

## 2 oct

# Numpy Package

In [ ]:

In [1]: `import numpy as np`

In [2]: `np.__version__`

Out[2]: '1.26.4'

In [3]: `import sys`  
`sys.version`

Out[3]: '3.12.4 | packaged by Anaconda, Inc. | (main, Jun 18 2024, 15:03:56) [MSC v.1929 64 bit (AMD64)]'

In [ ]:

## creating Array

In [ ]:

In [4]: `my_list=[0,1,2,3,4,5,6]`  
`my_list`

Out[4]: [0, 1, 2, 3, 4, 5, 6]

In [5]: `type(my_list)`

Out[5]: list

In [6]: `arr=np.array(my_list)`  
`arr`

Out[6]: array([0, 1, 2, 3, 4, 5, 6])

In [7]: `type(arr)`

Out[7]: numpy.ndarray

In [8]: `type(my_list)`

Out[8]: list

In [9]: `type(arr)`

Out[9]: numpy.ndarray

```
In [ ]:
```

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

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

```
In [11]: np.arange(3.4)
```

```
Out[11]: array([0.,  1.,  2.,  3.])
```

```
In [12]: np.arange(0,5)
```

```
Out[12]: array([0,  1,  2,  3,  4])
```

```
In [13]: np.arange(10,20)
```

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

```
In [14]: np.arange(-20,10)
```

```
Out[14]: 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 [15]: np.arange(-16,25)
```

```
Out[15]: 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,
               10,  11,  12,  13,  14,  15,  16,  17,  18,  19,  20,  21,  22,
               23,  24])
```

```
In [16]: np.arange(-20,-10)
```

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

```
In [17]: np.arange(30,20)
```

```
Out[17]: array([], dtype=int32)
```

```
In [18]: np.arange(-30,20)
```

```
Out[18]: array([-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 [19]: arr=np.arange(-30,20)
arr
```

```
Out[19]: array([-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 [20]: np.arange(10)
```

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

```
In [21]: np.arange(-30,20,5)
```

```
Out[21]: array([-30, -25, -20, -15, -10,  -5,   0,   5,  10,  15])
```

```
In [22]: np.arange(1,20,5)
```

```
Out[22]: array([ 1,  6, 11, 16])
```

```
In [23]: np.arange(1,20,5)
```

```
Out[23]: array([ 1,  6, 11, 16])
```

```
In [ ]:
```

```
In [24]: np.zeros(10)
```

```
Out[24]: array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])
```

```
In [25]: np.zeros(10, dtype=int)
```

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

```
In [ ]:
```

```
In [26]: np.zeros((5,5))
```

```
Out[26]: 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.]])
```

```
In [27]: np.zeros((5,5), dtype=int)
```

```
Out[27]: 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]])
```

```
In [28]: zero=np.zeros((5,5))
         type(zero)
```

```
Out[28]: numpy.ndarray
```

```
In [29]: zero=np.zeros((5,5))
         print(zero)
         print(type(zero))
```

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

```
In [30]: zero=np.zeros((5,5))
print(zero)
print('2222')
print(type(zero))
```

```
[[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.]]
2222
<class 'numpy.ndarray'>
```

```
In [ ]:
```

```
In [31]: n=(7,7)
n1=(6,8)
print(np.zeros(n))
```

```
[[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 [32]: n
```

```
Out[32]: (7, 7)
```

```
In [33]: n1
```

```
Out[33]: (6, 8)
```

```
In [34]: n=(7,7)
n1=(6,8)
print(np.zeros(n1, dtype=int))
```

```
[[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 [ ]:
```

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

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

```
In [36]: np.ones(13, dtype=int)
```

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

```
In [ ]:
```

```
In [37]: np.ones(n)
```

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

```
In [ ]:
```

```
np.twos(2,3)
```

```
In [ ]:
```

