Numpy

In [3]:
```
import numpy as np
```

- creating arrays

In [262…
```
arr
```

Out[262…
```
array([0, 1, 2, 3, 4, 5])
```

In [20]:
```
l = [0,1,2,3,4,5]
l
```

Out[20]:
```
[0, 1, 2, 3, 4, 5]
```

In [270…
```
arr=np.array(l)
arr
```

Out[270…
```
array([0, 1, 2, 3, 4, 5])
```

In [22]:
```
type(l)
```

Out[22]:
```
list
```

In [ ]:
```

```

In [26]:
```
type(arr)
```

Out[26]:
```
numpy.ndarray
```

In [34]:
```
np.arange(6)
```

Out[34]:
```
array([0, 1, 2, 3, 4, 5])
```

In [48]:
```
np.arange(10.)
```

Out[48]:
```
array([0., 1., 2., 3., 4., 5., 6., 7., 8., 9.])
```

In [50]:
```
np.arange(0,5)
```

Out[50]:
```
array([0, 1, 2, 3, 4])
```

In [52]:
```
np.arange(10,20)
```

Out[52]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [54]:
```
np.arange(-20,10)
```

Out[54]:
```
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 [58]:
```
np.arange(50,20)
```

Out[58]:
```
array([], dtype=int32)
```

In [60]:
```
np.arange(1,2,0.1)
```

Out[60]:
```
array([1. , 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9])
```

In [62]:
```
np.arange(10,100,20)
```

Out[62]:
```
array([10, 30, 50, 70, 90])
```

In [66]:
```
a=np.zeros(6)
a
```

Out[66]:
```
array([0., 0., 0., 0., 0., 0.])
```

In [72]:
```
a=np.zeros(7,dtype=int)
a
```

Out[72]:
```
array([0, 0, 0, 0, 0, 0, 0])
```

In [76]:
```
a= np.ones(20)
a
```

Out[76]:
```
array([1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1., 1.,
       1., 1., 1., 1.])
```

In [80]:
```
a=np.ones(8,dtype=int)
a
```

Out[80]:
```
array([1, 1, 1, 1, 1, 1, 1, 1])
```

In [103…
```
b=np.zeros((5,6),dtype=int)
b
```

Out[103…
```
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]])
```

In [105…
```
c = np.ones((10,5))
c
```

Out[105…

```
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., 1.]])
```

In [107…

```
n =(20,30)
n1 =(10,20)
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. 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. 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. 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. 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. 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. 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 [109…
```
print(np.ones(n1))
```

```
[[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. 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. 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. 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. 1. 1. 1. 1.]]
```

In [ ]:

