Basic Python Functions

First Tutorial for 3CP3 class

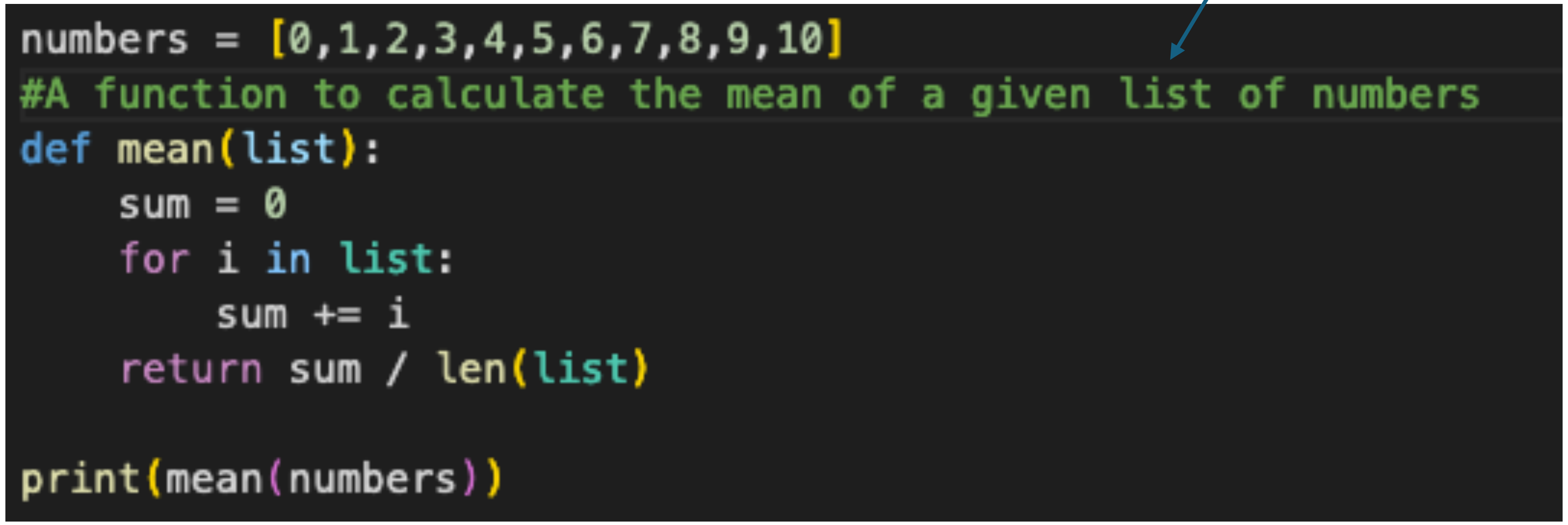
McMaster University

Python Indentation and basic syntax

- Python uses whitespace and indentation to construct the code structure

A comment that is not executed

Whitespace to define the block of coding



```python
numbers = [0,1,2,3,4,5,6,7,8,9,10]
#A function to calculate the mean of a given list of numbers
def mean(list):
    sum = 0
    for i in list:
        sum += i
    return sum / len(list)

print(mean(numbers))
```

- More readable and uniform

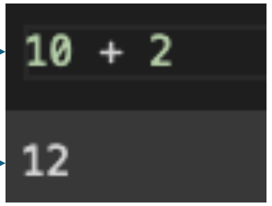
- Python is case sensitive, so it encourages precision and clarity while coding.

Basic operations

- You can compute basic operations directly.

Type on your jupyter notebook (Google Colab)

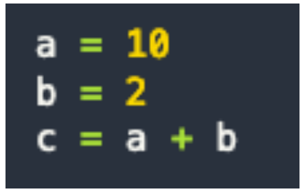
Get the answer



```
10 + 2
```

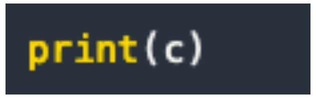
```
12
```

- But working with multiple variable is useful to assign each variable a name.



```
a = 10
b = 2
c = a + b
```

- And then you can print the variable that you stored the operation.

