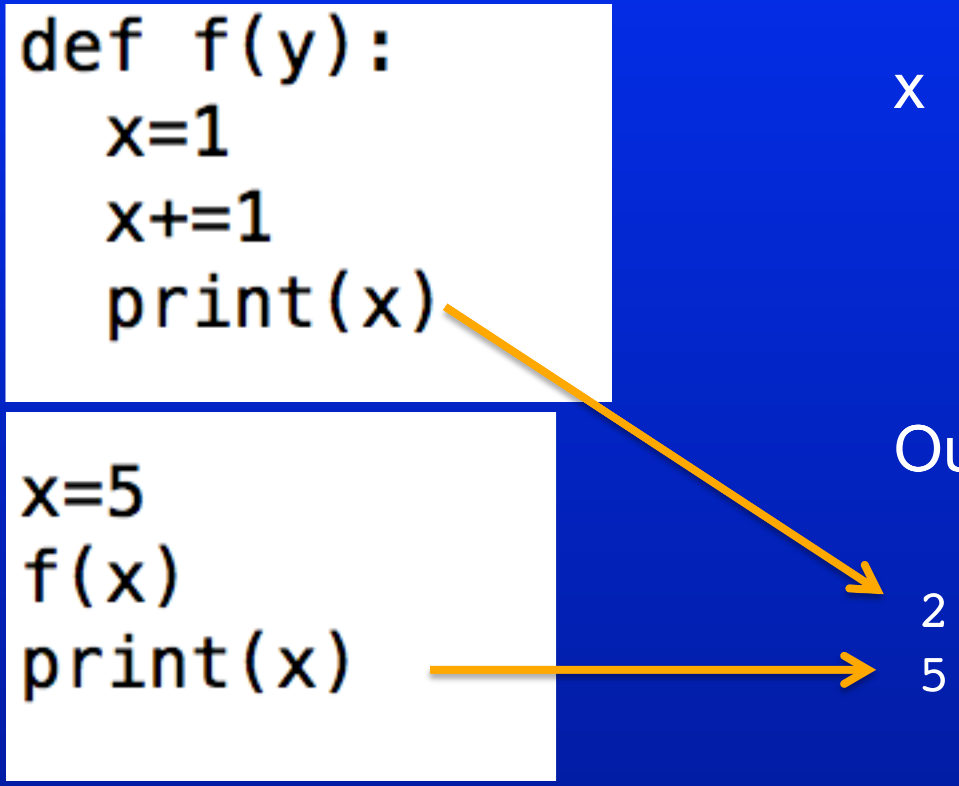
Function: Scope



```
def f(y):
   x=1
   x+=1
   print(x)
```

```
x=5
f(x)
print(x)
```

x is redefined locally

Output

```
2
5
```

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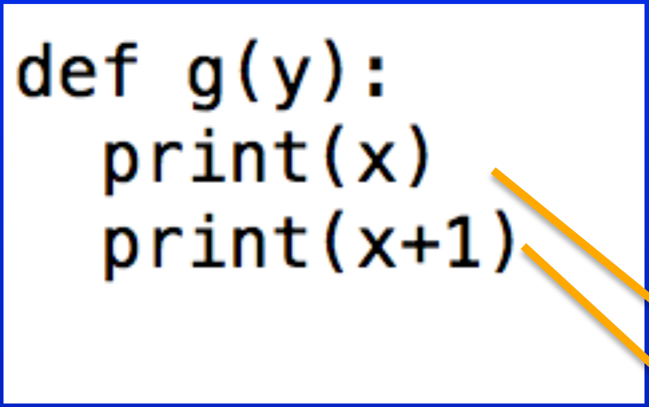
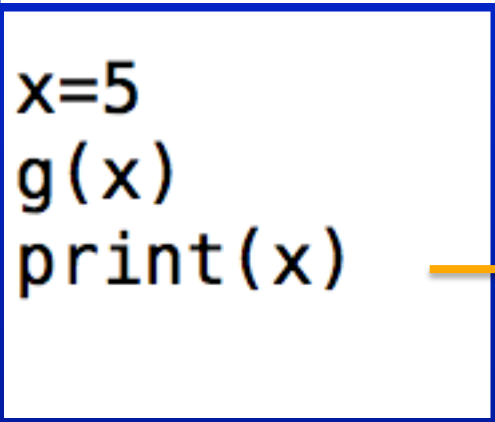
Function: Scope



```
def g(y):
  print(x)
  print(x+1)
```



```
x=5
g(x)
print(x)
```

