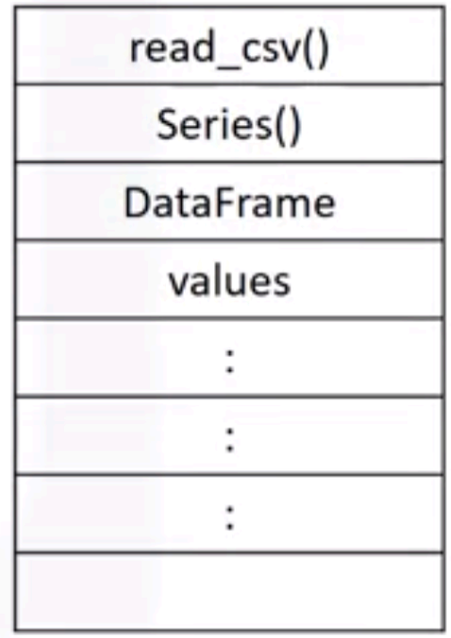
PYTHON
Pandas: Loading Data

Importing Pandas

```
import pandas

csv_path='file1.csv'

df=pandas.read_csv(csv_path)
```



Importing

```
import pandas as pd

csv_path='file1.csv'

df= pd.read_csv(csv_path)
```

Dataframes

```
csv_path='file1.csv'
df= pd.read_csv(csv_path)
df.head()
```

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
1	AC/DC	Back in Black	1980	0:42:11	hard rock	26.1	50	25-Jul-80	NaN	9.5
2	Pink Floyd	The Dark Side of the Moon	1973	0:42:49	progressive rock	24.2	45	01-Mar-73	NaN	9.0
3	Whitney Houston	The Bodyguard	1992	0:57:44	R&B, soul, pop	27.4	44	17-Nov-92	Y	8.5
4	Meat Loaf	Bat Out of Hell	1977	0:46:33	hard rock, progressive rock	20.6	43	21-Oct-77	NaN	8.0

Dataframes

```
xlsx_path='file1.xlsx'
df= pd.read_excel (xlsx_path)
df.head()
```

click to scroll output; double click to hide

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
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3	Whitney Houston	The Bodyguard	1992	0:57:44	R&B, soul, pop	27.4	44	17-Nov-92	Y	8.5
4	Meat Loaf	Bat Out of Hell	1977	0:46:33	hard rock, progressive rock	20.6	43	21-Oct-77	NaN	8.0

Dataframes

```
songs = {'Album' : ['Thriller','Back in Black', 'The Dark Side of the Moon',\
'The Bodyguard','Bat Out of Hell'],
 'Released' : [1982,1980,1973,1992,1977],
'Length':['00:42:19','00:42:11','00:42:49','00:57:44','00:46:33']}
```

	Album	Length	Released
0	Thriller	00:42:19	1982
1	Back in Black	00:42:11	1980
2	The Dark Side of the Moon	00:42:49	1973
3	The Bodyguard	00:57:44	1992
4	Bat Out of Hell	00:46:33	1977

x=df[['Length']]

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
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4	Meat Loaf	Bat Out of Hell	1977	0:46:33	ard rock, rogressive rock	20.6	43	21-Oct-77	NaN	8.0
5	Eagles	Their Greatest Hits (1971-1975)	1976	0:43:08	ock, soft rock, olk rock	32.2	42	17-Feb-76	NaN	7.5
6	Bee Gees	Saturday Night Fever	1977	1:15:54	isco	20.6	40	15-Nov-77	Y	7.0
7	Fleetwood Mac	Rumours	1977	0:40:01	oft rock	27.9	40	04-Feb-77	NaN	6.5

x

	Length
0	0:42:19
1	0:42:11
2	0:42:49
3	0:57:44
4	0:46:33
5	0:43:08
6	1:15:54
7	0:40:01

y=df[['Artist' ,'Length', 'Genre ']]

	Artist	Album	Release	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
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	Bee Gees	Saturday Night Fever	1977	1:15:54	disco	20.6	40	15-Nov-77	Y	7.0
	Fleetwood Mac	Rumours	1977	0:40:01	soft rock	27.9	40	04-Feb-77	NaN	6.5