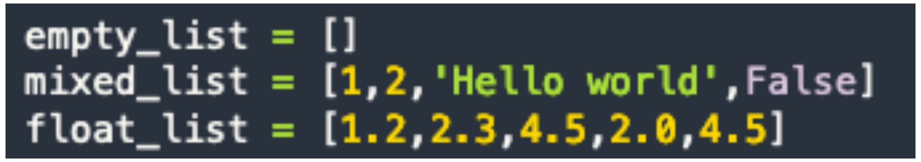


```
print(c)
```

- You can print multiple variables, strings, arrays…

List and operations with lists

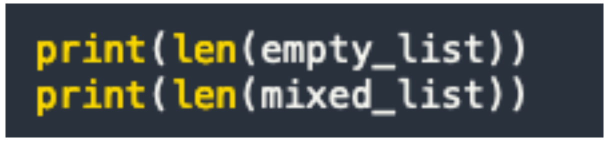
- You can create lists and populate them with numbers and strings.



```
empty_list = []
mixed_list = [1,2,'Hello world',False]
float_list = [1.2,2.3,4.5,2.0,4.5]
```

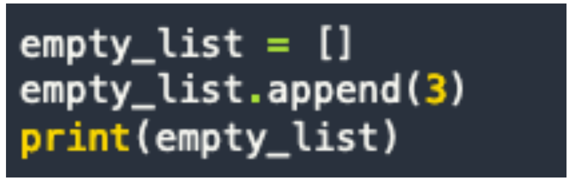
- Lists are:
    1. Ordered
    2. Mutable
    3. Denoted by square brackets

- You can check the length of a list



```
print(len(empty_list))
print(len(mixed_list))
```

- You can add more variables to your list by using the *append* command



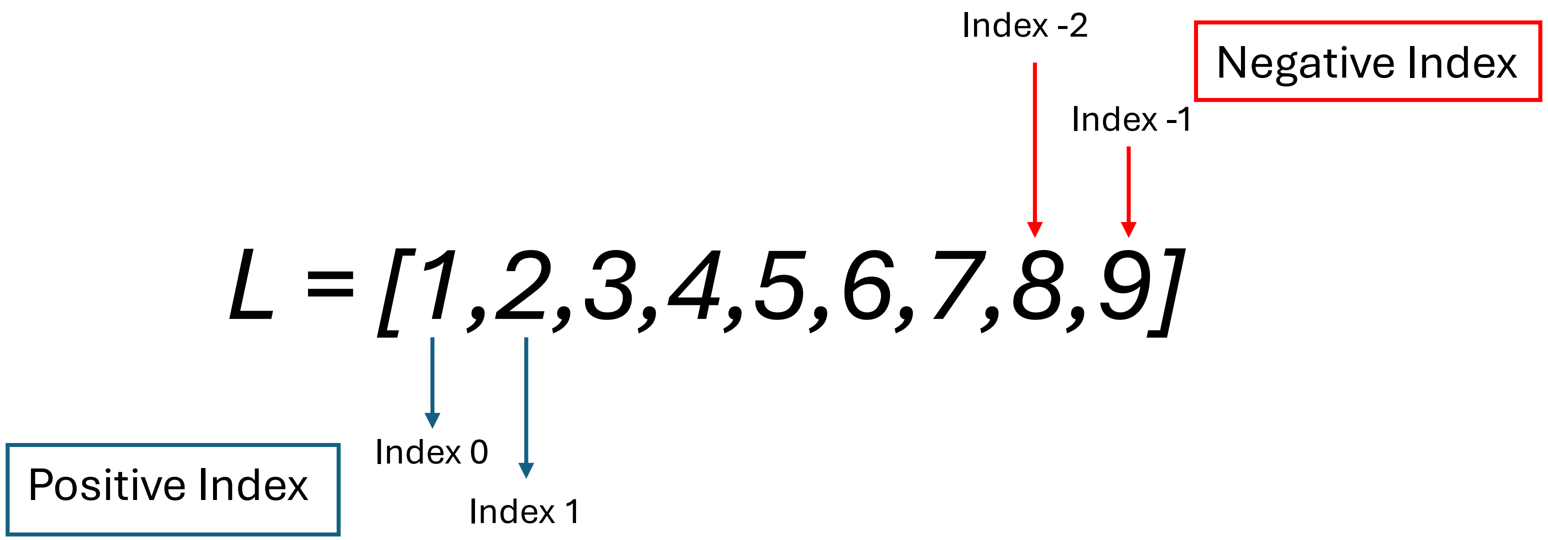
```
empty_list = []
empty_list.append(3)
print(empty_list)
```

- Given a list *L = [1,2,3,4,5,6,7,8,9]* . We can access a specific position of the list using slicing.