Can access x defined outside

Output

```
5
6
5
```

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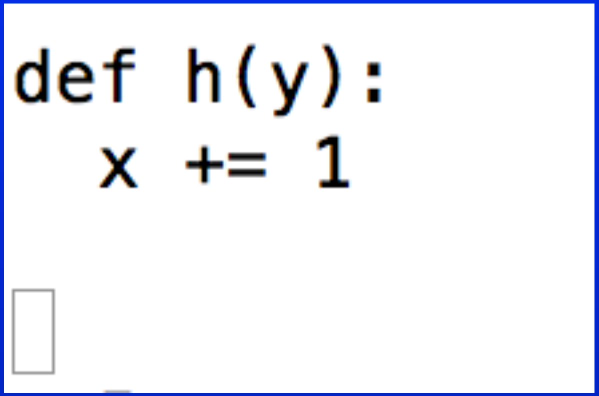
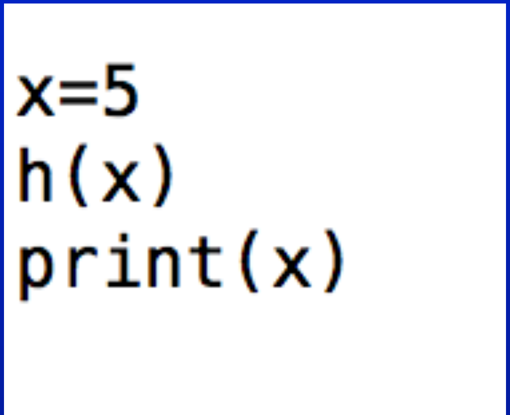


```
def h(y):
    x += 1
```



```
x=5
h(x)
print(x)
```

Can not modify
x defined outside

Output

`UnboundLocalError`

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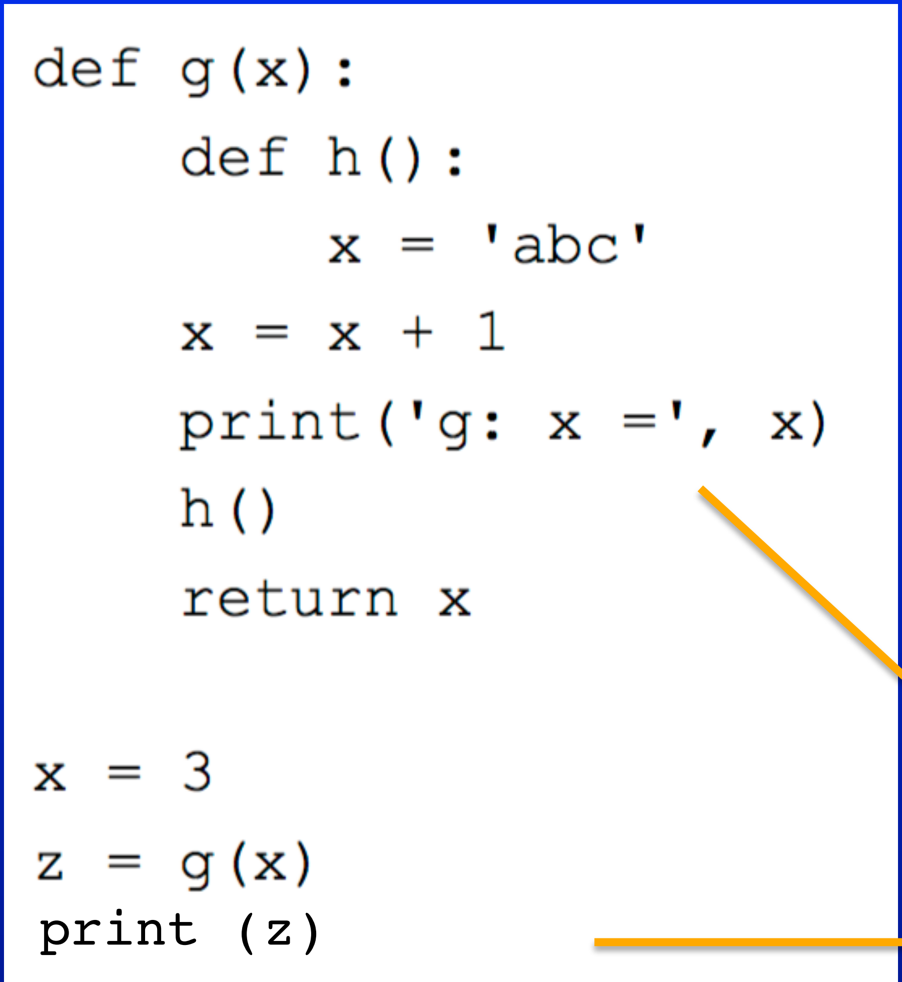
Function: Scope (Example)



```
def g(x):
    def h():
        x = 'abc'
    x = x + 1
    print('g: x =', x)
    h()
    return x

x = 3
z = g(x)
print (z)
```

Output

```
g:x=4
4
```

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