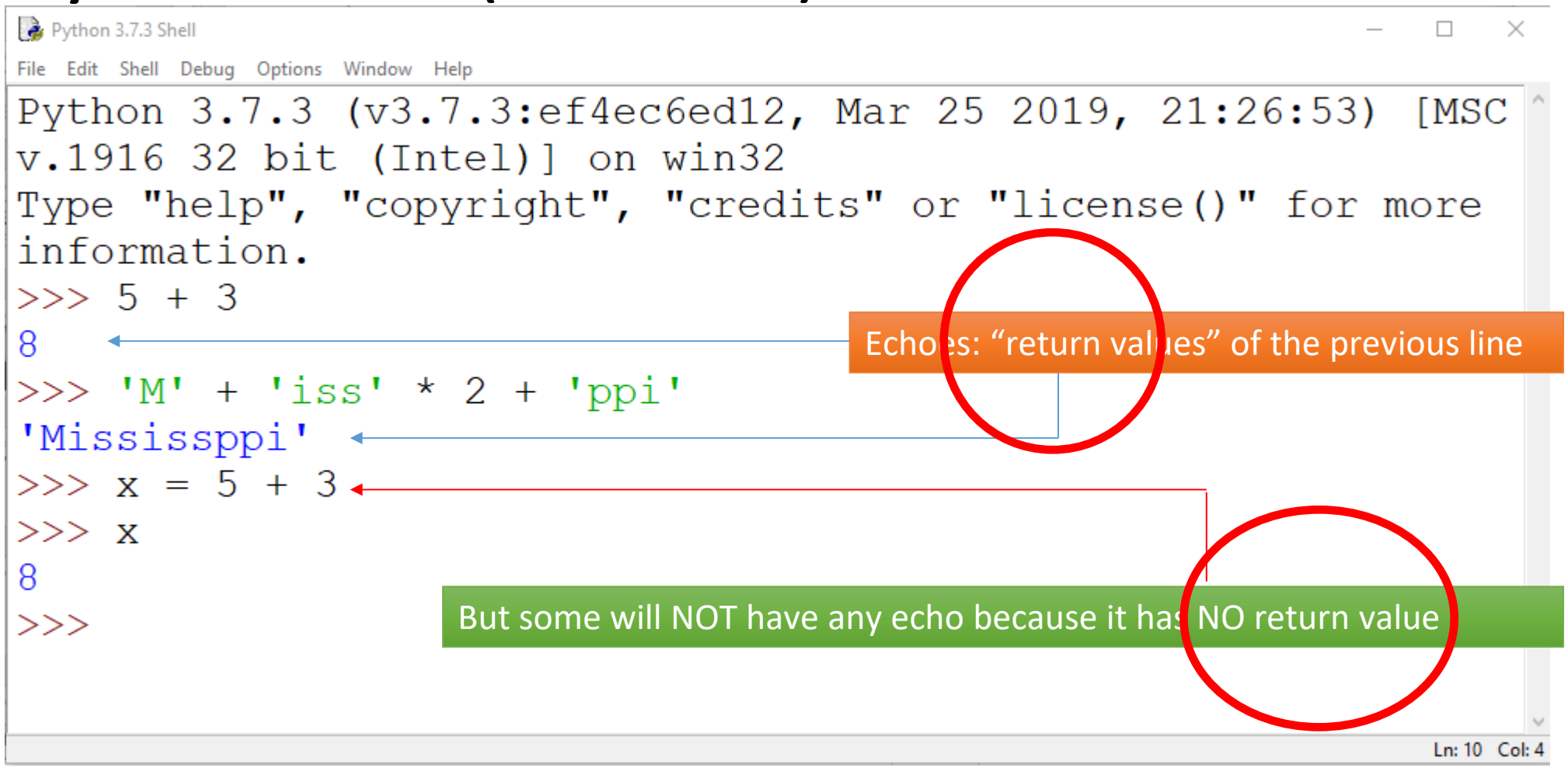
“Return” of Functions

(The previous drawing examples do not have any return values)

Python Shell(Console)



- However, this should NOT be the main area we work in

A Function may or may not return a value

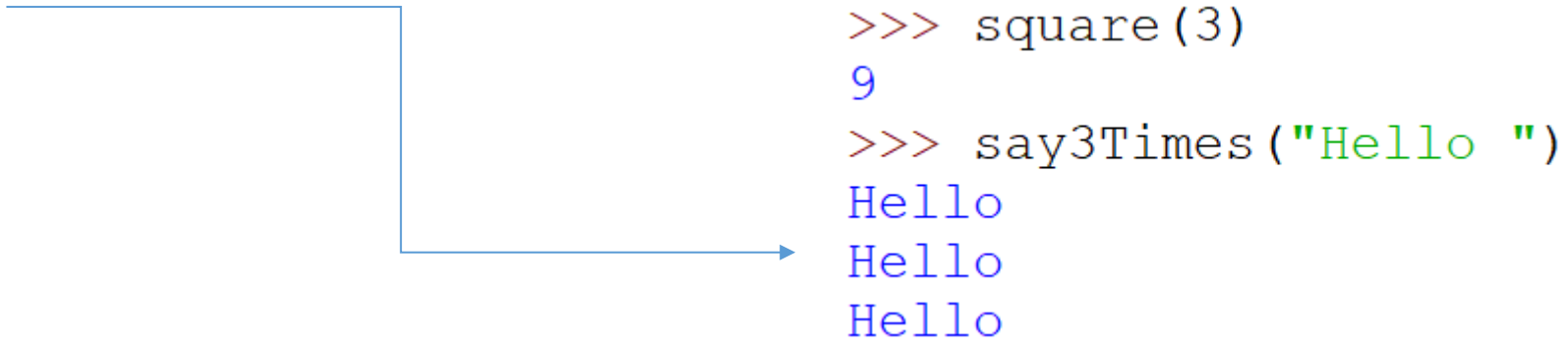
```
def square(x):
    return x * x

def say3Times(s):
    print(s)
    print(s)
    print(s)
```

This function returns a value

This function does NOT return a value
However, in Python, it “returns” a value of “None”

Python Echo in the Shell

- Wait a minute? I thought you say the second function does not return any value?



