

NUMPY

```
In [1]: import numpy as np  
  
In [2]: np.__version__  
  
Out[2]: '2.3.4'  
  
In [4]: np.arange(10)  
  
Out[4]: array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])  
  
In [5]: np.arange(2,12,2)  
  
Out[5]: array([ 2,  4,  6,  8, 10])
```

CREATION IN NUMPY

```
In [8]: import numpy as np  
  
In [11]: np.array([1,2,3]) # 1D array  
  
Out[11]: array([1, 2, 3])  
  
In [14]: np.array([[1,2,3],[10,20,30]]) # 2D array  
  
Out[14]: array([[ 1,  2,  3],  
                 [10, 20, 30]])  
  
In [17]: np.zeros([2,3]) # 2*3 of zeros element  
  
Out[17]: array([[0., 0., 0.],  
                 [0., 0., 0.]])  
  
In [18]: np.zeros((2,3))  
  
Out[18]: array([[0., 0., 0.],  
                 [0., 0., 0.]])  
  
In [20]: np.ones((3,3))  
  
Out[20]: array([[1., 1., 1.],  
                 [1., 1., 1.],  
                 [1., 1., 1.]])  
  
In [2]: import numpy as np  
  
In [4]: np.__version__  
  
Out[4]: '2.3.4'
```

```
In [5]: my_list=[0,1,2,3,4,5]
my_list
```

```
Out[5]: [0, 1, 2, 3, 4, 5]
```

```
In [6]: type(my_list)
```

```
Out[6]: list
```

```
In [10]: import numpy as np
```

```
In [13]: my_list=[1,2,3,4,5]
my_list
```

```
Out[13]: [1, 2, 3, 4, 5]
```

```
In [14]: arr=np.array(my_list)
```

```
In [15]: arr=np.array(my_list)
```

```
In [16]: arr
```

```
Out[16]: array([1, 2, 3, 4, 5])
```

```
In [19]: type(arr)
```

```
Out[19]: numpy.ndarray
```

```
In [14]: import numpy as np
```

```
In [17]: type(arr)
```

```
Out[17]: numpy.ndarray
```

```
In [16]: np.arange(10)
```

```
Out[16]: array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
In [20]: np.arange(15)
```

```
Out[20]: array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14])
```

```
In [17]: np.arange(5.0)
```

```
Out[17]: array([0., 1., 2., 3., 4.])
```

```
In [18]: np.arange(0,5)
```

```
Out[18]: array([0, 1, 2, 3, 4])
```

```
In [19]: np.arange(10,20)
```

```
Out[19]: array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

```
In [20]: np.arange(20,10)
```

```
Out[20]: array([], dtype=int64)
```

```
In [22]: np.arange(-20,10)
```

```
Out[22]: array([-20, -19, -18, -17, -16, -15, -14, -13, -12, -11, -10, -9, -8,
 -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5,
 6, 7, 8, 9])
```

```
In [24]: ar=np.arange(-30,20)
print(ar)
```

```
[-30 -29 -28 -27 -26 -25 -24 -23 -22 -21 -20 -19 -18 -17 -16 -15 -14 -13
 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5
 6 7 8 9 10 11 12 13 14 15 16 17 18 19]
```

```
In [22]: np.arange(-16,10)
```

```
Out[22]: array([-16, -15, -14, -13, -12, -11, -10, -9, -8, -7, -6, -5, -4,
 -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
In [23]: np.arange(-20,-10)
```

```
Out[23]: array([-20, -19, -18, -17, -16, -15, -14, -13, -12, -11])
```

```
In [25]: np.arange()
```

```
-----
TypeError                                         Traceback (most recent call last)
Cell In[25], line 1
----> 1 np.arange()

TypeError: arange() requires stop to be specified.
```

```
In [24]: np.arange(10,10)
```

```
Out[24]: array([], dtype=int64)
```

```
In [26]: np.arange(10,30,5)
```

```
Out[26]: array([10, 15, 20, 25])
```

```
In [27]: np.arange(0,10,3)
```

```
Out[27]: array([0, 3, 6, 9])
```

```
In [28]: np.arange(10,30,5,8)
```

```
-----
TypeError                                         Traceback (most recent call last)
Cell In[28], line 1
----> 1 np.arange(10,30,5,8)