	Artist	Length	Genre
0	Michael Jackson	0:42:19	pop, rock, R&B
1	AC/DC	0:42:11	hard rock
2	Pink Floyd	0:42:49	progressive rock
3	Whitney Houston	0:57:44	R&B, soul, pop
4	Meat Loaf	0:46:33	hard rock, progressive rock
5	Eagles	0:43:08	rock, soft rock, folk rock
6	Bee Gees	1:15:54	disco
7	Fleetwood Mac	0:40:01	soft rock

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df.ix[0,0]:'Michael Jackson'

df.ix[1,0]:’AC/DC'

z=df.ix[0:2, 0:3]

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
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7	Fleetwood Mac	Rumours	1977	0:40:01	soft rock	27.9	40	04-Feb-77	NaN	6.5

z

	Artist	Album	Released
0	Michael Jackson	Thriller	1982
1	AC/DC	Back in Black	1980
2	Pink Floyd	The Dark Side of the Moon	1973

```
z=df.ix[0:2, 'Artist':'Released']
```

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
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7	Fleetwood Mac	Rumours	1977	0:40:01	soft rock	27.9	40	04-Feb-77	NaN	6.5

z

	Artist	Album	Released
0	Michael Jackson	Thriller	1982
1	AC/DC	Back in Black	1980
2	Pink Floyd	The Dark Side of the Moon	1973

Pandas

Working with and Saving data

df['Released'].unique()

	Released
0	1982
1	1980
2	1973
3	1992
4	1977
5	1976
6	1977
7	1977

1982
1980
1973
1992
1977
1976

df['Released']>=1980

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	0:42:19	pop, rock, R&B	46.0	65	30-Nov-82	NaN	10.0
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6	Bee Gees	Saturday Night Fever	1977	1:15:54	disco	20.6	40	15-Nov-77	Y	7.0
7	Fleetwood Mac	Rumours	1977	0:40:01	soft rock	27.9	40	04-Feb-77	NaN	6.5

0	True
2	True
3	False
4	True
5	False
6	False
7	False
8	False

```
df1=df[df['Released']>=1980]
```

	Artist	Album	Released	Length	Genre	Music Recording Sales (millions)	Claimed Sales (millions)	Released.1	Soundtrack	Rating
0	Michael Jackson	Thriller	1982	00:42:19	pop, rock, R&B	46.0	65	1982-11-30	NaN	10.0
1	AC/DC	Back in Black	1980	00:42:11	hard rock	26.1	50	1980-07-25	NaN	9.5
3	Whitney Houston	The Bodyguard	1992	00:57:44	R&B, soul, pop	27.4	44	1992-11-17	Y	8.5

