

Session2-Numpy (Arrays Part-2)

DAwP_S2_Numpy2_1thAgu22

Training Clarusway

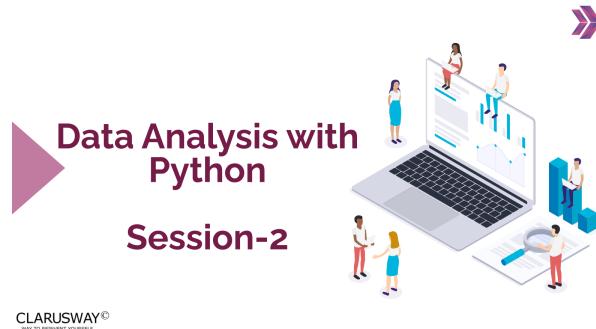
Pear Deck - August 1, 2022 at 7:04PM

Part 1 - Summary

Use this space to summarize your thoughts on the lesson

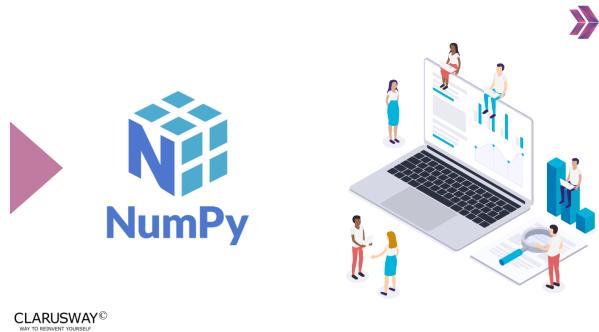
Part 2 - Responses

Slide 1



Use this space to take notes:

Slide 2



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▶ Table of Contents

- ▶ Concatenation/Splitting/Sorting of the Arrays
- ▶ Indexing of 1D Arrays
- ▶ Indexing of 2D Arrays
- ▶ Broadcasting
- ▶ Selection on a Condition
- ▶ NumPy Operations



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Slide 4

Your Response

You Chose

Slide 4

I've completed the pre-class content?

True **False**

 Pear Deck

 Students choose an option

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Your Response

- **True**

Other Choices

- False

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▶ Indexing of 1D Arrays



```
1 import numpy as np
2 a = np.arange(20, 30)
3 array([20, 21, 22, 23, 24, 25, 26, 27, 28, 29])
4 a[0]
5 20
6 a[3]
7 23
8 a[0:3]
9 array([20, 21, 22])
10 a[3:]
11 array([23, 24, 25, 26, 27, 28, 29])
12 a[1::2]
13 array([21, 23, 25, 27, 29])
```

It's similar to normal indexing of a Python list.

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▶ Indexing of 2D Arrays

```
import numpy as np  
  
a2 = np.array([[1, 2, 3],  
               [4, 5, 6],  
               [7, 8, 9]])
```



print(a2[2, 1]) # 8

Notice the syntax - the **i** and **j** values are both inside the square brackets, separated by a comma (the index is actually a tuple **(2, 1)**, but tuple packing is used). The example picks row 2, column 1, which has the value 8. This compares with the syntax you might use with a 2D list (ie a list of lists):

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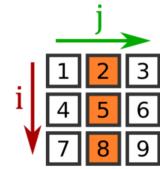
▶ Indexing of 2D Arrays

```
print(a2[:, 1]) # [2, 5, 8]
```

We are skipping ahead slightly to slicing, later in this tutorial, but what this syntax means is:

- for the **i** value, take all values (**:** is a full slice, from start to end)
- for the **j** value take 1

Giving this array [2, 5, 8]:



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Slide 8

Your Response

Slide 8

Your Response

► Slicing of 2D Arrays



| | | | | |
|----|----|----|----|----|
| 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 |

What is the code?



Students, write your response!

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Use this space to take notes:

Slide 9

► Slicing of 2D Arrays



| | | | | |
|----|----|----|----|----|
| 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 |
| 25 | 26 | 27 | 28 | 29 |

The Answer

`arr[1:, 2:4]`



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Slide 10

Broadcasting

$$\begin{matrix} (3,3) \\ \begin{array}{|c|c|c|} \hline 1 & 2 & 3 \\ \hline 4 & 5 & 6 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \end{matrix} \star \begin{matrix} (3,1) \text{ or } (1,3) \\ \begin{array}{|c|} \hline -1 & 0 & 1 \\ \hline -1 & 0 & 1 \\ \hline -1 & 0 & 1 \\ \hline \end{array} \end{matrix} = \begin{matrix} (3,3) \\ \begin{array}{|c|c|c|} \hline -1 & 0 & 3 \\ \hline -4 & 0 & 6 \\ \hline -7 & 0 & 9 \\ \hline \end{array} \end{matrix} \text{ multiplying several columns at once}$$

Rule

$$\begin{matrix} (3,3) \\ \begin{array}{|c|c|c|} \hline 1 & 2 & 3 \\ \hline 4 & 5 & 6 \\ \hline 7 & 8 & 9 \\ \hline \end{array} \end{matrix} / \begin{matrix} (3,1) \\ \begin{array}{|c|} \hline 3 & 3 & 3 \\ \hline 6 & 6 & 6 \\ \hline 9 & 9 & 9 \\ \hline \end{array} \end{matrix} = \begin{matrix} (3,3) \\ \begin{array}{|c|c|c|} \hline .3 & .7 & 1. \\ \hline .6 & .8 & 1. \\ \hline .8 & .9 & 1. \\ \hline \end{array} \end{matrix} \text{ row-wise normalization}$$

$$\begin{matrix} (3,1) \text{ or } (1,3) \\ \begin{array}{|c|} \hline 1 & 2 & 3 \\ \hline 1 & 2 & 3 \\ \hline 1 & 2 & 3 \\ \hline \end{array} \end{matrix} * \begin{matrix} (3,1) \\ \begin{array}{|c|} \hline 1 & 1 & 1 \\ \hline 2 & 2 & 2 \\ \hline 3 & 3 & 3 \\ \hline \end{array} \end{matrix} = \begin{matrix} (3,3) \\ \begin{array}{|c|c|c|} \hline 1 & 2 & 3 \\ \hline 2 & 4 & 6 \\ \hline 3 & 6 & 9 \\ \hline \end{array} \end{matrix} \text{ outer product}$$

