Data Science & AI
&
NIC - Param

Python-For Data Science

Numpy

Lecture No.- 02

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Recap of Previous Lecture

Topic NumPy Part 01

np.zeros()
np.ones()
np.full()
np.empty()
np.array()
np.arange()
np.linspace()

np.identity()
np.eye()

Topics to be Covered

Topic NumPy Part 02

slicing, indexing,

boolean indexing

→ imp ✓

Topic : NumPy

✓

$$\begin{array}{l} \quad\;\; 0 \quad\; 1 \quad\; 2 \quad\; 3 \quad\; 4 \\ l = [\boxed{10, 20, 30}, 40, 50] \end{array}$$

n_arr = np.array(l ,dtype = int)

$\left\{ \begin{array}{l} \text{l[0]} \\ \text{n\_arr[0]} \end{array} \right\}$ same $\left\{ \begin{array}{l} \text{print(l [0 : 3])} \\ \text{print(n\_arr [0 : 3])} \end{array} \right.$ → some result l1[2:4][1]

l1[2:4][4]

Error

2, 3

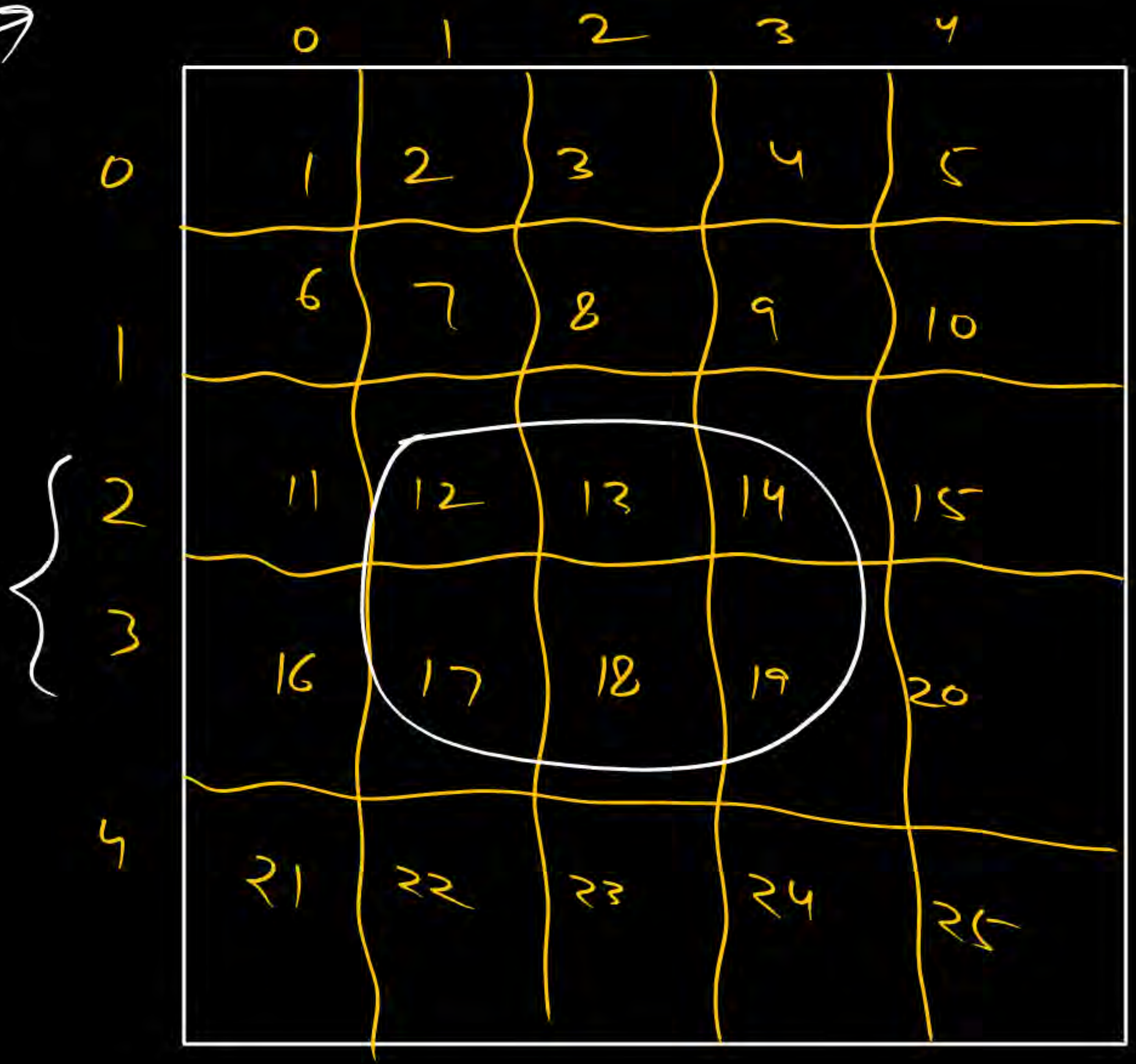
$$\left[\begin{array}{l}\overset{0}{[11, 12, 13, 14, 15]},\\ \underset{1}{[16, 17, 18, 19, 20]}\end{array}\right]$$