- The 9 is a return value from the function square and Python shell echo it
- The 3 “Hello” are NOT return value but from the “print()” function

Function that “doesn’t” return any value

- Note that the function print also only returns a “None”

```
>>> print(square(3))
9
>>> print(say3Times("Hello "))
Hello
Hello
Hello
None
>>> print(print())

None
```

Return Values

Vs “`print()`”

Print vs Return

```
def foo_print3():
     print(3)
     print(3)

def foo_return3():
    return 3
    return 3
```

```
>>> foo_print3()
3
3
>>> foo_return3()
3
>>>
```

- “return” will end the function immediately

Print vs Return

```
def foo_print3():
    print(3)

def foo_return3():
    return 3
```

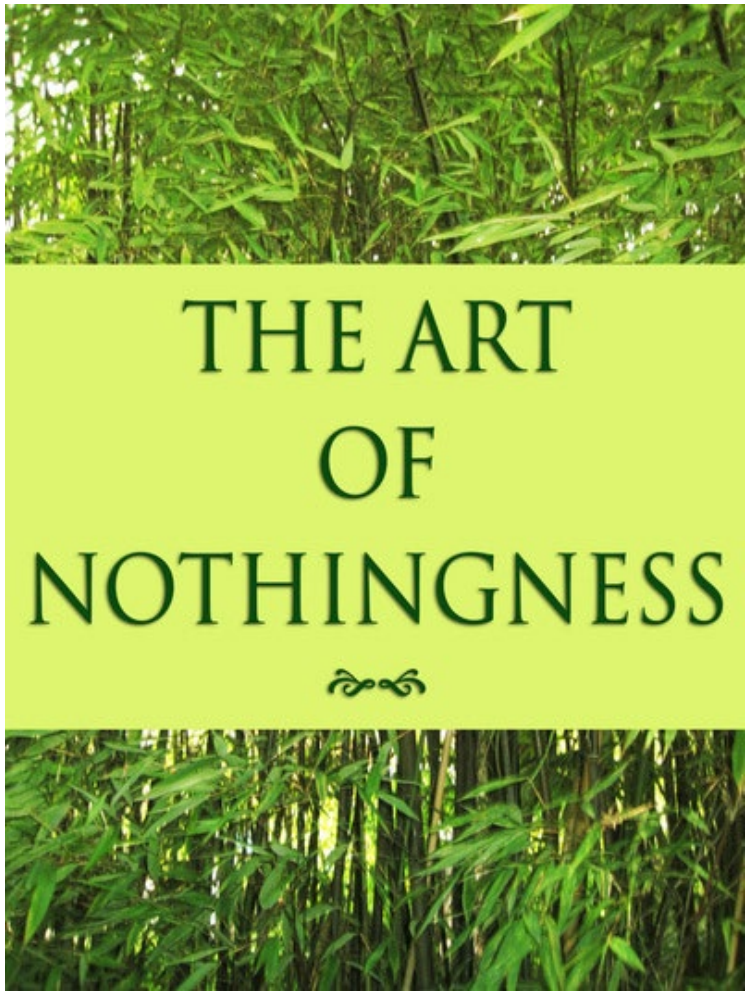
```
>>> foo_print3()
3
>>> foo_return3()
3
>>>
```

Wait…

```
>>> x = foo_print3()
3
>>> y = foo_return3()
>>>
```

Nothing?

```
>>> type(x)
<class 'NoneType'>
>>> type(y)
<class 'int'>
>>>
```



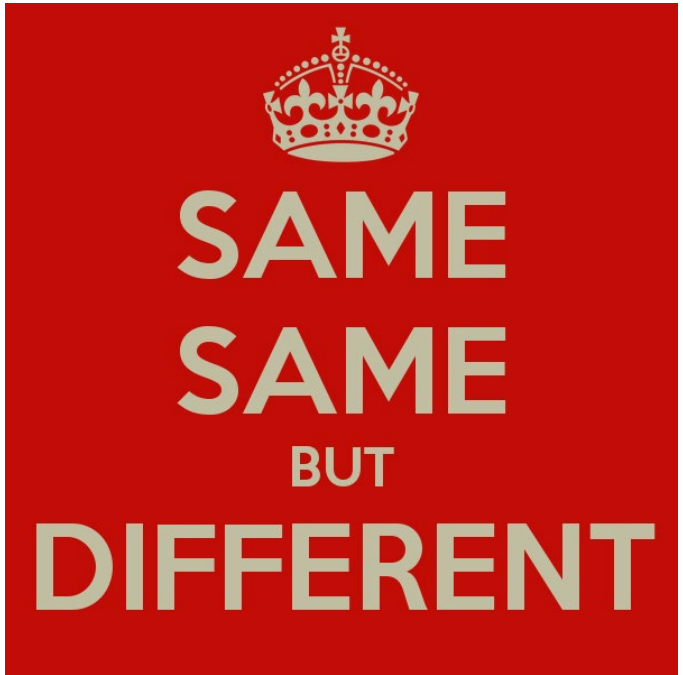
Print vs Return

```
def foo_print3():
    print(3)

def foo_return3():
    return 3
```