TypeError: Cannot interpret '8' as a data type
```

```
In [29]: np.zeros(10)
```

```
Out[29]: array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])
```

```
In [25]: np.zeros(3)
```

```
Out[25]: array([0., 0., 0.])
```

```
In [30]: np.zeros(3,dtype=int)
```

```
Out[30]: array([0, 0, 0])
```

```
In [33]: np.zeros((2,10))
```

```
Out[33]: array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],  
                [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

```
In [26]: np.zeros((2,2))
```

```
Out[26]: array([[0., 0.],  
                 [0., 0.]])
```

```
In [34]: np.zeros((10,10),dtype=int)
```

```
Out[34]: array([[0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],  
                  [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]])
```

```
In [27]: zero=np.zeros([2,2])  
print(zero)  
print(type(zero))
```

```
[[0. 0.]  
 [0. 0.]]  
<class 'numpy.ndarray'>
```

```
In [28]: zero=np.zeros([2,2])  
print(zero)  
print('####')  
print(type(zero))
```

```
[[0. 0.]  
 [0. 0.]]  
####  
<class 'numpy.ndarray'>
```

```
In [30]: np.zeros((5,10))
```

```
Out[30]: array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],  
                  [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],  
                  [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],  
                  [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],  
                  [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

```
In [31]: n=(6,7)  
n1=(6,8)
```

```
print(np.zeros(n1)) #parameter tuning  
[[0. 0. 0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0. 0. 0.]  
 [0. 0. 0. 0. 0. 0. 0. 0.]
```

In [32]: `print(np.zeros(n,dtype=int)) ## hyper parameter tuninhg`

```
[[0 0 0 0 0 0]  
 [0 0 0 0 0 0]  
 [0 0 0 0 0 0]  
 [0 0 0 0 0 0]  
 [0 0 0 0 0 0]  
 [0 0 0 0 0 0]]
```

In [33]: `n`

Out[33]: (6, 7)

In [34]: `n1`

Out[34]: (6, 8)

In [36]: `np.ones(3)`

Out[36]: array([1., 1., 1.])

In [35]: `np.ones(3)`

Out[35]: array([1., 1., 1.])

In [37]: `np.ones(3,dtype=int)`

Out[37]: array([1, 1, 1])

In [36]: `np.ones((5,4),dtype=int)`

Out[36]: array([[1, 1, 1, 1],
 [1, 1, 1, 1],
 [1, 1, 1, 1],
 [1, 1, 1, 1],
 [1, 1, 1, 1]])

In [40]: `np.random.rand(3,2)`

Out[40]: array([[0.67620021, 0.5769835],
 [0.60101257, 0.91521575],
 [0.06497883, 0.54005717]])

In [43]: `np.random.rand(3)`

Out[43]: array([0.85592098, 0.65158527, 0.95246873])

In [44]: `np.random.rand(3,5)`

```
Out[44]: array([[0.9177114 , 0.06722821, 0.52410285, 0.17364397, 0.98822881],  
                [0.46538241, 0.07798391, 0.73574707, 0.81758281, 0.20078606],  
                [0.88102884, 0.88910194, 0.74218311, 0.05569546, 0.52533174]])
```

```
In [47]: np.random.randint(4,6)
```

```
Out[47]: 5
```

```
In [48]: np.random.randint(4,6)
```

```
Out[48]: 4
```

```
In [49]: np.random.randint(2,20,4)
```

```
Out[49]: array([10, 7, 13, 11], dtype=int32)
```

```
In [50]: np.random.randint(30,20,10)
```

```
-----  
ValueError                                                 Traceback (most recent call last)  
Cell In[50], line 1  
----> 1 np.random.randint(30,20,10)  
  