	0	1	2	3	4
0	1	2	3	4	5
1	6	7	8	9	10
2	11	12	13	14	15
3	16	17	18	19	20
4	21	22	23	24	25

numpy

Rahul sir

narr1[2:4, 1:4]



	0	1	2	3	4
0	1	2	3	4	5
1	6	7	8	9	10
2	11	12	13	14	15
3	16	17	18	19	20
4	21	22	23	24	25

numpy → 3   read this

file handling

```
file_object = Open( filename, 'r' )
                               'w'
                               'a'

s = file-object.read()

list_of_lines = file-object.readlines()
```

Numpy ✓

file handling ✓

Pandas → 3-4 lectures

```
In [1]: import numpy as np
        l=[10,20,30,40,50,60]
        narr=np.array(l,dtype=int)
```

```
In [2]: print(l)
```

```
[10, 20, 30, 40, 50, 60]
```

```
In [3]: print(narr)
```

```
[10 20 30 40 50 60]
```

```
In [4]: #collection of pointers/refrences
        #data ===>first element
        #shape
        #dtype
        #strides
```

```
In [5]: print(narr.shape)
```

```
(6,)
```

```
In [6]: print(narr.data)
        print(narr.shape)#1D ==>6 * 1 ===> (6,)
        print(narr.dtype)#4 bytes
        print(narr.strides)# ==>how many bytes to cross to move from 1 element to other
```

```
<memory at 0x0000024AB8CE6680>
(6,)
int32
(4,)
```

```
In [7]: l1=[[1,2,3,4,5],[6,7,8,9,10],[11,12,13,14,15],[16,17,18,19,20],[21,22,23,24,25]]
        narr1=np.array(l1,dtype=int)
```

```
In [8]: print(l1)
        print(narr1)
```

```
[[1, 2, 3, 4, 5], [6, 7, 8, 9, 10], [11, 12, 13, 14, 15], [16, 17, 18, 19, 20], [21,
22, 23, 24, 25]]
[[ 1  2  3  4  5]
 [ 6  7  8  9 10]
 [11 12 13 14 15]
 [16 17 18 19 20]
 [21 22 23 24 25]]
```

```
In [9]: print(narr1.data)
        print(narr1.shape)#2D array ==>5 rows and 5 cols
        print(narr1.dtype)
        print(narr.strides)
```

```
<memory at 0x0000024AB916F920>
(5, 5)
int32
(4,)
```

```
In [11]: l1[1][3]  #===>2nd row ka 4th element(col)
```

Out[11]:
```
9
```

In [12]:
```
narr1[1][3]
```

Out[12]:
```
9
```

In [13]:
```
narr1[1,3] #same as narr1[1][3]
```

Out[13]:
```
9
```

In [14]:
```
l1[1][1:4]  #2nd,3rd,4th col of row index 1(2nd row)
```

Out[14]:
```
[7, 8, 9]
```

In [17]:
```
print(narr1[1][1:4])
```

```
[7 8 9]
```

In [20]:
```
l1[2:4][0]
```

Out[20]:
```
[11, 12, 13, 14, 15]
```

In [22]:
```
print(narr1[2:4,4])#it will work
```

```
[15 20]
```

In [23]:
```
narr1[2:4,1:4]
```

Out[23]:
```
array([[12, 13, 14],
       [17, 18, 19]])
```

In [24]:
```
#operations
```

In [25]:
```
l2=[10,20,30,40,50,60]
```

In [26]:
```
x=np.random.randint(1,30,6)
y=np.random.randint(1,30,6)
print(l2)
print(x)
print(y)
```

```
[10, 20, 30, 40, 50, 60]
[26  4 21 26 22 17]
[ 5 11  3 20 24 23]
```