By the print function

```
>>> foo_print3()
3
>>> foo_return3()
3
>>>
```

IDLE's **echo**



Print vs Return

```
def foo_print3():
    print(3)

def foo_return3():
    return 3
```

- foo_print3() does not “return” a value

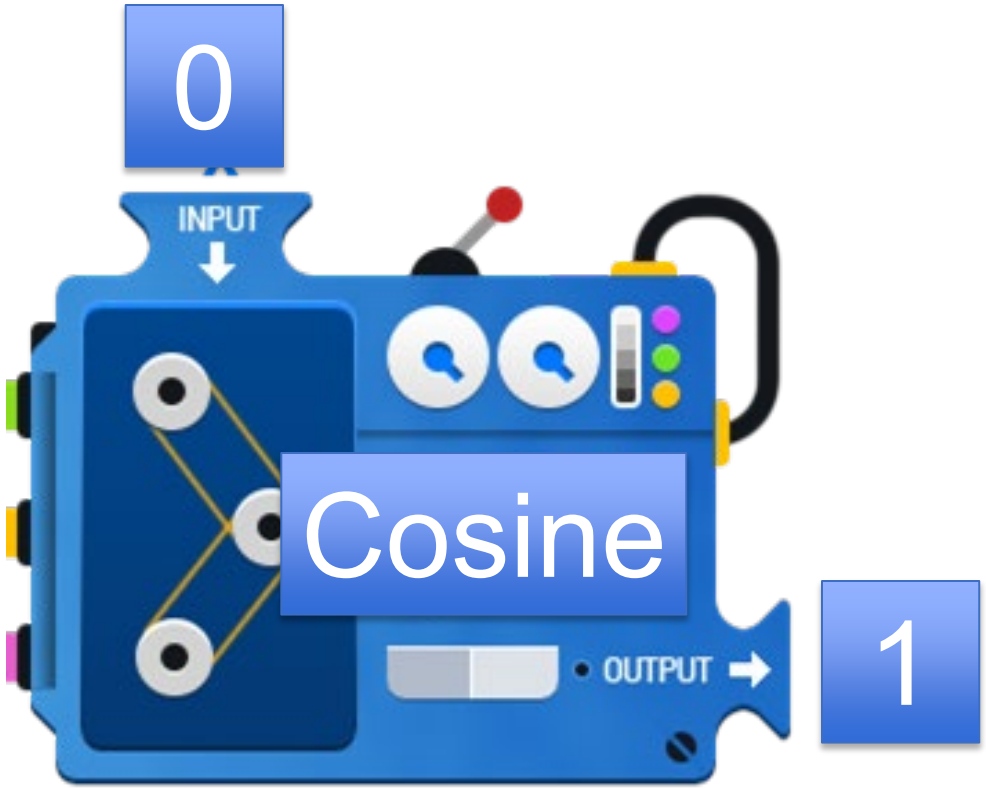
```
>>> x = foo_print3()
3
>>> y = foo_return3()
>>>
```

IDLE echoes “nothing”

Function

- “Cosine” is a function
  - Input 0
  - Output/return 1
  - x = cos(0)

    return
  - That’ why x = 1



Function

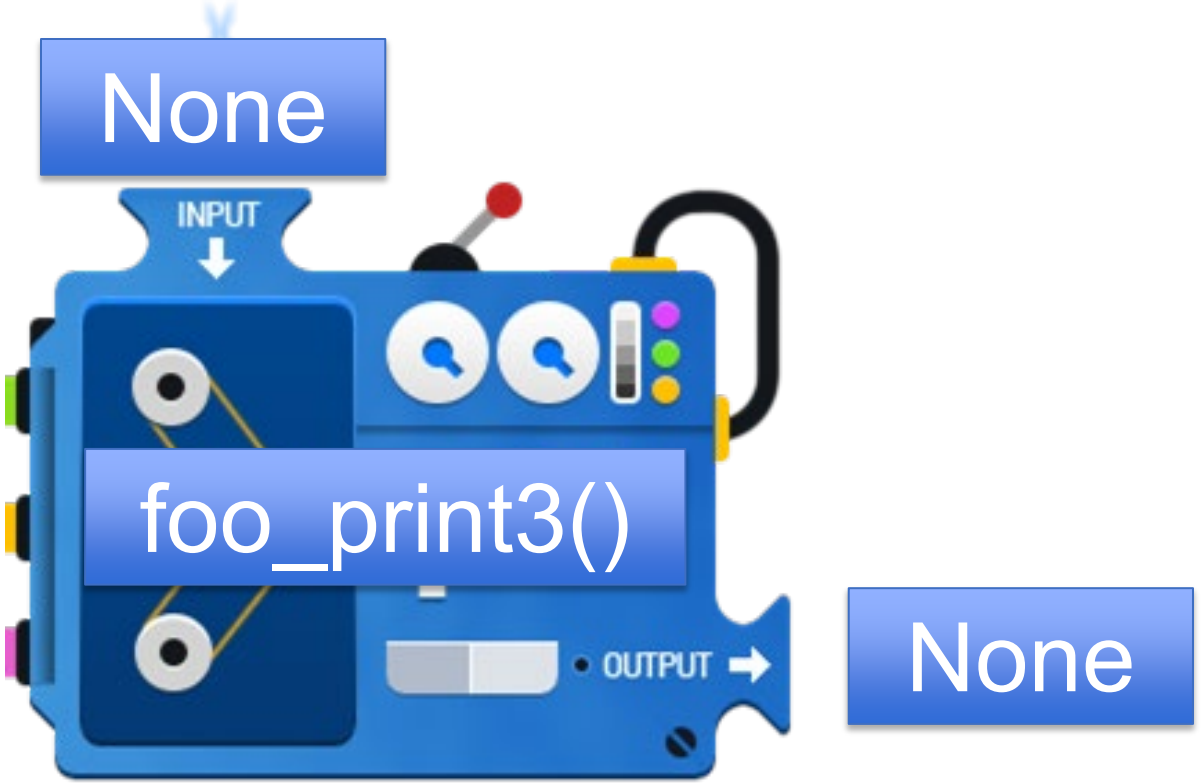
- “`foo_print3()`” is a function
  - Input nothing
  - No output

```
y = foo_print3()
```