df1

Save as CCV

```
df1. to_csv('new_songes.csv')
```

PYTHON
1D Numpy

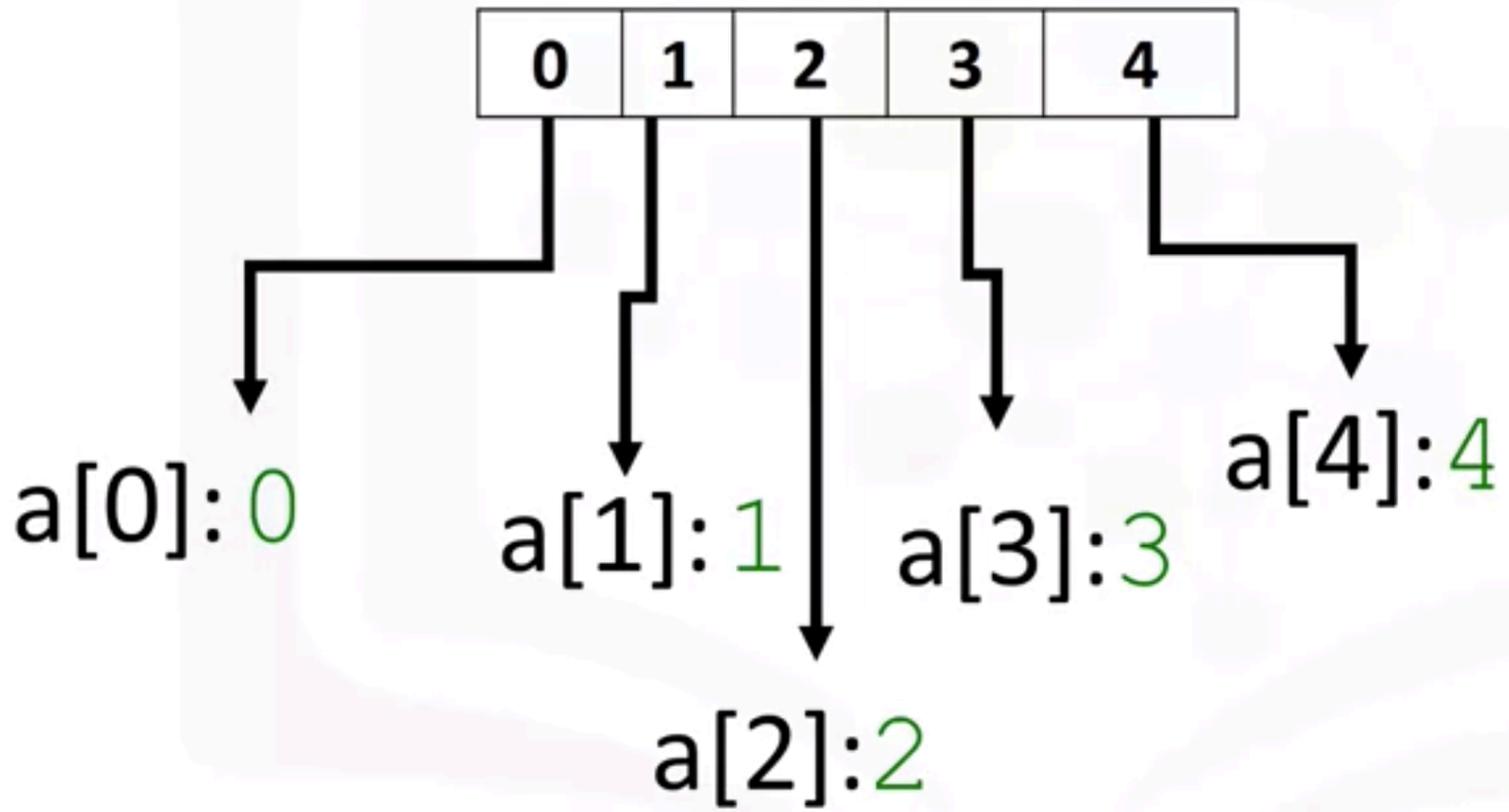
Objectives

- The Basics and Array Creation
- Indexing and Slicing

The Basics & Array Creation

COGNITIVE CLASS.ai

```
import numpy as np
a=np.array( [0,1,2,3,4] )
```



```
a:array([0,1,2,3, 4])
type(a): numpy.ndarray
a.dtype:dtype('int64')
```

```
a=np.array( [0,1,2,3,4] )
```

1	2	3	4	5

a.size :5

a.ndim: 1

a.shape: (5,)

COGNITIVE CLASS.ai

```
b=np.array([3.1,11.02,6.2, 213.2,5.2])
```

type(b): numpy.ndarray

b.dtype:dtype('float64')

```
c=np.array([20,1,2,3, 4])
c:array([20,1,2,3, 4])

c[0]=100
c:array([100,1,2,3,4])

c[4]=0
c:array([100,1,2,3,0])
```

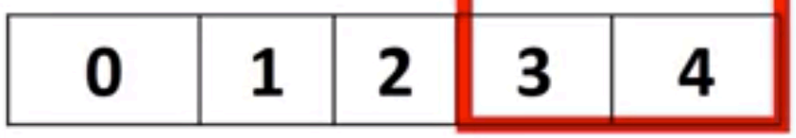
c:array([100, 1, 2, 3, 0])

0	1	2	3	4

d=c[1:4]

d:array([1, 2, 3])

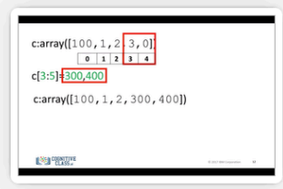
c:array([100,1,2,3,0])



c[3:5]=300,400

c:array([100,1,2,300,400])

Basic Operations

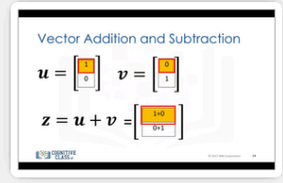


Vector Addition and Subtraction

$$\boldsymbol{u} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \qquad \boldsymbol{v} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$\boldsymbol{z} = \boldsymbol{u} + \boldsymbol{v} = \begin{bmatrix} 1+0 \\ 0+1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