18th Nov

In [115…
```
from numpy import *
arange(3)
```

Out[115…
```
array([0, 1, 2])
```

In [117…
```
range(12)
```

Out[117…
```
range(0, 12)
```

In [119…
```
list(range(12))
```

Out[119…
```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
```

In [121…
```
range(15)
```

Out[121…
```
range(0, 15)
```

In [123…
```
list(range(15))
```

Out[123…
```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14]
```

In [125…
```
rand(2,10)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[125], line 1
----> 1 rand(2,10)

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

In [131…
```
np.random.rand(2,10)
```

Out[131…
```
array([[3.63955822e-01, 5.56957287e-01, 6.92117468e-01, 1.96494194e-01,
        3.20430360e-01, 7.93304276e-01, 2.67708098e-01, 6.05201326e-02,
        2.48284190e-02, 6.97128044e-01],
       [9.22495268e-01, 4.57899834e-01, 2.96637657e-01, 9.80196832e-01,
        8.60622260e-01, 3.31300332e-01, 1.30562169e-01, 8.70258791e-01,
        8.79825917e-01, 8.48149174e-04]])
```

In [153…
```
np.random.randint(-10,0)
```

Out[153…
```
-6
```

In [169…
```
np.random.randint(10)
```

Out[169…
```
8
```

In [171…
```
np.random.rand(10)
```

Out[171…
```
array([0.60929058, 0.31675058, 0.39613455, 0.44594633, 0.84849937,
       0.74998746, 0.01592775, 0.21088815, 0.71191288, 0.54184678])
```

In [175…
```
np.random.randint(0,10,3)
```

Out[175…
```
array([6, 1, 7])
```

In [185…
```
np.random.randint(10,40,(10,10))
```

Out[185…
```
array([[32, 36, 38, 35, 19, 25, 18, 32, 20, 19],
       [19, 38, 28, 29, 37, 11, 23, 18, 12, 36],
       [32, 38, 10, 20, 37, 18, 24, 20, 39, 17],
       [18, 33, 19, 34, 24, 16, 17, 26, 34, 32],
       [39, 33, 27, 17, 36, 24, 13, 36, 32, 12],
       [30, 20, 30, 19, 34, 18, 39, 20, 22, 27],
       [21, 34, 33, 12, 27, 30, 27, 25, 14, 25],
       [22, 27, 34, 21, 28, 35, 31, 27, 31, 27],
       [24, 11, 25, 37, 30, 33, 19, 28, 11, 14],
       [39, 20, 28, 33, 19, 15, 34, 39, 32, 25]])
```

In [191…
```
n=np.random.randint(2,10,(4,4))
n
```

Out[191…
```
array([[9, 6, 9, 8],
       [2, 9, 9, 8],
       [9, 7, 4, 5],
       [8, 2, 8, 4]])
```

In [195…
```
n[:]
```

Out[195…
```
array([[9, 6, 9, 8],
       [2, 9, 9, 8],
       [9, 7, 4, 5],
       [8, 2, 8, 4]])
```

In [197…
```
n[0:2]
```

Out[197…
```
array([[9, 6, 9, 8],
       [2, 9, 9, 8]])
```

In [211…
```
n=np.random.randint(10,30,(10,10))
n
```

Out[211…
```
array([[15, 23, 18, 13, 24, 25, 22, 20, 19, 24],
       [16, 22, 19, 28, 21, 18, 14, 20, 19, 18],
       [20, 11, 29, 20, 12, 17, 12, 18, 25, 14],
       [18, 23, 29, 18, 22, 16, 26, 17, 11, 20],
       [11, 10, 14, 13, 12, 14, 12, 27, 15, 18],
       [26, 21, 21, 16, 29, 15, 16, 24, 19, 22],
       [21, 29, 13, 27, 28, 17, 16, 20, 29, 18],
       [27, 16, 29, 20, 14, 10, 16, 20, 18, 17],
       [22, 28, 22, 29, 28, 26, 17, 22, 19, 14],
       [29, 18, 20, 14, 19, 20, 23, 17, 17, 20]])
```

In [213…
```
n[0:2]
```

Out[213…
```
array([[15, 23, 18, 13, 24, 25, 22, 20, 19, 24],
       [16, 22, 19, 28, 21, 18, 14, 20, 19, 18]])
```

In [215…
```
n
```

Out[215…
```
array([[15, 23, 18, 13, 24, 25, 22, 20, 19, 24],
       [16, 22, 19, 28, 21, 18, 14, 20, 19, 18],
       [20, 11, 29, 20, 12, 17, 12, 18, 25, 14],
       [18, 23, 29, 18, 22, 16, 26, 17, 11, 20],
       [11, 10, 14, 13, 12, 14, 12, 27, 15, 18],
       [26, 21, 21, 16, 29, 15, 16, 24, 19, 22],
       [21, 29, 13, 27, 28, 17, 16, 20, 29, 18],
       [27, 16, 29, 20, 14, 10, 16, 20, 18, 17],
       [22, 28, 22, 29, 28, 26, 17, 22, 19, 14],
       [29, 18, 20, 14, 19, 20, 23, 17, 17, 20]])
```

In [221…
```
n[0:-8]
```

Out[221…
```
array([[15, 23, 18, 13, 24, 25, 22, 20, 19, 24],
       [16, 22, 19, 28, 21, 18, 14, 20, 19, 18]])
```

In [233…
```
n[0,9]
```

Out[233…
```
24
```

In [235…
```
n[4,6]
```

Out[235…
```
12
```

- Operations

In [244…
```
a =np.random.randint(10,20,(10,10))
a
```

Out[244…
```
array([[13, 13, 19, 14, 14, 13, 12, 11, 14, 12],
       [11, 13, 15, 14, 10, 10, 12, 16, 15, 11],
       [18, 14, 19, 19, 17, 17, 13, 19, 17, 17],
       [18, 19, 16, 12, 13, 11, 16, 16, 14, 13],
       [17, 14, 14, 18, 17, 18, 16, 19, 17, 16],
       [16, 15, 13, 16, 17, 13, 13, 18, 18, 16],
       [17, 12, 17, 10, 19, 13, 14, 10, 19, 16],
       [10, 13, 12, 10, 15, 19, 17, 13, 17, 12],
       [12, 15, 12, 14, 18, 11, 14, 16, 16, 15],