File numpy/random/mtrand.pyx:794, in numpy.random.mtrand.RandomState.randint()  
  
File numpy/random/_bounded_integers.pyx:2885, in numpy.random._bounded_integers._rand_int32()  
  
ValueError: low >= high
```

```
In [51]: np.random.randint(-30,20,10)
```

```
Out[51]: array([-4, -11, -15, -20, 16, -14, 17, -30, -20, -23], dtype=int32)
```

```
In [52]: np.random.randint(10,40,(10,10))
```

```
Out[52]: array([[21, 32, 38, 21, 20, 27, 27, 34, 14, 24],  
                [10, 31, 39, 25, 26, 38, 38, 13, 18, 28],  
                [33, 28, 36, 34, 25, 15, 30, 10, 11, 32],  
                [31, 39, 35, 31, 16, 11, 33, 22, 11, 14],  
                [23, 37, 21, 18, 18, 26, 24, 20, 28, 32],  
                [24, 38, 20, 22, 37, 12, 30, 17, 39, 33],  
                [27, 37, 10, 22, 38, 37, 30, 31, 39, 39],  
                [11, 25, 29, 35, 16, 21, 13, 32, 29, 33],  
                [23, 14, 35, 39, 30, 20, 20, 10, 22, 35],  
                [39, 22, 29, 32, 11, 18, 23, 17, 27, 31]], dtype=int32)
```

```
arr
```

```
In [53]: np.arange(1,13)
```

```
Out[53]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [54]: np.arange(1,13).reshape(3,4)
```

```
Out[54]: array([[ 1,  2,  3,  4],  
                [ 5,  6,  7,  8],  
                [ 9, 10, 11, 12]])
```

```
In [55]: np.arange(1,13).reshape(4,3)
```

```
Out[55]: array([[ 1,  2,  3],
   [ 4,  5,  6],
   [ 7,  8,  9],
   [10, 11, 12]])
```

slicing in matrix

```
In [56]: b=np.random.randint(10,20,(5,4))
b
```

```
Out[56]: array([[15, 11, 18, 18],
   [14, 11, 17, 18],
   [17, 18, 11, 18],
   [18, 16, 11, 14],
   [19, 19, 11, 19]], dtype=int32)
```

```
In [57]: b[0]
```

```
Out[57]: array([15, 11, 18, 18], dtype=int32)
```

```
In [37]: range(5)
```

```
Out[37]: range(0, 5)
```

```
In [38]: r=range(5)
r
```

```
Out[38]: range(0, 5)
```

```
In [40]: for i in r:
    print(i)
```

```
0
1
2
3
4
```

```
In [41]: list(range(5))
```

```
Out[41]: [0, 1, 2, 3, 4]
```

```
In [59]: range(1,10)
```

```
Out[59]: range(1, 10)
```

```
In [43]: list(range(1,10))
```

```
Out[43]: [1, 2, 3, 4, 5, 6, 7, 8, 9]
```

```
In [44]: list(range(1,10,3))
```

```
Out[44]: [1, 4, 7]
```

```
In [45]: y=list(range(12))
```

```
In [46]: y
```

```
Out[46]: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
```

```
In [49]: rand(3,2)
```

```
NameError Traceback (most recent call last)
Cell In[49], line 1
----> 1 rand(3,2)

NameError: name 'rand' is not defined
```

```
In [48]: rand(3,2)
```

```
random.rand(3,2)
```

```
np.random.rand(3,2)
```

```
NameError Traceback (most recent call last)
Cell In[48], line 1
----> 1 rand(3,2)
      2 random.rand(3,2)
      3 np.random.rand(3,2)

NameError: name 'rand' is not defined
```

```
In [50]: np.random.rand(5)
```

```
Out[50]: array([0.39125069, 0.55587322, 0.97586769, 0.20386185, 0.47056266])
```

```
In [51]: np.random.rand(2,4)
```

```
Out[51]: array([[0.34361921, 0.25642339, 0.66082882, 0.92629622],
 [0.29619849, 0.11065333, 0.88204433, 0.16121207]])
```