COGNITIVE CLASS.ai



Array multiplication with a Scalar

$$y = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

$$z = 2y = \begin{bmatrix} 2(1) \\ 2(2) \end{bmatrix}$$

COGNITIVE CLASS.ai

Product of two numpy arrays

$$u = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad v = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

$$z = u \circ v = \begin{bmatrix} 1*3 \\ 2*2 \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$$

COGNITIVE CLASS.ai

Dot Product

$$\boldsymbol{u} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \qquad \boldsymbol{v} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

$$\boldsymbol{u}^T\boldsymbol{v} = \boxed{1} \times \boxed{3} + \boxed{2} \times \boxed{1} = 5$$

```
u=np.array([1,2])
v=np.array([3,1])

result =np.dot(u,v)
```

result :5

Adding Constant to an numpy Array

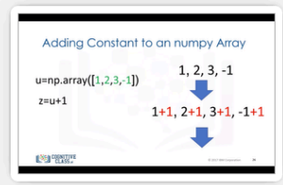
```
u=np.array([1,2,3,-1])

z=u+1
```

1, 2, 3, -1

1+1, 2+1, 3+1, -1+1

Universal Functions



Universal Functions

```
a=np.array([1,-1,1,-1])
mean_a=a.mean()
mean_a:0.0
```

$$\frac{1}{4}\ (1-1+1-1)$$

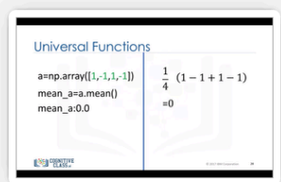
$$=0$$

Universal Functions

```
b=np.array([1, -2,3,4,5])

max_b=b.max()
```

max_b:5



Universal Functions

```
np.pi

x=np.array([ 0 , np.pi/2, np.pi ] )

y=np.sin(x)

y:array([ 0,1, 1.2e-16])
```

$$\pi$$

$$\boldsymbol{x} = [0, \frac{\pi}{2}, \pi]$$

$$\boldsymbol{y} = [\sin(0), \sin(\frac{\pi}{2}), \sin(\pi)]$$

$$\boldsymbol{y} = [0,1,0]$$

COGNITIVE CLASS.ai

np.linspace(-2,2,num=5)