## Rand

```
In [ ]:
```

```
In [38]: np.random.randint(6)
```

```
Out[38]: 4
```

```
In [39]: np.random.rand(5)
```

```
Out[39]: array([0.91230109, 0.81967044, 0.92314801, 0.69779503, 0.41963723])
```

```
In [40]: np.random.rand(5,5)
```

```
Out[40]: array([[0.3595998 , 0.0774371 , 0.33167468, 0.85050368, 0.65741015],
                [0.81108131, 0.65266674, 0.62440655, 0.23947127, 0.02373575],
                [0.70122152, 0.11878829, 0.40152937, 0.24056464, 0.43124678],
                [0.85814653, 0.45378784, 0.44020302, 0.45386463, 0.79896146],
                [0.75675663, 0.94438909, 0.54401458, 0.44975269, 0.62425385]])
```

```
In [41]: #To change its datatype
```

```
In [42]: np.random.randint((10))
```

```
Out[42]: 7
```

```
In [43]: np.random.randint(1,20,3)
```

```
Out[43]: array([11, 16, 15])
```

```
In [ ]:
```

## 3 oct

```
In [44]: np.random.randint(10,40,(10,10))
```

```
Out[44]: array([[20, 14, 28, 26, 16, 14, 35, 27, 24, 27],
               [26, 34, 13, 23, 10, 37, 18, 33, 10, 27],
               [39, 34, 34, 24, 38, 35, 24, 36, 24, 35],
               [13, 10, 32, 23, 12, 29, 32, 31, 16, 10],
               [25, 11, 26, 27, 12, 38, 17, 37, 29, 19],
               [27, 26, 26, 21, 17, 15, 35, 14, 22, 24],
               [36, 20, 15, 23, 14, 31, 24, 10, 39, 35],
               [12, 16, 11, 35, 22, 23, 36, 34, 24, 13],
               [19, 26, 15, 31, 20, 33, 19, 30, 30, 23],
               [13, 34, 25, 27, 13, 13, 36, 30, 28, 17]])
```

```
In [45]: b=np.random.randint(10,20,(5,4))
b
```

```
Out[45]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15],
               [13, 17, 17, 12],
               [12, 12, 13, 12]])
```

```
In [46]: b[:]
```

```
Out[46]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15],
               [13, 17, 17, 12],
               [12, 12, 13, 12]])
```

```
In [47]: b[0:3]
```

```
Out[47]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15]])
```

```
In [48]: b
```

```
Out[48]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15],
               [13, 17, 17, 12],
               [12, 12, 13, 12]])
```

```
In [49]: b[0:-1]
```

```
Out[49]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15],
               [13, 17, 17, 12]])
```

```
In [50]: b
```

```
Out[50]: array([[19, 18, 13, 17],
               [15, 14, 18, 15],
               [12, 10, 16, 15],
               [13, 17, 17, 12],
               [12, 12, 13, 12]])
```

```
In [51]: b[0,2]
```

```
Out[51]: 13
```

```
In [52]: np.random.randint(10,20,(4,4))
```

```
Out[52]: array([[11, 17, 13, 16],
                [16, 14, 18, 17],
                [10, 11, 18, 14],
                [10, 17, 17, 15]])
```

```
In [ ]:
```