       [15, 12, 18, 15, 14, 10, 13, 17, 16, 11]])
```

In [248…
```
a = np.random.randint(2,10,5)
a
```

Out[248…
```
array([3, 9, 6, 2, 3])
```

In [253…
```
arr
```

Out[253…
```
array([0, 1, 2, 3, 4, 5])
```

In [272…
```
arr2 = np.random.randint(10,100,(10,10))
arr2
```

Out[272…
```
array([[60, 84, 32, 62, 30, 75, 15, 85, 64, 13],
       [54, 63, 87, 27, 19, 94, 52, 98, 95, 88],
       [68, 46, 24, 72, 86, 41, 28, 39, 54, 74],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [56, 87, 12, 56, 72, 52, 41, 72, 90, 56],
       [15, 54, 31, 63, 37, 41, 25, 99, 12, 81],
       [87, 76, 71, 67, 99, 62, 10, 74, 55, 21],
       [91, 34, 76, 43, 96, 74, 11, 48, 78, 90],
       [83, 75, 56, 70, 15, 47, 31, 32, 37, 35],
       [95, 97, 50, 14, 70, 18, 81, 90, 73, 36]])
```

In [274…
```
arr[:]
```

Out[274…
```
array([0, 1, 2, 3, 4, 5])
```

In [276…
```
arr[:2]
```

Out[276…
```
array([0, 1])
```

In [278…
```
arr[:-1]
```

Out[278…
```
array([0, 1, 2, 3, 4])
```

In [282…
```
arr2[1:-1]
```

Out[282…
```
array([[54, 63, 87, 27, 19, 94, 52, 98, 95, 88],
       [68, 46, 24, 72, 86, 41, 28, 39, 54, 74],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [56, 87, 12, 56, 72, 52, 41, 72, 90, 56],
       [15, 54, 31, 63, 37, 41, 25, 99, 12, 81],
       [87, 76, 71, 67, 99, 62, 10, 74, 55, 21],
       [91, 34, 76, 43, 96, 74, 11, 48, 78, 90],
       [83, 75, 56, 70, 15, 47, 31, 32, 37, 35]])
```

In [290…
```
arr2[:]
```

Out[290…
```
array([[60, 84, 32, 62, 30, 75, 15, 85, 64, 13],
       [54, 63, 87, 27, 19, 94, 52, 98, 95, 88],
       [68, 46, 24, 72, 86, 41, 28, 39, 54, 74],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [56, 87, 12, 56, 72, 52, 41, 72, 90, 56],
       [15, 54, 31, 63, 37, 41, 25, 99, 12, 81],
       [87, 76, 71, 67, 99, 62, 10, 74, 55, 21],
       [91, 34, 76, 43, 96, 74, 11, 48, 78, 90],
       [83, 75, 56, 70, 15, 47, 31, 32, 37, 35],
       [95, 97, 50, 14, 70, 18, 81, 90, 73, 36]])
```

In [294…
```
arr2[4,5]
```

Out[294…
```
52
```

In [296…
```
arr2[-4,2]
```

Out[296…
```
71
```

In [298…
```
arr2[4,-3]
```

Out[298…
```
72
```

In [300…
```
arr2[-5,-5]
```

Out[300…
```
41
```

In [302…
```
arr2
```

Out[302…
```
array([[60, 84, 32, 62, 30, 75, 15, 85, 64, 13],
       [54, 63, 87, 27, 19, 94, 52, 98, 95, 88],
       [68, 46, 24, 72, 86, 41, 28, 39, 54, 74],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [56, 87, 12, 56, 72, 52, 41, 72, 90, 56],
       [15, 54, 31, 63, 37, 41, 25, 99, 12, 81],
       [87, 76, 71, 67, 99, 62, 10, 74, 55, 21],
       [91, 34, 76, 43, 96, 74, 11, 48, 78, 90],
       [83, 75, 56, 70, 15, 47, 31, 32, 37, 35],
       [95, 97, 50, 14, 70, 18, 81, 90, 73, 36]])
```

In [308…
```
arr2[::-2]
```

Out[308…
```
array([[95, 97, 50, 14, 70, 18, 81, 90, 73, 36],
       [91, 34, 76, 43, 96, 74, 11, 48, 78, 90],
       [15, 54, 31, 63, 37, 41, 25, 99, 12, 81],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [54, 63, 87, 27, 19, 94, 52, 98, 95, 88]])
```

In [312…
```
arr2[::-3]
```

Out[312…
```
array([[95, 97, 50, 14, 70, 18, 81, 90, 73, 36],
       [87, 76, 71, 67, 99, 62, 10, 74, 55, 21],
       [92, 78, 38, 62, 89, 73, 88, 37, 27, 75],
       [60, 84, 32, 62, 30, 75, 15, 85, 64, 13]])
```

In [314…
```
arr2.max()
```

Out[314…
```
99
```

In [316…
```
arr2.min()
```

Out[316…
```
10
```

In [320…
```
arr2.mean()
```

Out[320…
```
58.08
```

In [326…
```
median(arr2)
```

Out[326…
```
62.0
```

In [350…
```
from numpy import *
a = array([9,2,5,6,8])
median(a)
```

Out[350…
```
6.0
```

In [352…
```
arr
```

Out[352…
```
array([0, 1, 2, 3, 4, 5])
```

In [356…
```
arr.reshape(2,3)
```

Out[356…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [358…
```
arr.reshape(6,1)
```

Out[358…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [360…
```
arr.reshape(1,6)
```

Out[360… array([[0, 1, 2, 3, 4, 5]])

In [368…
```
arr.reshape(3,2,order = 'A')
```

Out[368…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [370…
```
arr.reshape(3,2,order='C')
```

Out[370…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [374…
```
arr.reshape(3,2,order='F')
```

Out[374…
```
array([[0, 3],
       [1, 4],
       [2, 5]])
```

- indexing

In [379…
```
mat = np.arange(0,100),reshape(10,10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[379], line 1
----> 1 mat = np.arange(0,100),reshape(10,10)