  - The whole list: *L[:]*
  - Everything after (and including) index position i : *L[i:]*
  - Everything before index position i: *L[:i]*
  - Everything before the position j steps from the end: *L[:-j]*
  - Everything after (and including) the position j steps from the end: *L[-j:]*

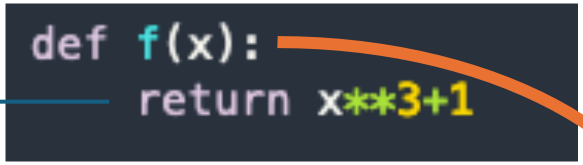
- *L[0] = [1]*
- *L[2:] = [3,4,5,6,7,8,9]*
- *L[:4] = [1,2,3,4]*
- *L[-2:] = [8,9]*
- *L[:-6] = [1,2,3]*

- Note



Functions

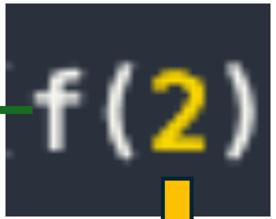
- A function in Python works the same as a function in math: you define an input and an output.



```
def f(x):
    return x**3+1
```

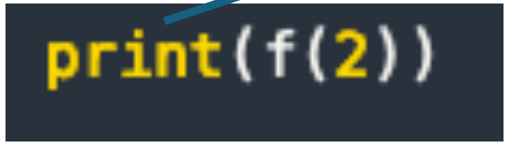
  - Functions in Python are defined by the def keyword.
  - And you put the list of outputs inside a parenthesis followed by :

- This defines the function $f(x) = x^3 + 1$ and to evaluate the function in each input you do,



```
f(2)
```

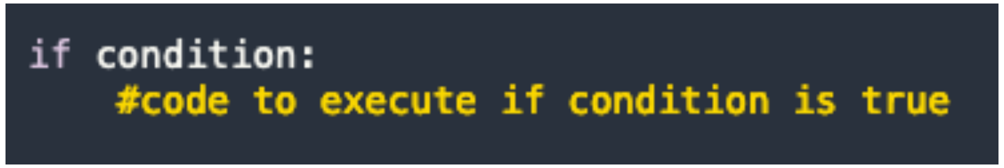
Call the function by its name
Put the input inside the parenthesis. This is the value that you want to evaluate.



```
print(f(2))
```

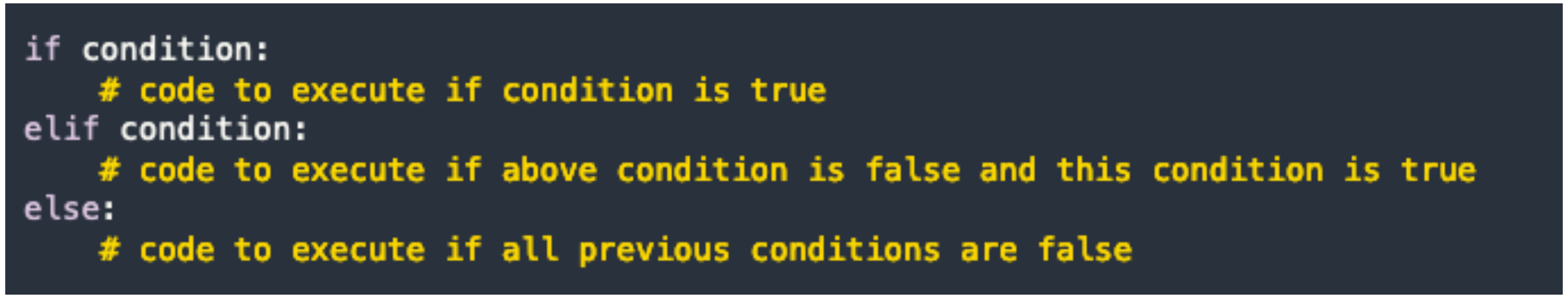
Conditional Statements

- There are instances where we want to only execute a particular block of code if a certain condition is true.



```
if condition:
    #code to execute if condition is true
```

- For multiple conditions, the syntax is,

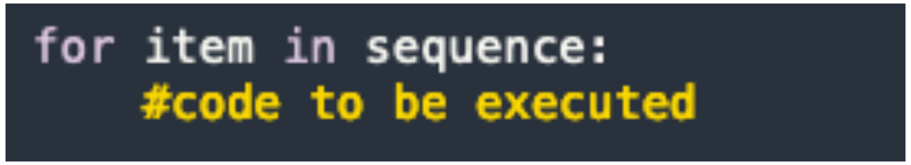


```
if condition:
    # code to execute if condition is true
elif condition:
    # code to execute if above condition is false and this condition is true
else:
    # code to execute if all previous conditions are false
```

- Comparison operations,
  - Equals x == y
  - Not Equal x != y
  - Less Than (strictly) x < y
  - Greater Than (strictly) x > y
  - Less Than or Equal to x <= y
  - Greater Than or Equal to x >= y

Loop

- When programming, there are times when you need to repeatedly perform a specific operation/action while updating certain parameters. In these situations, we use loops,



```
for item in sequence:
    #code to be executed
```

Exercise

- Test the convergence of the alternating series,

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$$