## Operations

```
In [ ]:
```

```
In [53]: a=np.random.randint(10,20,5)
a
```

```
Out[53]: array([17, 17, 11, 11, 17])
```

```
In [54]: arr
```

```
Out[54]: array([-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 [55]: arr2=np.random.randint(0,100,(10,10))
arr2
```

```
Out[55]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
                [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
                [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
                [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
                [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
                [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
                [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
                [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
                [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
                [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [56]: arr
```

```
Out[56]: array([-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 [57]: arr[:]
```

```
Out[57]: array([-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 [58]: arr[:20]
```

```
Out[58]: array([-30, -29, -28, -27, -26, -25, -24, -23, -22, -21, -20, -19, -18,
               -17, -16, -15, -14, -13, -12, -11])
```

```
In [59]: arr2[:]
```

```
Out[59]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [60]: arr2[0:5]
```

```
Out[60]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68]])
```

```
In [61]: arr2
```

```
Out[61]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [62]: arr2[1,5]
```

```
Out[62]: 24
```

```
In [63]: arr2
```

```
Out[63]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [64]: arr2[-5,5]
```

```
Out[64]: 5
```

```
In [65]: arr2
```



```
Out[65]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [66]: arr2[-5,-5]
```

```
Out[66]: 5
```

```
In [67]: arr2
```

```
Out[67]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [68]: arr2[-1,-2]
```

```
Out[68]: 71
```

```
In [69]: arr2
```

```
Out[69]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [70]: arr2[::-1]
```

```
Out[70]: array([[86, 60, 77, 93, 11, 56, 70, 32, 71, 77],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [45, 37, 47, 32, 69, 94, 64, 95, 44,  3]])
```

```
In [71]: arr2
```

```
Out[71]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [72]: arr2[::-2]
```

```
Out[72]: array([[86, 60, 77, 93, 11, 56, 70, 32, 71, 77],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29]])
```

```
In [73]: arr2
```

```
Out[73]: array([[45, 37, 47, 32, 69, 94, 64, 95, 44,  3],
               [63, 53, 57, 32, 36, 24, 41, 76, 34, 29],
               [97, 77, 10, 53, 92, 10, 96, 71, 23, 69],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [16, 76, 55, 32,  4, 47, 11, 49, 52, 68],
               [27, 92, 50, 51, 94,  5,  7, 27, 38, 16],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [46, 34, 28, 51,  0, 98, 70, 31, 70, 99],
               [50, 17, 89, 31, 46, 12, 35,  1, 61, 21],
               [86, 60, 77, 93, 11, 56, 70, 32, 71, 77]])
```

```
In [74]: arr2[::-3]
```

```
Out[74]: array([[86, 60, 77, 93, 11, 56, 70, 32, 71, 77],
               [81, 59, 39, 86, 48, 46, 52, 71, 11, 42],
               [60, 46, 77, 53,  6, 71, 51,  0, 30, 98],
               [45, 37, 47, 32, 69, 94, 64, 95, 44,  3]])
```

```
In [75]: arr
```

```
Out[75]: array([-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 [76]: arr.max()
```

```
Out[76]: 19
```

```
In [77]: arr.mean()
```

```
Out[77]: -5.5
```

```
In [78]: arr.min()
```

```
Out[78]: -30
```

```
In [110... arr.median()
```

```
-----
AttributeError                                Traceback (most recent call last)
Cell In[110], line 1
----> 1 arr.median()

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

In [ ]:

```
In [80]: a=array([1,2,3,4,5,6])
         median(a)
```

```
-----
NameError                                    Traceback (most recent call last)
Cell In[80], line 1
----> 1 a=array([1,2,3,4,5,6])
      2 median(a)

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

In [ ]:

## if any thinf is not defined then use

from numpy import \* it is used to recall all the numpy functions

```
In [81]: from numpy import *
         a=array([1,2,3,4,5,6])
         median(a)
```

Out[81]: 3.5

In [82]: arr

```
Out[82]: array([-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 [83]: arr.reshape(10,5)