return “None”

In general, we called all these “functions”

But for a function that “returns” nothing. Sometime we call it a “procedure”



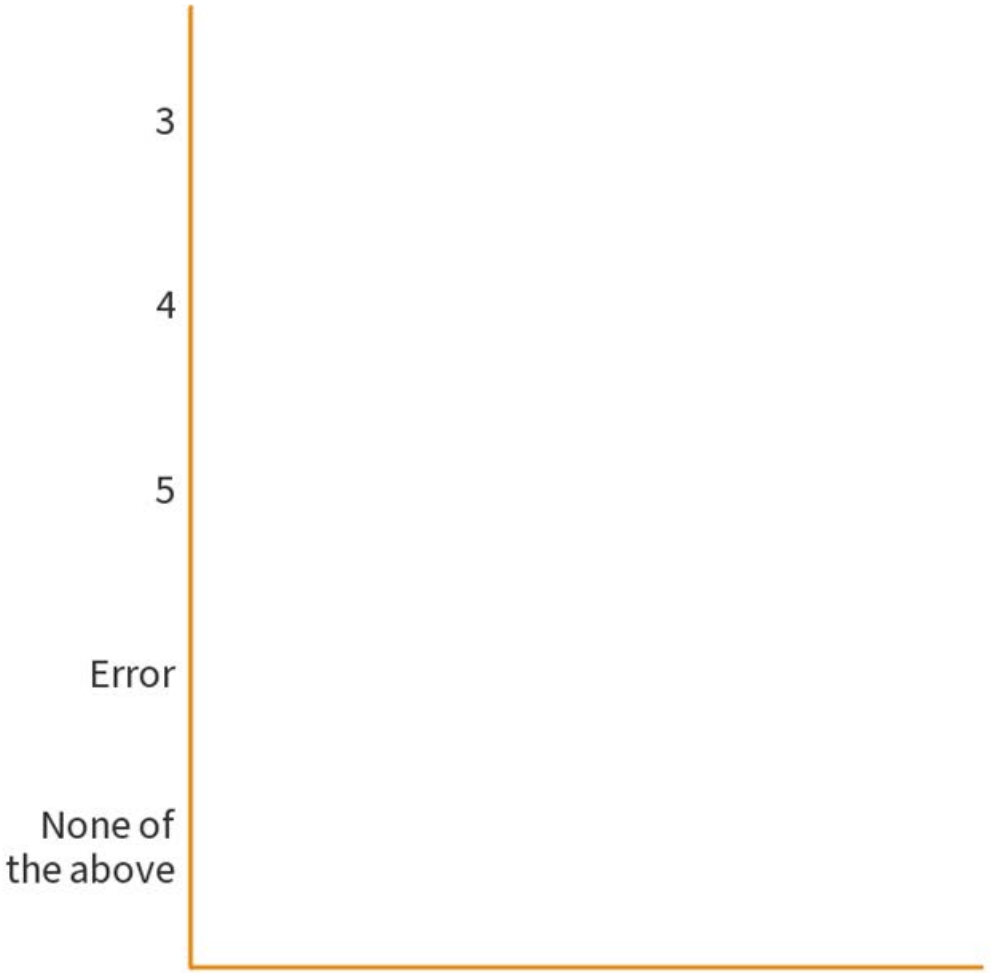
Return Values

- All functions returns “something”
- `foo_return3()` return the integer 3
- `foo_print3()`
  - Do not have any return statement
  - So it returns “None”

Question: Can we assume that a function always return something of the same TYPE?

