numpy crash course

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

In [2]:
```
import sys
sys.version
```

Out[2]:
```
'3.12.7 | packaged by Anaconda, Inc. | (main, Oct  4 2024, 13:17:27) [MSC v.192
9 64 bit (AMD64)]'
```

In [3]:
```
np.__version__
```

Out[3]:
```
'1.26.4'
```

creating list

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

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

In [5]:
```
type(my_list)
```

Out[5]:
```
list
```

convert list to array

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

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

In [7]:
```
print(type(arr))
print(type(my_list))
```

```
<class 'numpy.ndarray'>
<class 'list'>
```

In [8]:
```
np.arange(10)
```

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

In [9]:
```
np.arange(10,20)
```

Out[9]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [10]:
```
np.arange(10,50,5)
```

Out[10]:
```
array([10, 15, 20, 25, 30, 35, 40, 45])
```

In [11]:
```
np.arange(10,50,3)
```

Out[11]:
```
array([10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46, 49])
```

In [12]:
```
np.arange(10,30,3)
```

Out[12]:
```
array([10, 13, 16, 19, 22, 25, 28])
```

In [13]:
```
np.arange(10,50,3,4)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[13], line 1
----> 1 np.arange(10,50,3,4)

TypeError: Cannot interpret '4' as a data type
```

In [ ]:
```
np.arange(20,8)
```

In [ ]:
```
np.arange(8,20)
```

In [14]:
```
np.arange(-20,8) #1st arg should less than 2nd arg always
```

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])
```

In [15]:
```
n = np.arange(-20,8) #n is obj
n
```

Out[15]:
```
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])
```

In [16]:
```
np.zeros(3)#parameter tunning-sys defined
```

Out[16]:
```
array([0., 0., 0.])
```

In [17]:
```
np.zeros(3, dtype=int)#hyper parameter tunning-used defined
```

Out[17]:
```
array([0, 0, 0])
```

In [18]:
```
z = np.zeros(5)
z
```

Out[18]:
```
array([0., 0., 0., 0., 0.])
```

In [19]:
```
z = np.zeros((5,3))#5x3 matrix
z
```

Out[19]:
```
array([[0., 0., 0.],
       [0., 0., 0.],
       [0., 0., 0.],
       [0., 0., 0.],
       [0., 0., 0.]])
```

In [20]:
```
z = np.zeros((2,2))
```

```
z
```

Out[20]:
```
array([[0., 0.],
       [0., 0.]])
```

In [21]:
```
np.zeros((3,3), dtype=int)#int zero matrix
```

Out[21]:
```
array([[0, 0, 0],
       [0, 0, 0],
       [0, 0, 0]])
```

In [22]:
```
nd = np.zeros((5,9), dtype=int)
nd
```

Out[22]:
```
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]])
```

In [23]:
```
nd = np.ones(3, dtype=int)
nd
```

Out[23]:
```
array([1, 1, 1])
```

In [24]:
```
nd = np.ones((3,3), dtype=int)
nd
```

Out[24]:
```
array([[1, 1, 1],
       [1, 1, 1],
       [1, 1, 1]])
```

In [28]:
```
nd1 = np.ones((10,10), dtype=int)
nd1
```

Out[28]:
```
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],
       [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 [27]:
```
nd = np.three((10,10), dtype=int)#np can do only 1 and 0
nd
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[27], line 1
----> 1 nd = np.three((10,10), dtype=int)#np can do only 1 and 0
      2 nd

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'three'
```

In [ ]:
```
# random function
```

In [29]:
```
rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[29], line 1
----> 1 rand(3,2)

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

In [30]:
```
random.rand(2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[30], line 1
----> 1 random.rand(2)

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

In [31]:
```
np.random.rand(2)
```

Out[31]:
```
array([0.8330325 , 0.62349546])
```

In [32]:
```
np.random.rand(3)
```

Out[32]:
```
array([0.4941235 , 0.66595344, 0.16965735])
```

In [33]:
```
np.random.rand(4)
```

Out[33]:
```
array([0.94019231, 0.29190546, 0.19790881, 0.85610785])
```

In [34]:
```
np.random.rand(2)
```

Out[34]:
```
array([0.60525869, 0.49622508])
```

In [35]:
```
np.random.rand(2,3)
```

Out[35]:
```
array([[0.25501986, 0.45500197, 0.67004751],
       [0.64436739, 0.69683821, 0.54147165]])
```

In [36]:
```
np.random.rand(2,3)
```

Out[36]:
```
array([[0.01995047, 0.68457148, 0.49221758],
       [0.26383926, 0.62406305, 0.34090553]])
```

In [37]:
```
np.random.rand(4,3)
```

Out[37]:
```
array([[0.8554796 , 0.43009443, 0.38621021],
       [0.47351108, 0.33490724, 0.44630272],
       [0.2555422 , 0.78384743, 0.2994479 ],
       [0.03742367, 0.1282381 , 0.35297365]])
```