```
Out[83]: array([[ -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 [84]: arr.reshape(5,10)

```
Out[84]: array([[ -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 [85]: arr.reshape(1,50)
```

```
Out[85]: array([[ -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 [86]: arr.reshape(50,1)
```

```
Out[86]: array([[ -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 [87]: arr.reshape(10,5)
```

```
Out[87]: array([[ -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 [88]: arr.reshape(5,10,order='C')
```

```
Out[88]: array([[ -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 [89]: arr.reshape(5,10,order='F')
```

```
Out[89]: array([[ -30, -25, -20, -15, -10,  -5,   0,   5,  10,  15],
               [-29, -24, -19, -14,  -9,  -4,   1,   6,  11,  16],
               [-28, -23, -18, -13,  -8,  -3,   2,   7,  12,  17],
               [-27, -22, -17, -12,  -7,  -2,   3,   8,  13,  18],
               [-26, -21, -16, -11,  -6,  -1,   4,   9,  14,  19]])
```

```
In [90]: arr.reshape(10,5,order='A')
```

```
Out[90]: array([[ -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 [91]: arr
```

```
Out[91]: array([-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 [92]: arr.reshape(10,5)
```

```
Out[92]: array([[ -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 [ ]:

# Indexing

In [ ]:

In [93]: `mat=np.arange(0,100).reshape(10,10)`

In [94]: `mat`

Out[94]: `array([[ 0, 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, 26, 27, 28, 29],  
 [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
 [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
 [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
 [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
 [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
 [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
 [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])`

In [95]: `row=5  
col=6`

In [96]: `col`

Out[96]: `6`

In [97]: `row`

Out[97]: `5`

In [98]: `mat`

Out[98]: `array([[ 0, 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, 26, 27, 28, 29],  
 [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
 [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
 [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
 [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
 [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
 [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
 [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])`

In [99]: `mat[row,col]`

Out[99]: `56`

In [100... `mat[:]`

```
Out[100...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [101...] mat[:,col]
```

```
Out[101...] array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

```
In [102...] mat[:,8]
```

```
Out[102...] array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

```
In [103...] mat[row,:]
```

```
Out[103...] array([50, 51, 52, 53, 54, 55, 56, 57, 58, 59])
```

```
In [104...] mat[row:8]
```

```
Out[104...] array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79]])
```

```
In [105...] mat[8,:]
```

```
Out[105...] array([80, 81, 82, 83, 84, 85, 86, 87, 88, 89])
```

```
In [106...] mat[:row]
```

```
Out[106...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

```
In [107...] mat[row:col]
```

```
Out[107...] array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59]])
```

```
In [108...] mat
```

```
Out[108...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```



```
In [109... mat[:, -1]
```

```
Out[109... array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

```
In [111... mat
```

```
Out[111... array([[ 0,  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, 26, 27, 28, 29],
        [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
        [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
        [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
        [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [112... row
```

```
Out[112... 5
```

```
In [114... col
```

```
Out[114... 6
```

```
In [115... mat[:, col]
```

```
Out[115... array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

```
In [116... mat[1, 4]
```

```
Out[116... 14
```

```
In [117... mat
```

```
Out[117... array([[ 0,  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, 26, 27, 28, 29],
        [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
        [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
        [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
        [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [119... mat[3:-3]
```

```
Out[119... array([[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]])
```

```
In [120... mat
```

```
Out[120...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [121...] mat[0]
```

```
Out[121...] array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
In [122...] mat[6]
```

```
Out[122...] array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

```
In [123...] mat
```

```
Out[123...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [124...] mat[:6]
```

```
Out[124...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]])
```

```
In [125...] mat[6:]
```

```
Out[125...] array([[60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [126...] mat
```

```
Out[126...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [128...] mat[0:10]
```

```
Out[128...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [129...] mat[0:10:3]
```

```
Out[129...] array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [130...] mat
```

```
Out[130...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [131...] mat[4:]
```

```
Out[131...] array([[40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [132...] mat[:,4]
```

```
Out[132...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39]])
```

In [133... `mat[:, :-1]`

Out[133... `array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],  
[80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
[70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
[60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
[40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
[20, 21, 22, 23, 24, 25, 26, 27, 28, 29],  
[10, 11, 12, 13, 14, 15, 16, 17, 18, 19],  
[ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9]])`

In [134... `mat[:, :-2]`

Out[134... `array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],  
[70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
[10, 11, 12, 13, 14, 15, 16, 17, 18, 19]])`

In [135... `mat[:, :-3]`

Out[135... `array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],  
[60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
[ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9]])`

In [136... `mat`

Out[136... `array([[ 0, 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, 26, 27, 28, 29],  
[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
[40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
[60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
[70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
[80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
[90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])`