In [27]:
```
#doubling each element of list
l2=[2*i for i in l2]
l2
```

Out[27]:
```
[20, 40, 60, 80, 100, 120]
```

In [28]:
```
x=x*2
x
```

Out[28]:
```
array([52,  8, 42, 52, 44, 34])
```

```
In [29]: print(x)
         print(y)

         [52  8 42 52 44 34]
         [ 5 11  3 20 24 23]
```

```
In [30]: z=x+y #it will work fine
```

```
In [31]: z

Out[31]: array([57, 19, 45, 72, 68, 57])
```

```
In [32]: n1=x+y
         n2=x-y
         n3=x*y
```

```
In [33]: n1

Out[33]: array([57, 19, 45, 72, 68, 57])
```

```
In [34]: n2

Out[34]: array([47, -3, 39, 32, 20, 11])
```

```
In [35]: n3

Out[35]: array([ 260,   88,  126, 1040, 1056,  782])
```

```
In [36]: n4=x/y
```

```
In [37]: n4

Out[37]: array([10.4       ,  0.72727273, 14.        ,  2.6       ,  1.83333333,
                 1.47826087])
```

```
In [38]: n5=x**y
```

```
In [39]: n5

Out[39]: array([380204032,         0,     74088,         0,         0, 947912704])
```

```
In [40]: x=np.array([2,3,4,5,6],dtype=int)
         y=np.array([1,2,3,4,5],dtype=int)
         x**y

Out[40]: array([   2,    9,   64,  625, 7776])
```

```
In [41]: x

Out[41]: array([2, 3, 4, 5, 6])
```

```
In [42]: x.sum()

Out[42]: 20
```

```
In [43]:  x.mean()

Out[43]:  4.0

In [44]:  x.min()

Out[44]:  2

In [45]:  x.max()

Out[45]:  6

In [46]:  x.argmin() #===>index of min element

Out[46]:  0

In [47]:  x.argmax()

Out[47]:  4

In [48]:  #narray ===>relational

In [49]:  x=np.random.randint(1,30,6)
          y=np.random.randint(1,30,6)

In [50]:  print(x)

          [ 3  6 18 19 18 14]

In [51]:  print(y)

          [12  9 21  6 27 22]

In [52]:  x>y #[3>12  6>9  18>21  19>6   18>27   14>22]

Out[52]:  array([False, False, False,  True, False, False])

In [53]:  x<y

Out[53]:  array([ True,  True,  True, False,  True,  True])

In [54]:  x==y

Out[54]:  array([False, False, False, False, False, False])

In [55]:  x!=y

Out[55]:  array([ True,  True,  True,  True,  True,  True])

In [56]:  #logical operator #np.logical_or   np.logical_and    np.logical_not
          x=np.array([12,3,44,0,56,90],dtype=int)
          y=np.array([1,2,3,4,0,23],dtype=int)
```

In [57]:
```
print(x)
print(y)
```
```
[12  3 44  0 56 90]
[ 1  2  3  4  0 23]
```

In [58]:
```
print(np.logical_or(x,y))
```
```
[ True  True  True  True  True  True]
```

In [59]:
```
print(np.logical_and(x,y))
```
```
[ True  True  True False False  True]
```

In [60]:
```
print(np.logical_not(x))
```
```
[False False False  True False False]
```

In [61]:
```
y
```
Out[61]:
```
array([ 1,  2,  3,  4,  0, 23])
```

In [62]:
```
print(np.logical_not(y))
```
```
[False False False False  True False]
```

In [63]:
```
#boolean indexing
x=np.array([1,23,4,56,7,89,900],dtype=int)
y=np.random.randint(1,100,7)
```

In [64]:
```
print(x)
print(y)
```
```
[  1  23   4  56   7  89 900]
[26 30 35 42 62 58 43]
```

In [65]:
```
print(y>30) #boolean array ayega ===>[26>30    30>30   35>30 .......]
```
```
[False False  True  True  True  True  True]
```

In [66]:
```
boolean_array=y>30
```

In [67]:
```
print(boolean_array)
```
```
[False False  True  True  True  True  True]
```