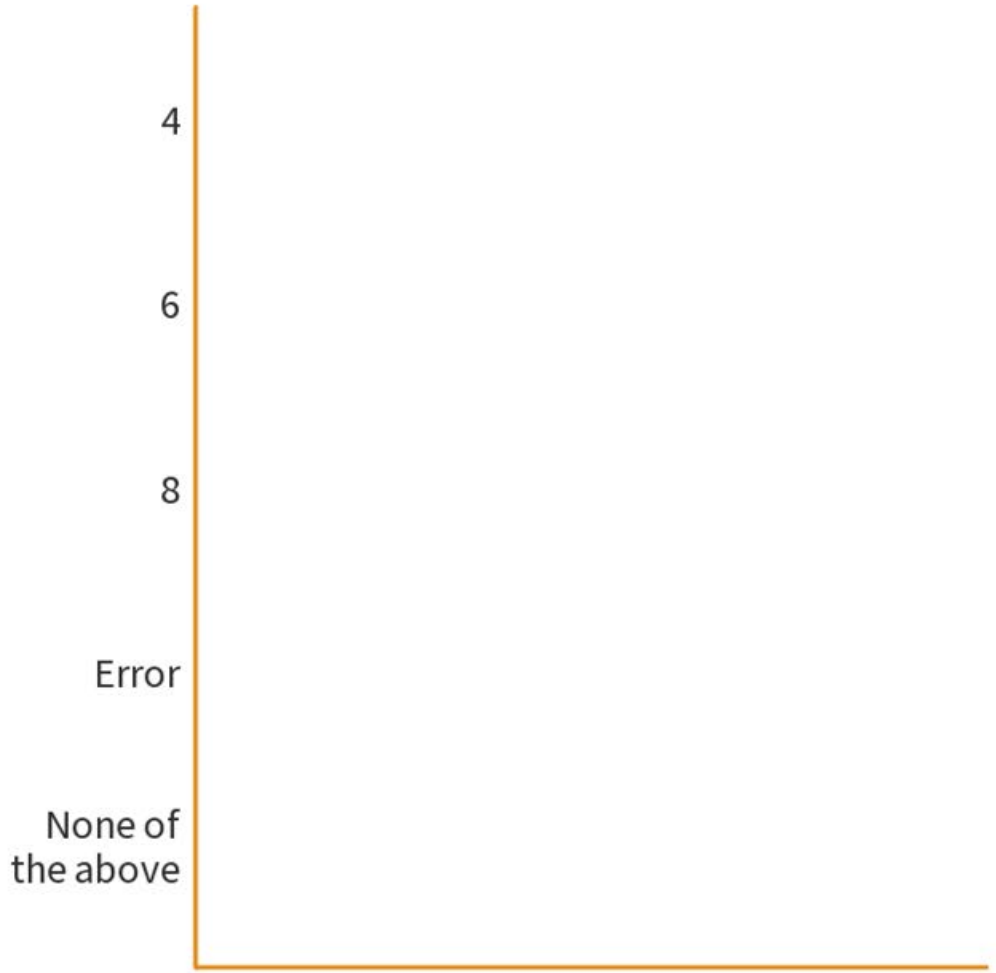
What is the output from the call strange(3,100)?

```
def strange(a,b):
    c = a * b // b
    return c
    return c+1
    return c+2

>>> strange(3,100)
```



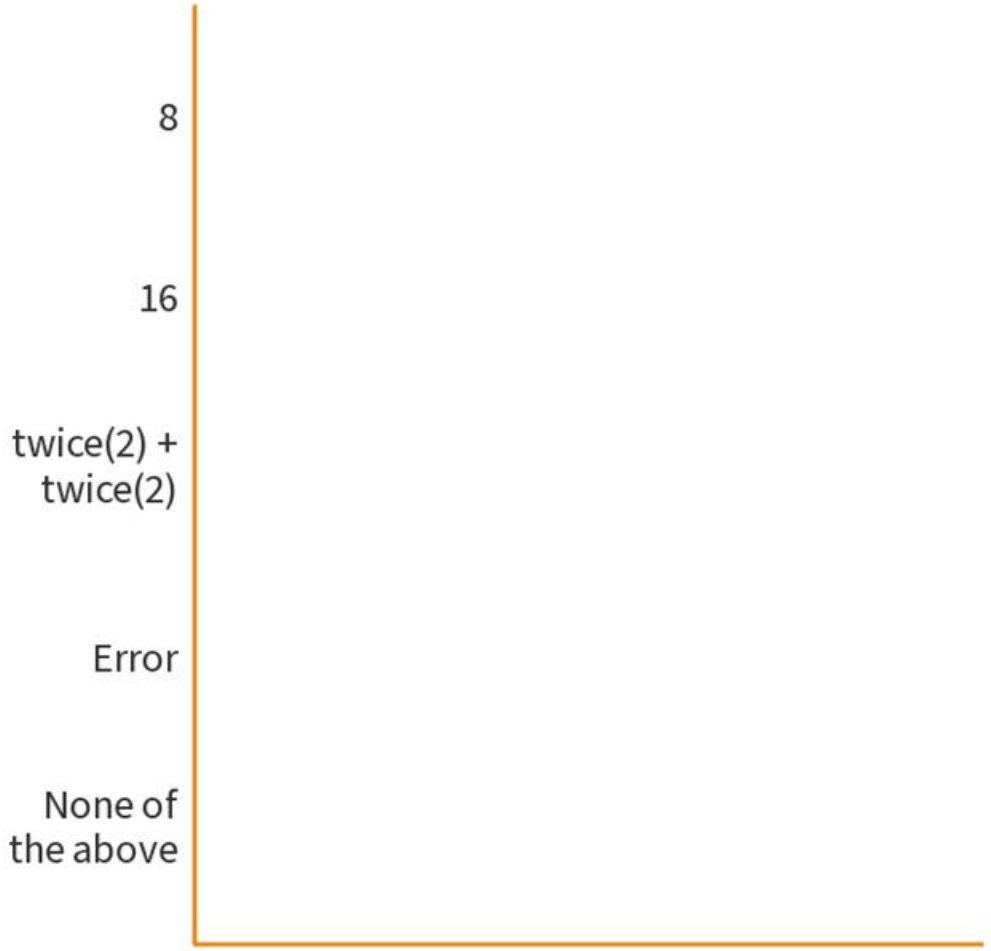
What is the output from the call f(1,1)?

```
def g(a,b):
    (a + b) * 2

def f(x,y):
    res = g(x,y)
    return res + res
```



What is the output from the call twice(twice(twice(2)))?

```
def twice(x):
    return x + x
```



Get’s get some real coding!