```
In [52]: np.random.rand(2,4)
```

```
Out[52]: array([[0.69247204, 0.3813036 , 0.70517241, 0.17942772],
 [0.16601577, 0.95795826, 0.37367079, 0.6583489 ]])
```

```
In [57]: np.random.randint(2,4)
```

```
Out[57]: 3
```

```
In [58]: np.random.randint(2,4)
```

```
Out[58]: 2
```

np.random.randint it show the value start from lower value and in between upper value it doesn't takes the upper value

```
In [60]: np.random.randint(0,1)
```

```
Out[60]: 0
```

```
In [62]: np.random.randint(10,20,5) # show the random 5 value 10-19
```

```
Out[62]: array([16, 15, 13, 16, 19], dtype=int32)
```

```
In [63]: np.random.randint(1,6,4) # show the random 4 value 1-5
```

```
Out[63]: array([1, 2, 4, 4], dtype=int32)
```

```
In [65]: np.random.randint(2,20)
```

```
Out[65]: 15
```

```
In [66]: np.random.randint(2,20)
```

```
Out[66]: 7
```

```
In [67]: np.random.randint(-30,20,5)
```

```
Out[67]: array([-19, -24, -2, 5, -17], dtype=int32)
```

```
In [68]: np.random.randint(5,9)
```

```
Out[68]: 6
```

```
In [69]: np.random.randint(5,9)
```

```
Out[69]: 5
```

```
In [70]: np.random.randint(5,9)
```

```
Out[70]: 8
```

```
In [72]: np.random.randint(10,20,3)
```

```
Out[72]: array([15, 14, 11], dtype=int32)
```

```
In [73]: np.random.randint(10,40,(10,10))
```

```
Out[73]: array([[24, 29, 33, 36, 13, 18, 10, 26, 16, 15],
 [31, 20, 12, 34, 20, 33, 17, 23, 17, 19],
 [31, 39, 13, 35, 17, 20, 32, 26, 14, 13],
 [10, 36, 24, 37, 23, 26, 11, 26, 38, 34],
 [25, 16, 25, 21, 39, 33, 13, 13, 31, 16],
 [37, 11, 21, 26, 21, 26, 11, 32, 14, 38],
 [21, 25, 35, 26, 17, 28, 18, 14, 26, 18],
 [32, 18, 16, 17, 23, 26, 25, 39, 18, 11],
 [39, 38, 24, 26, 32, 31, 32, 20, 32, 39],
 [36, 18, 35, 11, 18, 18, 36, 12, 13, 29]], dtype=int32)
```

```
In [74]: np.arange(1,13)
```

```
Out[74]: array([ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12])
```

```
In [75]: np.arange(1,13).reshape(3,4)
```

```
Out[75]: array([[ 1,  2,  3,  4],
   [ 5,  6,  7,  8],
   [ 9, 10, 11, 12]])
```

```
In [76]: np.arange(1,13).reshape(1,12)
```

```
Out[76]: array([[ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12]])
```

```
In [77]: np.arange(1,13).reshape(12,1)
```

```
Out[77]: array([[ 1],
   [ 2],
   [ 3],
   [ 4],
   [ 5],
   [ 6],
   [ 7],
   [ 8],
   [ 9],
   [10],
   [11],
   [12]])
```

```
In [78]: b=np.random.randint(10,20,(5,4))
b
```

```
Out[78]: array([[12, 16, 16, 11],
   [18, 18, 12, 19],
   [14, 18, 19, 12],
   [17, 13, 10, 14],
   [14, 19, 17, 15]], dtype=int32)
```

```
In [80]: type(b)
```

```
Out[80]: numpy.ndarray
```

```
In [81]: b
```

```
Out[81]: array([[12, 16, 16, 11],
   [18, 18, 12, 19],
   [14, 18, 19, 12],
   [17, 13, 10, 14],
   [14, 19, 17, 15]], dtype=int32)
```