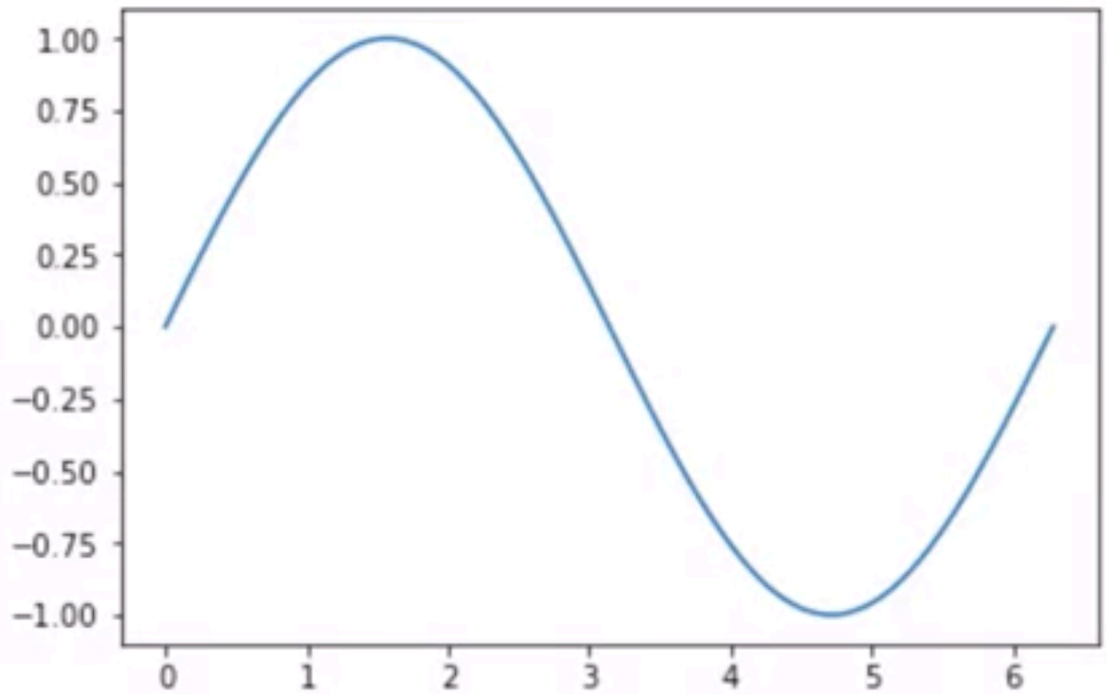
-2	-1	0	1	2

1	2	3	4	5

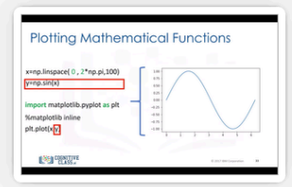
Plotting Mathematical Functions

```
x=np.linspace( 0 , 2*np.pi,100)
y=np.sin(x)
```

```
import matplotlib.pyplot as plt
%matplotlib inline
plt.plot(x,y)
```



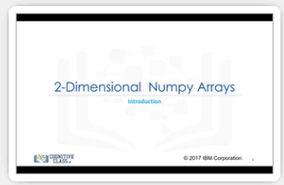
COGNITIVE CLASS.ai



2-Dimensional Numpy Arrays

Introduction

Table of Contents



$$a = [[11, 12, 13], [21, 22, 23], [31, 32, 33]]$$

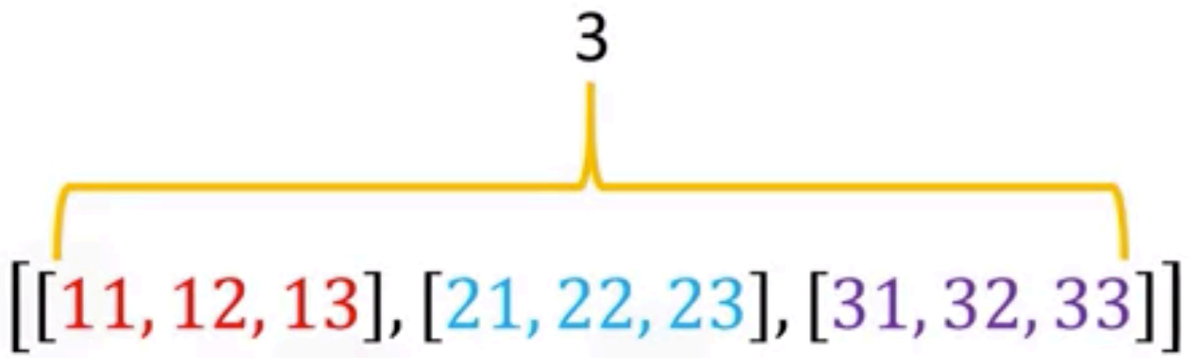
$$\mathrm{A} = \mathrm{np.array(a)}$$

$$\mathrm{A:} \begin{bmatrix} 11 & 12 & 13 \\ 21 & 22 & 23 \\ 31 & 32 & 33 \end{bmatrix}$$

A.ndim:2

A.ndim:2

A.shape: (3,3)

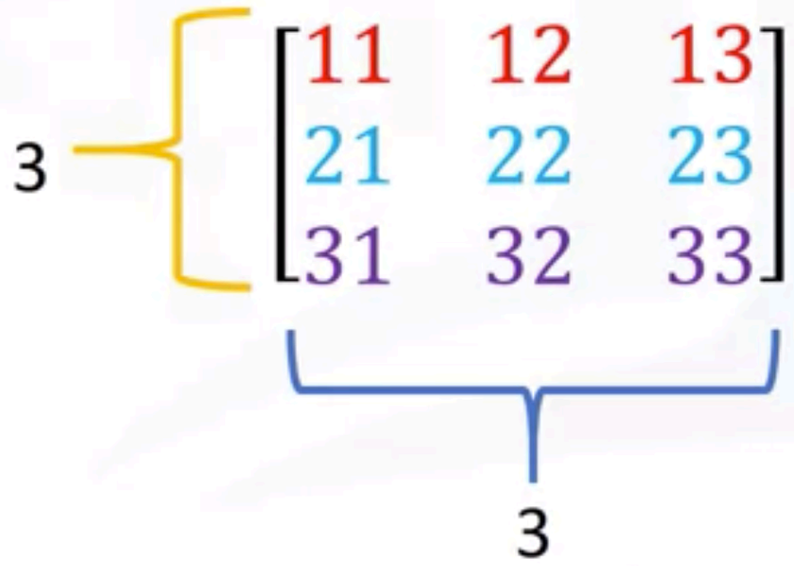


A.ndim:2

A.shape: (3,3)