Some Fast food has Food Customization

- Meaning, you can micro-manage what will be or will not be in your burgers

This guy went to McDonald's and ended up just ordering a slice of cheese

Miranda Larbi Wednesday 15 Mar 2017 11:36 am

Burger Customization

- ‘B’ stands for a piece of bun
- ‘C’ stands for cheese
- ‘P’ stands for patty
- ‘V’ stands for veggies
- ‘O’ stands for onions
- ‘M’ stands for mushroom
- (maybe you can come up with more?)

Encoding as a String

- A simple burger
  - ‘BVPB’
- A double cheese burger
  - ‘BVCPCPB’
- A Big Mac?

Write a function `burgerPrice()` to calculate the **price**

• ‘B’ stands for a piece of bun	$0.5
• ‘C’ stands for cheese	$0.8
• ‘P’ stands for patty	$1.5
• ‘V’ stands for veggies	$0.7
• ‘O’ stands for onions	$0.4
• ‘M’ stands for mushroom	$0.9

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

Discuss With your Neighbor on how to start/do it

(5 min)

Write a function `burgerPrice()` to calculate the **price**

• ‘B’ stands for a piece of bun	$0.5
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• ‘M’ stands for mushroom	$0.9

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

How will you do that in real life?

- You receive a string into your function
- Go through each character of the string one by one
- Accumulate the price for that character
- Output the final price

Which line(s) is the repetition if there are many characters in the

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

How will you do that in real life?

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Which line(s) is the repetition if there are many characters in the

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

How will you do that in real life?

- You receive a string into your function
- Set the "final price" to be zero
- Go through each character of the string one by one
  - Accumulate the price for that character to the "final price"
- Output the final price

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

Then you need to start with 0

Whenever you want to accumulate some kind of sum or produce, you need a variable to store it

How do I go through each character of the sting?

- You receive a string into your function
- Set the “final price” to be zero
- Go through each character of the string one by one
  - Accumulate the price for that character to the “final price”
- Output the final price

- E.g.

```
>>> burgerPrice('BVPB')
3.2
```

Now it’s a good time to start your IDLE and code together!

How do I go through each character of the sting? E.g. Just print out the letters one-by-one

- You receive a string into your function
- Set the "final price" to be zero
- Go through each character of the string one by one
  - Accumulate the price for that character to the "final price"
- Output the final price

```
def burgerPrice(burger):
    length = len(burger)
    for i in range(length):
        print(burger[i])


burgerPrice('BVPB')
```

Output:

```
>>> burgerPrice('BPB')
B
P
B
```

Note that this is NOT the final code.
However, we usually write some immediate code to make sure what is right.
E.g. This code make sure that "burger[i]" will give you each character in the loop

How do I find the price of each ingredient?

- You receive a string into your function
- Set the “final price” to be zero
- Go through each character of the string one by one
  - Accumulate the price for that character to the “final price”
- Output the final price

Output:

```
burgerPrice('BVPB')
0.5
0.7
1.5
0.5
>>>
```

How do I find the price of each ingredient?

```
def burgerPrice(burger):
    length = len(burger)
    for i in range(length):
        if burger[i] == 'B':
            print(0.5)
        elif burger[i] == 'C':
            print(0.8)
        elif burger[i] == 'P':
            print(1.5)
        elif burger[i] == 'V':
            print(0.7)


burgerPrice('BVPB')
```

- Output:

```
0.5
0.7
1.5
0.5
>>>
```

- How to sum them?

“Finally”

```
def burgerPrice(burger):
    price = 0
    length = len(burger)
    for i in range(length):
        if burger[i] == 'B':
            price = price + (0.5)
        elif burger[i] == 'C':
            price = price + (0.8)
        elif burger[i] == 'P':
            price = price + (1.5)
        elif burger[i] == 'V':
            price = price + (0.7)
    return price


burgerPrice('BVPB')
```

- Wait? Nothing happened if I run this code?

```
def burgerPrice(burger):
    price = 0
    length = len(burger)
    for i in range(length):
        if burger[i] == 'B':
            price = price + (0.5)
        elif burger[i] == 'C':
            price = price + (0.8)
        elif burger[i] == 'P':
            price = price + (1.5)
        elif burger[i] == 'V':
            price = price + (0.7)
    return price

print(burgerPrice('BVPB'))
```

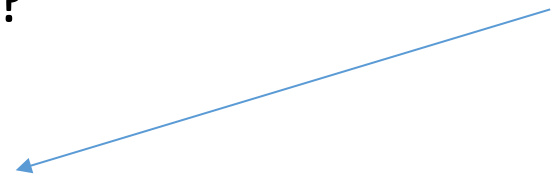
- If you run a .py file, there will be NO Python Echo

Are we done?