In [137... `mat[2:6]`

Out[137... `array([[20, 21, 22, 23, 24, 25, 26, 27, 28, 29],  
[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
[40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
[50, 51, 52, 53, 54, 55, 56, 57, 58, 59]])`

In [138... `mat`

```
Out[138...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [139...] mat[2:6,2:4]
```

```
Out[139...] array([[22, 23],
          [32, 33],
          [42, 43],
          [52, 53]])
```

```
In [140...] mat
```

```
Out[140...] array([[ 0,  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, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [141...] mat[0,1]
```

```
Out[141...] 1
```

```
In [142...] mat[1,6]
```

```
Out[142...] 16
```

```
In [143...] mat[1:6]
```

```
Out[143...] array([[10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
          [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]])
```

```
In [144...] mat[1:]
```

```
Out[144...] array([[10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
          [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
          [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
          [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
          [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
          [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
          [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
          [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
          [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [145... mat[3:5]
```

```
Out[145... array([[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
         [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

```
In [146... mat[3,5]
```

```
Out[146... 35
```

```
In [147... mat
```

```
Out[147... array([[ 0,  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, 26, 27, 28, 29],  
                [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
                [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
                [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
                [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
                [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
                [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
                [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [148... mat[1:2,2:4]
```

```
Out[148... array([[12, 13]])
```

```
In [149... mat[3:5,2:4,]
```

```
Out[149... array([[32, 33],  
                 [42, 43]])
```

```
In [150... mat
```

```
Out[150... array([[ 0,  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, 26, 27, 28, 29],  
                [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],  
                [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],  
                [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],  
                [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],  
                [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],  
                [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],  
                [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [151... mat[2:3,4:5]
```

```
Out[151... array([[24]])
```

```
In [ ]:
```

## Masking

```
In [152... mat
```

```
Out[152...] array([[ 0,  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, 26, 27, 28, 29],
        [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
        [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
        [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
        [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [153...] id(mat)
```

```
Out[153...] 2145449189872
```

```
In [154...] mat
```

```
Out[154...] array([[ 0,  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, 26, 27, 28, 29],
        [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
        [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
        [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
        [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [155...] mat<50
```

```
Out[155...] array([[ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True],
        [ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True],
        [ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True],
        [ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True],
        [ True,  True,  True,  True,  True,  True,  True,  True,  True,
        True],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False]])
```

```
In [156...] mat>50
```

```
Out[156...] array([[False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, True, True, True, True, True, True, True, True,
        True],
        [ True, True, True, True, True, True, True, True, True,
        True],
        [ True, True, True, True, True, True, True, True, True,
        True],
        [ True, True, True, True, True, True, True, True, True,
        True],
        [ True, True, True, True, True, True, True, True, True,
        True]])
```

```
In [157...] mat==50
```

```
Out[157...] array([[False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [ True, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False],
        [False, False, False, False, False, False, False, False, False,
        False]])
```

```
In [158...] mat[mat==50]
```

```
Out[158...] array([50])
```

```
In [159...] a1=mat[mat<50]
```

```
In [160...] a1
```

```
Out[160...] array([ 0,  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, 26, 27, 28, 29, 30, 31, 32, 33,
        34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

```
In [161...] mat
```



```
Out[161...] array([[ 0,  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, 26, 27, 28, 29],
        [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
        [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
        [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
        [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
        [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
        [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
        [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

```
In [162...] a2=mat[mat>50]
```

```
In [163...] a2
```

```
Out[163...] array([51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67,
        68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84,
        85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99])
```

```
In [164...] a3=mat[mat==50]
a3
```

```
Out[164...] array([50])
```

```
In [165...] a1
```

```
Out[165...] array([ 0,  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, 26, 27, 28, 29, 30, 31, 32, 33,
        34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

```
In [166...] a2
```

```
Out[166...] array([51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67,
        68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84,
        85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99])
```

```
In [167...] a3
```

```
Out[167...] array([50])
```

```
In [ ]:
```