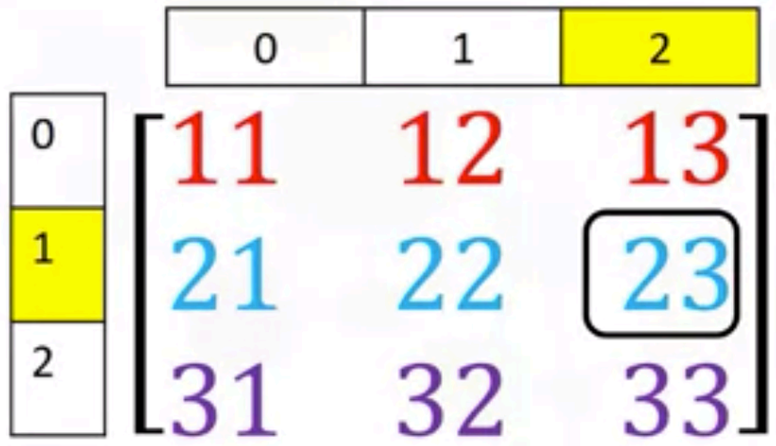
A.size : 9

[[11, 12, 13], [21, 22, 23], [31, 32, 33]]



$$A = [[11, 12, 13], [21, 22, 23], [31, 32, 33]]$$

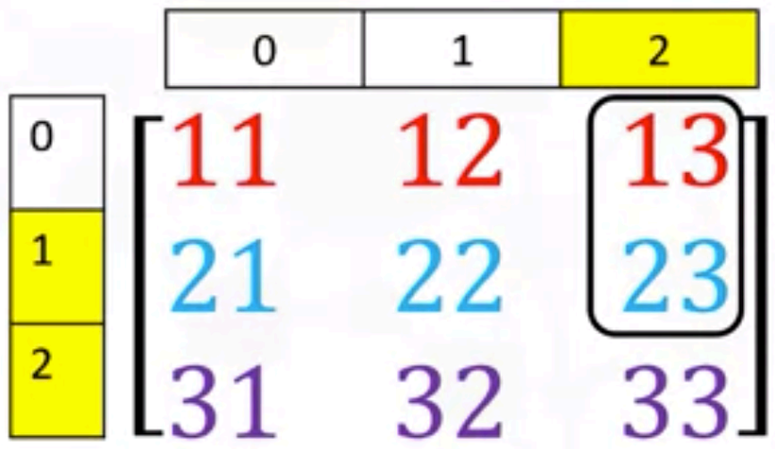
A[1][2] : 23



Example 4.2

$$A = [[11, 12, 13], [21, 22, 23], [31, 32, 33]]$$

A[0: 2,2]:array([13, 23])



Example 4.2

```
X=np.array([[1,0],[0,1]])
Y=np.array([[2,1],[1,2]])
Z=X+Y;
Z:array([[3,1],
         [1,3]])
```

$$X = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$Y = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

$$Z = X + Y$$

$$Z = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$$

COGNITIVE CLASS.ai

```
Y=np.array([[2,1],[1,2]])

Z=2*Y;

Z:array([[4,2],
         [2,4]])
```

$$\boldsymbol{Y} = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

$$\boldsymbol{Z} = 2\boldsymbol{Y} = \begin{bmatrix} (2)2 & (2)1 \\ (2)1 & (2)2 \end{bmatrix}$$

$$\boldsymbol{Z} = \begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$$

COGNITIVE CLASS.ai

```
X=np.array([[1,0],[0,1]])
Y=np.array([[2,1][1,2]])
Z=X*Y;
Z:array([[2,0],
         [0,2]])
```

$$X = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$Y = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

$$Z = X \circ Y = \begin{bmatrix} (1)2 & (0)1 \\ (0)1 & (1)2 \end{bmatrix}$$

$$Z = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$$

COGNITIVE CLASS.ai

$$\boldsymbol{A} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

$$\boldsymbol{B} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ -1 & 1 \end{bmatrix}$$

$$1 \times 1 + 0 \times 1 + (1) \times 1 = 2$$

$$\boldsymbol{A}\,\boldsymbol{B} = \begin{bmatrix} 0 & 2 \\ 0 & 2 \end{bmatrix}$$

COGNITIVE CLASS.ai