- Always give it a thought on
  - Can we do it another way?
  - Or, is there any other better way?
- In lecture we learnt:

```
for <var> in <sequence>:
    <body>
```

- sequence
  - a sequence of values
- var
  - variable that take each value in the sequence
- body
  - statement(s) that will be evaluated for each value in the sequence



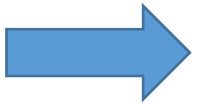
Other than “range”, a string is a “sequence”!!!

“for i in <sequence>:”

- Originally
- The variable i is the index of the string
  - So you need to get the character by burger[i]

```
def burgerPrice(burger):
    length = len(burger)
    for i in range(length):
        print(burger[i])


burgerPrice('BVPB')
```



- However, Python can iterate through a sequence by giving each **element** in the sequence directly in a for loop
  - The variable c is a character in burger

```
def burgerPrice(burger):
    for c in burger:
        print(c)


burgerPrice('BVPB')
```

Finally

- New version

```
def burgerPrice(burger):
    price = 0
    for char in burger:
        if char == 'B':
            price = price + (0.5)
        elif char == 'C':
            price = price + (0.8)
        elif char == 'P':
            price = price + (1.5)
        elif char == 'V':
            price = price + (0.7)
    return price

print(burgerPrice('BVPB'))
```

- Compare to the old version

```
def burgerPrice(burger):
    price = 0
    length = len(burger)
    for i in range(length):
        if burger[i] == 'B':
            price = price + (0.5)
        elif burger[i] == 'C':
            price = price + (0.8)
        elif burger[i] == 'P':
            price = price + (1.5)
        elif burger[i] == 'V':
            price = price + (0.7)
    return price

print(burgerPrice('BVPB'))
```

Learning Points

- Not only about how to get the final code but..
- Plan and write your code in English first
- You may need to write some intermediate code for a “semi finished product” to test out your idea
- After you finally get your code working, you should think about how to improve it
  - Not only for that single shot, you are improving your coding skill for your future coding

Three Types of Loops

Three Types of Loops

- For A and C, it means you know the number N when your loop starts

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
    - Check all True (or check all False)
    - Find any True (or False)

Which Type is it?

- Iteration version of computing the factorial of N

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
    - Check all True (or check all False)
    - Find any True (or False)

Which Type is it?

- Given a string, e.g. ‘abcdef’, compute its length
  - The function len()
  - First, think of how to do it without using the function len()

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
   - Check all True (or check all False)
   - Find any True (or False)

Which Type is it?

- Check if a string contains any vowel, e.g. the word ‘sky’ does not have any vowel

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
    - Check all True (or check all False)
    - Find any True (or False)

Which Type is it?

- Check if a number N is prime

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
    - Check all True (or check all False)
    - Find any True (or False)

Think of an Example of Each Type?

A. Must run exactly N times (definite)
B. Run any number of times (indefinite)
C. Run at most N times (definite loop that may break)
   - Check all True (or check all False)
   - Find any True (or False)

Comments in Python

Comments in Python

- Usually denoted by # at the start of a line

- Can also be done between pairs of triple quotes

```
#Example of single line comment

'''
Example of triple quotes comment
Wow I can do multiple lines
'''
```

Comments in Python

- Good habit to have comments in your code
- Remind yourself what the code is for
- Help others understand your code

- Remember to make sure you mark out your comments properly. Otherwise, you might get an error when trying to run your program.

Selection Statements

What will it return?

```
def foo():
    if True:
        if False:
            return 1
        else:
            return 2
```

A Computer Science thing:
If you don't want to name a function.
Anyhow name it "foo()"

But DON'T do it in practise

if-else

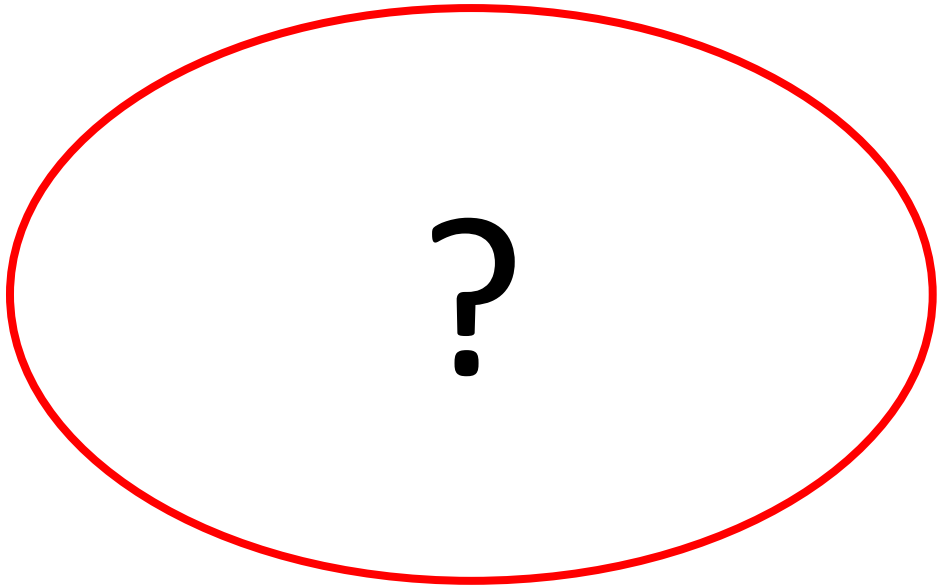
```
def foo():
    if False:
        if True:
            return 1
    else:
        return 2
```

```
def foo():
    if False:
        return 1
    elif False:
        return 2
    elif True:
        return 3
    elif True:
        return 4
    else:
        return 5
```

elif statements will ‘break’ the moment one of them is True

if-else

```
def foo():
    if not True:
        if True:
            print(1)
        else:
            print(2)
```



Be careful with your if-else. You might return nothing!