```
In [82]: b[:, :]
```

```
Out[82]: array([[12, 16, 16, 11],
   [18, 18, 12, 19],
   [14, 18, 19, 12],
   [17, 13, 10, 14],
   [14, 19, 17, 15]], dtype=int32)
```

```
In [83]: b[1:3]
```

```
Out[83]: array([[18, 18, 12, 19],
   [14, 18, 19, 12]], dtype=int32)
```

```
In [84]: b
```

```
Out[84]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [86]: b[1,2]
```

```
Out[86]: np.int32(12)
```

```
In [87]: b[1,3]
```

```
Out[87]: np.int32(19)
```

```
In [88]: b
```

```
Out[88]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [89]: b[1,-1]
```

```
Out[89]: np.int32(19)
```

```
In [90]: b
```

```
Out[90]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [91]: b[2:3]
```

```
Out[91]: array([[14, 18, 19, 12]], dtype=int32)
```

```
In [92]: b[0:-2]
```

```
Out[92]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12]], dtype=int32)
```

```
In [93]: b
```

```
Out[93]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [94]: b[0,2]
```

```
Out[94]: np.int32(16)
```

```
In [95]: b
```

```
Out[95]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [96]: b[-5,-3]
```

```
Out[96]: np.int32(16)
```

```
In [97]: np.random.randint(10,20,(4,4))
```

```
Out[97]: array([[12, 12, 12, 17],  
                 [11, 12, 16, 11],  
                 [11, 12, 15, 19],  
                 [19, 19, 15, 10]], dtype=int32)
```

```
In [98]: b
```

```
Out[98]: array([[12, 16, 16, 11],  
                 [18, 18, 12, 19],  
                 [14, 18, 19, 12],  
                 [17, 13, 10, 14],  
                 [14, 19, 17, 15]], dtype=int32)
```

```
In [99]: b[-4,-2]
```

```
Out[99]: np.int32(12)
```

```
In [100...]: b
```

```
Out[100...]: array([[12, 16, 16, 11],  
                     [18, 18, 12, 19],  
                     [14, 18, 19, 12],  
                     [17, 13, 10, 14],  
                     [14, 19, 17, 15]], dtype=int32)
```

```
In [101...]: b[-4:2]
```

```
Out[101...]: array([[18, 18, 12, 19]], dtype=int32)
```

```
In [102...]: b[:]
```

```
Out[102...]: array([[12, 16, 16, 11],  
                     [18, 18, 12, 19],  
                     [14, 18, 19, 12],  
                     [17, 13, 10, 14],  
                     [14, 19, 17, 15]], dtype=int32)
```

Operations

```
In [1]: import os  
print(os.getcwd())
```

```
C:\Users\ARUN KUMAR SAHU\Python
```

```
In [1]: import numpy as np
```

```
In [3]: a=np.random.randint(10,20,10)
a
```

```
Out[3]: array([18, 15, 15, 18, 18, 14, 18, 11, 16, 18], dtype=int32)
```

```
In [4]: id(a)
```

```
Out[4]: 2968844683280
```

```
In [5]: a
```

```
Out[5]: array([18, 15, 15, 18, 18, 14, 18, 11, 16, 18], dtype=int32)
```

```
In [6]: arr2=np.random.randint(0,100,(10,10))
arr2
```

```
Out[6]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],
 [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],
 [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],
 [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],
 [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],
 [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],
 [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],
 [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],
 [20, 56, 86, 57, 42, 96, 19, 19, 98, 55],
 [89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [13]: arr=np.array([0,1,2,3,4,5])
arr
```

```
Out[13]: array([0, 1, 2, 3, 4, 5])
```

```
In [14]: arr[:]
```

```
Out[14]: array([0, 1, 2, 3, 4, 5])
```

```
In [15]: arr
```

```
Out[15]: array([0, 1, 2, 3, 4, 5])
```

```
In [16]: arr[:4]
```

```
Out[16]: array([0, 1, 2, 3])
```

```
In [18]: arr2[:]
```

```
Out[18]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],
 [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],
 [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],
 [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],
 [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],
 [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],
 [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],
 [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],
 [20, 56, 86, 57, 42, 96, 19, 19, 98, 55],
 [89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [20]: arr2[0:5]
```