In [68]:
```
arr1=y[boolean_array]
```

In [69]:
```
arr1
```
Out[69]:
```
array([35, 42, 62, 58, 43])
```

In [70]:
```
arr2=y[y>30]#y[condition]
```

In [71]:
```
arr2
```
Out[71]:
```
array([35, 42, 62, 58, 43])
```

```
In [75]: arr3=y[ (y>30) &  (y<50)]
```

```
In [76]: arr3

Out[76]: array([35, 42, 43])
```

```
In [77]: y

Out[77]: array([26, 30, 35, 42, 62, 58, 43])
```

```
In [78]: x=y
```

```
In [79]: print(x)

[26 30 35 42 62 58 43]
```

```
In [80]: print(y)

[26 30 35 42 62 58 43]
```

```
In [81]: x[0]=126 #1 element got change
```

```
In [82]: x

Out[82]: array([126,  30,  35,  42,  62,  58,  43])
```

```
In [83]: x[0:4] #index 0,1,2,3 element 1st,2nd,3rd,4th

Out[83]: array([126,  30,  35,  42])
```

```
In [84]: x[0:4]=100
```

```
In [85]: x

Out[85]: array([100, 100, 100, 100,  62,  58,  43])
```

```
In [86]: print(x)

[100 100 100 100  62  58  43]
```

```
In [87]: x[x>70]=20
```

```
In [88]: x

Out[88]: array([20, 20, 20, 20, 62, 58, 43])
```

```
In [89]: x==20

Out[89]: array([ True,  True,  True,  True, False, False, False])
```

```
In [90]: indexes=np.where(x==20)
```

```
In [91]: indexes
```

```
Out[91]: (array([0, 1, 2, 3], dtype=int64),)
```

```
In [92]: x=np.random.randint(1,50,(4,5))#4rows 5 cols
```

```
In [93]: print(x)
```

```
[[30 38 25 45 45]
 [ 8 42 40 42 49]
 [30 18 27 13 23]
 [34 28 49  2 11]]
```

```
In [94]: x>25
```

```
Out[94]: array([[ True,  True, False,  True,  True],
                [False,  True,  True,  True,  True],
                [ True, False,  True, False, False],
                [ True,  True,  True, False, False]])
```

```
In [95]: boolean_arr=x>25
```

```
In [96]: boolean_arr
```

```
Out[96]: array([[ True,  True, False,  True,  True],
                [False,  True,  True,  True,  True],
                [ True, False,  True, False, False],
                [ True,  True,  True, False, False]])
```

```
In [97]: print(x[boolean_arr])
```

```
[30 38 45 45 42 40 42 49 30 27 34 28 49]
```

```
In [98]: y=x
```

```
In [99]: x
```

```
Out[99]: array([[30, 38, 25, 45, 45],
                [ 8, 42, 40, 42, 49],
                [30, 18, 27, 13, 23],
                [34, 28, 49,  2, 11]])
```

```
In [100…: y
```

```
Out[100]: array([[30, 38, 25, 45, 45],
                 [ 8, 42, 40, 42, 49],
                 [30, 18, 27, 13, 23],
                 [34, 28, 49,  2, 11]])
```

```
In [101…: boolean_arr
```

```
Out[101]: array([[ True,  True, False,  True,  True],
                 [False,  True,  True,  True,  True],
                 [ True, False,  True, False, False],
                 [ True,  True,  True, False, False]])
```

```
In [102…: #size is same for boolean_arr ,x and y
```

```
In [103…: x[boolean_arr]=0
```

```
In [104…: x
```

```
Out[104]: array([[ 0,  0, 25,  0,  0],
                 [ 8,  0,  0,  0,  0],
                 [ 0, 18,  0, 13, 23],
                 [ 0,  0,  0,  2, 11]])
```

```
In [105…  x=np.random.randint(10,20,(3,3))
```

```
In [106…  y=np.random.randint(10,20,(2,3))
```

```
In [107…  x
```

```
Out[107]: array([[18, 14, 13],
                 [18, 10, 18],
                 [14, 17, 10]])
```

```
In [108…  y
```

```
Out[108]: array([[10, 12, 11],
                 [11, 13, 10]])
```

```
In [109…  boolean_arr=np.array([[True,False],[False,True]])
```

```
In [110…  boolean_arr
```

```
Out[110]: array([[ True, False],
                 [False,  True]])
```

```
In [111…  y[boolean_arr] #y===>         (2,3)
                         #boolean_arr==>(2,2)
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
Cell In[111], line 1
----> 1 y[boolean_arr]

IndexError: boolean index did not match indexed array along dimension 1; dimension is
3 but corresponding boolean dimension is 2
```

```
In [112…  x[boolean_arr]
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
Cell In[112], line 1
----> 1 x[boolean_arr]

IndexError: boolean index did not match indexed array along dimension 0; dimension is
3 but corresponding boolean dimension is 2
```

```
In [ ]:
```

THANK - YOU