Can you spot the difference?

Example 1

```
def foo():
     if True:
          if False:
               print(1)
          else:
               print(2)
```

Example 2

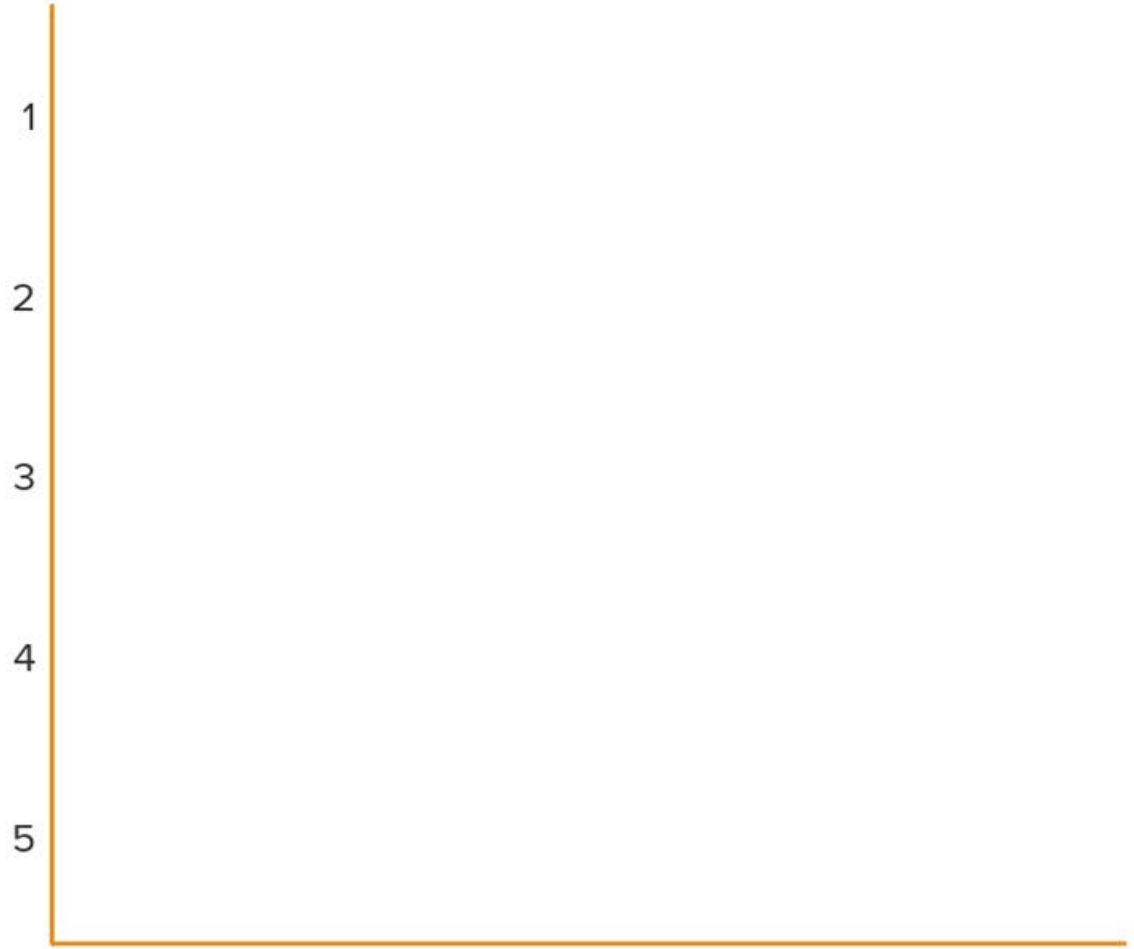
```
def foo():
     if True:
          if False:
               print(1)
     else:
          print(2)
```

What will be printed out from executing f(5) and g(5) ? Enter one of the choices given.

```
def f(a):
    if a < 10:
        if a < 4:
            print('Here')
        else:
            print('There')
```

```
def g(a):
    if a < 10:
        if a < 4:
            print('Here')
    else:
        print('There')
```

Choices	f(5) prints:	g(5) prints:
1	There	There
2	There	
3		There
4		
5	I am lost!	



What printed out from f(2), f(5), f(15)?

```
def f(a):
    if a < 10:
        if a < 4:
            print('Here')
        else:
            print('There')
    else:
        print('Where')
```

'Here', 'There', 'Where'

'Here', 'Where', 'There'

'There', 'Here', 'Where'

'Where', 'There', 'Here'

None of the above

What printed out from executing g(2)?

```
def g(a):
    if a < 10:
        if a < 4:
            print('Here')
        else:
            print('There')
    print('Where')
```

'Here'

'Where'

'Here' and 'Where'

'There' and 'Where'

None of the above

What printed out when calling *pain()*?

```
def pain():
    if False:
        print('False')
    else:
        if True:
            print('True')
        else:
            print('neither True nor False')
```

- True
- False
- Neither True nor False
- None
- None of the above