```
Out[20]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
[84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
[38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
[64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
[49, 17, 56, 42, 71, 54, 65, 26, 42, 22]], dtype=int32)
```

```
In [21]: arr2
```

```
Out[21]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
[84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
[38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
[64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
[49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
[24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
[53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
[1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
[20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
[89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [23]: arr2[1,4]
```

```
Out[23]: np.int32(14)
```

```
In [24]: arr2[-5,-5]
```

```
Out[24]: np.int32(4)
```

```
In [25]: arr2
```

```
Out[25]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
[84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
[38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
[64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
[49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
[24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
[53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
[1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
[20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
[89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [26]: arr2[::-1]
```

```
Out[26]: array([[89, 28, 86, 40, 46, 74, 79, 90, 50, 68],  
[20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
[1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
[53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
[24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
[49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
[64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
[38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
[84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
[73, 24, 62, 43, 23, 70, 56, 57, 11, 0]], dtype=int32)
```

```
In [27]: arr2
```

```
Out[27]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
   [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
   [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
   [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
   [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
   [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
   [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
   [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
   [20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
   [89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [28]: arr2[:::-2]
```

```
Out[28]: array([[89, 28, 86, 40, 46, 74, 79, 90, 50, 68],  
   [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
   [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
   [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
   [84, 81, 48, 74, 14, 2, 50, 3, 79, 27]], dtype=int32)
```

```
In [29]: arr2
```

```
Out[29]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
   [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
   [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
   [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
   [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
   [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
   [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
   [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
   [20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
   [89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [30]: arr2[:::-3]
```

```
Out[30]: array([[89, 28, 86, 40, 46, 74, 79, 90, 50, 68],  
   [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
   [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
   [73, 24, 62, 43, 23, 70, 56, 57, 11, 0]], dtype=int32)
```

```
In [31]: arr2
```

```
Out[31]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
   [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
   [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
   [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
   [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
   [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
   [53, 75, 79, 79, 35, 51, 20, 31, 20, 38],  
   [1, 14, 55, 80, 90, 54, 56, 41, 71, 99],  
   [20, 56, 86, 57, 42, 96, 19, 19, 98, 55],  
   [89, 28, 86, 40, 46, 74, 79, 90, 50, 68]], dtype=int32)
```

```
In [32]: arr2[:::-3]
```

```
Out[32]: array([[73, 24, 62, 43, 23, 70, 56, 57, 11, 0],  
                 [84, 81, 48, 74, 14, 2, 50, 3, 79, 27],  
                 [38, 87, 23, 99, 7, 18, 14, 66, 79, 83],  
                 [64, 60, 15, 87, 73, 33, 74, 55, 80, 9],  
                 [49, 17, 56, 42, 71, 54, 65, 26, 42, 22],  
                 [24, 73, 51, 7, 11, 4, 72, 18, 1, 52],  
                 [53, 75, 79, 79, 35, 51, 20, 31, 20, 38]], dtype=int32)
```

```
In [33]: arr
```

```
Out[33]: array([0, 1, 2, 3, 4, 5])
```

```
In [34]: arr.max()
```

```
Out[34]: np.int64(5)
```

```
In [35]: arr.min()
```

```
Out[35]: np.int64(0)
```

```
In [36]: arr.mean()
```

```
Out[36]: np.float64(2.5)
```

```
In [37]: arr
```

```
Out[37]: array([0, 1, 2, 3, 4, 5])
```

```
In [38]: arr.median
```

```
AttributeError  
Cell In[38], line 1  
----> 1 arr.median
```

```
Traceback (most recent call last)
```

```
AttributeError: 'numpy.ndarray' object has no attribute 'median'
```

```
In [39]: from numpy import *  
a = array([1,2,3,4,9])  
median(a)
```

```
Out[39]: np.float64(3.0)
```

```
In [ ]:
```