File ~\anaconda3\Lib\site-packages\numpy\core\fromnumeric.py:285, in reshape(a, newshape, order)
    200 @array_function_dispatch(_reshape_dispatcher)
    201 def reshape(a, newshape, order='C'):
    202     """
    203     Gives a new shape to an array without changing its data.
    204
   (...)
    283            [5, 6]])
    284     """
--> 285     return _wrapfunc(a, 'reshape', newshape, order=order)

File ~\anaconda3\Lib\site-packages\numpy\core\fromnumeric.py:56, in _wrapfunc(obj, method, *args, **kwds)
     54 bound = getattr(obj, method, None)
     55 if bound is None:
---> 56     return _wrapit(obj, method, *args, **kwds)
     58 try:
     59     return bound(*args, **kwds)

File ~\anaconda3\Lib\site-packages\numpy\core\fromnumeric.py:45, in _wrapit(obj, method, *args, **kwds)
     43 except AttributeError:
     44     wrap = None
---> 45 result = getattr(asarray(obj), method)(*args, **kwds)
     46 if wrap:
     47     if not isinstance(result, mu.ndarray):

ValueError: cannot reshape array of size 1 into shape (10,)
```

In [383…
```
mat =np.arange(0,100).reshape(10,10)
mat
```

Out[383…
```
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 [385…
```
row = 4
col = 5
```

In [387…
```
mat[row,col]
```

Out[387…
```
45
```

In [389…
```
mat[4,5]
```

Out[389…
```
45
```

In [391…
```
mat
```

Out[391…
```
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 [393…
```
mat[:]
```

Out[393…
```
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 [395…
```
col = 6
```

In [397…
```
mat[:col]
```

Out[397…
```
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 [401…
```
mat[:,col]
```

Out[401…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [403…
```
mat[row:]
```

Out[403…
```
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 [405…
```
mat[row,:]
```

Out[405…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [407…
```
mat[:8]
```

Out[407…
```
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]])
```

In [409…
```
mat[:,8]
```

Out[409…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [421…
```
mat [3:-3]
```

Out[421…
```
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 [423…
```
mat[0:10:3]
```

Out[423…
```
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 [425…
```
mat[::-1]
```

Out[425…
```
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 [427…
```
mat[::-2]
```

Out[427…
```
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 [431…
```
mat
```

Out[431…
```
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 [429…
```
mat[2:5,2:4]
```

Out[429…
```
array([[22, 23],
       [32, 33],
       [42, 43]])
```

In [433…
```
mat[3:5,2:4]
```

Out[433…
```
array([[32, 33],
       [42, 43]])
```

In [ ]:
```

```

- Masking

In [439…
```
mat
```

Out[439…
```
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 [441…
```
id(mat)
```

Out[441…
```
2873549588880
```

In [443…
```
mat<50
```

Out[443…
```
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 [447…
```
mat>50
```

Out[447…
```
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 [449…
```
mat == 50
```

Out[449…
```
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],
       [ 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]])
```

In [453…
```
mat = mat[mat>50]
mat
```

Out[453…
```
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 [477…
```
mat = np.arange(0,100).reshape(10,10)
mat
```

Out[477…
```
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 [481…
```
mat = mat[mat<50]
mat
```

Out[481…
```
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 [493…
```
mat = mat[mat>=50]
```

In [497…
```
mat = np.arange(0,100).reshape(10,10)
```

In [ ]: