Motion Capture and Future Interaction Technology Research

Fundamental Structures of Python Programming: Part B

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Outline

- Numpy Array
- for Loops
- While Loops
- Functions in Python
- Classes and Objects in Python

Numpy Array

- Numpy is a library that adds support for multidimensional array, matrix, and high-level math function to Python
- Numpy arrays are like lists with lots of additional features and capabilities.

NumPy Arrays in Python

In [ ]:
```
#import the NumPy library and assign it the alias 'np'
import numpy as np

#create a two-dimensional array of size 2x3 (i.e., 2 rows, 3 columns), and set all of its values to zero
np_array = np.zeros((2, 3))

#print the current state of the two-dimensional array
print(np_array)
```

alis of “np”

zeros() function to set the values of all of the items in the array to zero.

Numpy Array

Indexing in Two-Dimensional Lists and Arrays

When working with two-dimensional lists or arrays, we need to specify the index of an element's row and the index of its column.

In [ ]:
```
#set the values of the upper-left and lower-right elements to 5 and 3, respectively
np_array[0,0] = 5
np_array[1,2] = 3

#print the current state of the two-dimensional array
print(np_array)

#print the mean (average) of all of the array elements
print(np.mean(np_array))
```

NumPy's "mean" function to automatically calculate the average of all of the elements in the array.

NumPy has many similar functions such as **min, max, median,** etc. that can be very useful when working with numeric data.

NumPy Arrays in Python

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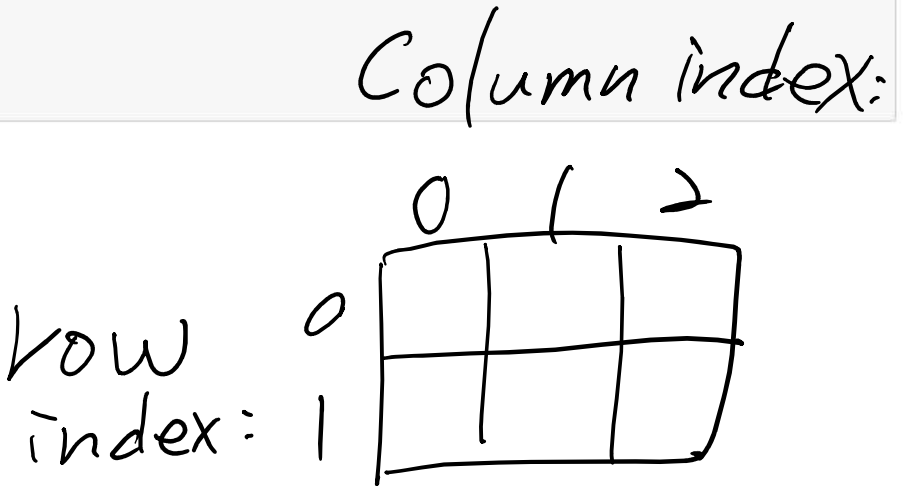
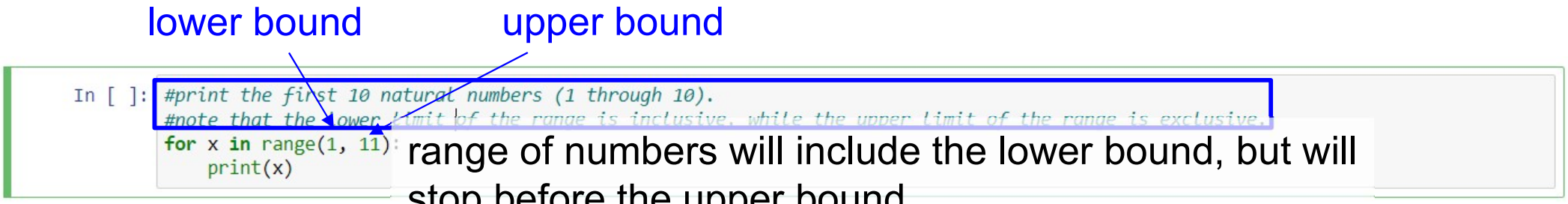


for AND while LOOPS IN PYTHON

- Loops allow us to run a set of instructions repeatedly. Python has two kinds of loops: **for** loops and **while** loops
  - for loops run a specific number of times
  - while loops run until a condition is met



range of numbers will include the lower bound, but will stop before the upper bound.

range() function

simply return a range of numbers between the lower bound and upper bound.

Inner AND Outer Loops

In [ ]:
```
#use nested for loops to print out each individual element in the array
for row in range(0, 2):
    for column in range(0, 3):
        print('The value of element [{0},{1}] is {2}'.format(row, column, np_array[row,column]))
```

`while` Loops in Python

In [11]:
```
#use a while loop to print a geometric series with a factor of 2
x = 1
while x < 1000:
    print(x)
    x = x * 2
```

FUNCTIONS IN PYTHON

- A function is a black of code that only runs when it is called
  - Functions are useful when we need to perform the same task multiple times
  - One or more values (called parameters) are passed into a function, and a function returns a result.

Functions in Python

In [ ]:
```
#define a function that multiplies two numbers together
def multiply(a, b):
    return a * b

#call the function and print the result
c = multiply(33, 147)
print('33 multiplied by 147 is {}'.format(c))
```

In [ ]:

```python
#define a function that determines if a number is even
def is_even(x):
    if x % 2 == 0: #a number is even if it can be evenly divided by 2
        return True
    else:
        return False

#call the function several times and print the results
for i in range(0, 10):
    print('Is {0} an even number? Answer: {1}'.format(i, is_even(i)))
```

CLASSES AND OBJECTS IN PYTHON

- In Python, a class is a plan or a framework for something, and an object is an instance of a class

Classes and Objects in Python

In [ ]:
```
#define a 'Movie' class to hold information about movies
class Movie():
    def __init__(self, title, year, director):
        self.title = title
        self.year = year
        self.director = director

#add a few movie objects to a 'movies' list
movies = [] #create an empty list
movies.append(Movie('Avatar', 2009, 'James Cameron'))
movies.append(Movie('Black Panther', 2018, 'Ryan Coogler'))

#print information about each movie
for movie in movies:
    print('The {0} movie {1} was directed by {2}.'.format(movie.year, movie.title, movie.director))
```

Q&A