In order to broadcast, the size of the trailing axes for both arrays in an operation must either be the same size or one of them must be one.

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Use this space to take notes:

Slide 11

Broadcasting

```
import numpy as np
a = np.arange(29,30)
a
array([29, 21, 22, 23, 24, 25, 26, 27, 28, 29])
a[::5] = 5
a
array([ 5,  5,  5, 23, 24, 25, 26, 27, 28, 29])
l = list(range(10))
l
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
l[::5] = 100
-----
TypeError                                 Traceback (most recent call last)
<ipython-input-10-5ca3a359de> in <module>
      2 l[::5] = 100
      3
TypeError: can only assign an iterable
l[::5] = [100, 100, 100]
l
[100, 100, 100, 2, 4, 5, 6, 7, 8, 9]
```

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Use this space to take notes:

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► Broadcasting

```
a = np.arange(20,30)
a
array([20, 21, 22, 23, 24, 25, 26, 27, 28, 29])

a_slice = a[:5]
a_slice
array([20, 21, 22, 23, 24])

a_slice[:3] = 5
a_slice
array([ 5,  5,  5, 23, 24])

a
array([ 5,  5,  5, 23, 24, 25, 26, 27, 28, 29])
```

```
a = np.arange(20,30)
a
array([20, 21, 22, 23, 24, 25, 26, 27, 28, 29])

a_copy = a.copy()
a_slice = a_copy[:5]
a_slice
array([20, 21, 22, 23, 24])

a_slice[:3] = 5
a_slice
array([ 5,  5,  5, 23, 24])

a
array([20, 21, 22, 23, 24, 25, 26, 27, 28, 29])
```

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Use this space to take notes:

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► Selection on a Condition

```
a = np.random.randint(1, 100, 15)
a
array([66, 93, 22, 91, 24, 66, 72, 67, 54, 85, 90, 50, 28, 67, 34])

a < 50
array([False, False, True, False, True, False, False, False,
       False, False, True, False, True, False, True])

a[a < 50]
array([22, 24, 28, 34])

a[(a < 25) | (a > 75)]
array([93, 22, 91, 24, 85, 90])

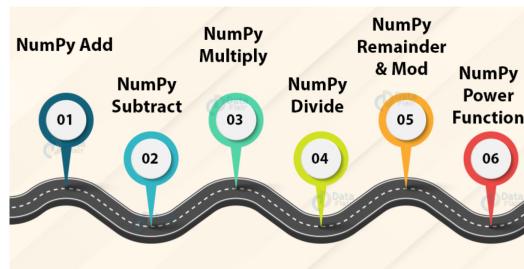
a[(a > 25) & (a < 75)]
array([66, 66, 72, 67, 54, 50, 28, 67, 34])
```

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Use this space to take notes:

Slide 14

▶ NumPy Operations



Use this space to take notes:

Slide 15

▶ NumPy Operations

Arithmetic Operations & Universal Array Functions

| | |
|--|--|
| <pre>a = np.array([10, 20, 30, 40]) b = np.array([5, 5, 5, 5])</pre> | <pre>a2 = np.array([4, 9, 16, 25]) b2 = np.array([2, 2, 2, 2])</pre> |
| <pre>Addition np.add(a,b) = a+b =[15,25,35,45]</pre> | <pre>Square Root np.sqrt(a2) =[2,3,4,5]</pre> |
| <pre>Subtraction np.subtract(a,b) = a-b =[5,15,25,35]</pre> | <pre>Power np.power(a2,b2) =[16,81,256,625]</pre> |
| <pre>Multiplication np.multiply(a,b) = a*b =[50,100,150,200]</pre> | <pre>Mod/Remainder np.mod(a2,b2) = np.remainder(a2+b2) =[0,1,0,1]</pre> |
| <pre>Division np.divide(a,b) = a/b =[2,4,6,8]</pre> | <pre>Exponential np.exp([1, 3, 5]) =[2.71828183 20.08553692 148.4131591]</pre> |

Use this space to take notes:

Slide 16

▶ NumPy Operations

► Statistical Calculations

- np.mean(arr,axis=0) => Returns mean along specific axis
- arr.sum() => Returns sum of arr
- arr.min() => Returns minimum value of arr
- arr.max(axis=0) => Returns maximum value of specific axis
- np.var(arr) => Returns the variance of array
- np.std(arr,axis=1) => Returns the standard deviation of specific axis
- np.corrcoef(arr) => Returns correlation coefficient of array



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Use this space to take notes:

Slide 17

▶ Data Analysis with Python



let's start the
hands-on phase



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Use this space to take notes:

Slide 18

Your Response

Slide 18

Your Response

Did you find this lesson interesting and challenging?

Too hard Just right Too easy

SMILE Students, drag the icon!

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Use this space to take notes:

Slide 19

THANKS!
Any questions?

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