In [38]:
```
np.random.randint(3)#gives output random int numbers
```

Out[38]:
```
2
```

In [41]:
```
np.random.randint(3)
```

Out[41]:
```
0
```

In [43]:
```
np.random.randint(2,10)
```

Out[43]:
```
3
```

In [46]:
```
np.random.randint(2,10,3)
```

Out[46]:
```
array([6, 7, 8])
```

In [47]:
```
np.random.randint(2,10,4)
```

Out[47]:
```
array([9, 5, 6, 4])
```

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

Out[50]:
```
array([-23, -11, -26,  -8,   3,  -7, -13, -24,   0,   5])
```

In [55]:
```
np.random.randint(10,40,(10,10))#to generate 10x10 dimen matrix from 10to40
```

Out[55]:
```
array([[17, 23, 31, 21, 32, 10, 33, 12, 36, 28],
       [27, 23, 34, 23, 16, 31, 32, 15, 26, 36],
       [23, 19, 35, 35, 27, 11, 22, 33, 29, 11],
       [14, 21, 11, 36, 23, 34, 15, 10, 12, 14],
       [19, 33, 19, 27, 22, 11, 19, 24, 22, 10],
       [12, 18, 33, 28, 30, 39, 27, 20, 13, 15],
       [29, 13, 12, 14, 14, 18, 32, 10, 11, 36],
       [17, 11, 10, 21, 15, 20, 33, 20, 19, 10],
       [21, 21, 14, 14, 17, 38, 34, 36, 30, 27],
       [36, 14, 23, 21, 29, 27, 35, 28, 17, 33]])
```

In [56]:
```
m = np.random.randint(10,40,(10,10))
m
```

Out[56]:
```
array([[38, 36, 14, 26, 37, 23, 26, 11, 24, 26],
       [34, 31, 38, 17, 34, 17, 37, 31, 34, 27],
       [19, 22, 20, 30, 34, 12, 35, 11, 19, 39],
       [19, 33, 31, 25, 25, 18, 38, 25, 15, 19],
       [32, 37, 31, 36, 13, 37, 28, 11, 14, 29],
       [27, 39, 35, 12, 25, 14, 35, 17, 31, 21],
       [36, 31, 31, 23, 25, 39, 14, 12, 27, 32],
       [13, 16, 17, 22, 17, 32, 16, 27, 23, 10],
       [28, 27, 35, 11, 18, 20, 30, 17, 11, 29],
       [21, 12, 14, 27, 27, 34, 18, 14, 26, 37]])
```

In [ ]:
```
#SLICING
```

In [57]:
```
arr
```

Out[57]:
```
array([0, 1, 2, 3, 4, 5])
```

In [58]:
```
arr.reshape(2,3)
```

Out[58]:
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [59]:
```
arr.reshape(3,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[59], line 1
----> 1 arr.reshape(3,3)

ValueError: cannot reshape array of size 6 into shape (3,3)
```

In [60]:
```
arr.reshape(6,1)
```

Out[60]:
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [61]:
```
arr.reshape(1,6)
```

Out[61]:
```
array([[0, 1, 2, 3, 4, 5]])
```

slicing in matrix

In [62]:
```
m
```

Out[62]:
```
array([[38, 36, 14, 26, 37, 23, 26, 11, 24, 26],
       [34, 31, 38, 17, 34, 17, 37, 31, 34, 27],
       [19, 22, 20, 30, 34, 12, 35, 11, 19, 39],
       [19, 33, 31, 25, 25, 18, 38, 25, 15, 19],
       [32, 37, 31, 36, 13, 37, 28, 11, 14, 29],
       [27, 39, 35, 12, 25, 14, 35, 17, 31, 21],
       [36, 31, 31, 23, 25, 39, 14, 12, 27, 32],
       [13, 16, 17, 22, 17, 32, 16, 27, 23, 10],
       [28, 27, 35, 11, 18, 20, 30, 17, 11, 29],
       [21, 12, 14, 27, 27, 34, 18, 14, 26, 37]])
```

In [65]:
```
b = np.random.randint(10,20,(5,4))
b
```

Out[65]:
```
array([[10, 11, 17, 17],
       [19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14],
       [12, 16, 19, 15]])
```

In [66]:
```
b[:]
```

Out[66]:
```
array([[10, 11, 17, 17],
       [19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14],
       [12, 16, 19, 15]])
```

In [67]:
```
b[1:4]
```

Out[67]:
```
array([[19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14]])
```

In [68]:
```
b[-1:]
```

Out[68]:
```
array([[12, 16, 19, 15]])
```

In [69]:
```
b[:-1]
```

Out[69]:
```
array([[10, 11, 17, 17],
       [19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14]])
```

In [70]:
```
b[:-2]
```

Out[70]:
```
array([[10, 11, 17, 17],
       [19, 11, 15, 11],
       [14, 14, 10, 18]])
```

In [71]:
```
b[1:4]#gives row information
```

Out[71]:
```
array([[19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14]])
```

In [72]:
```
b[1,2]#gives row,col element
```

Out[72]: 15

In [73]:
```
b[1,3]
```

Out[73]: 11

In [74]:
```
b
```

Out[74]:
```
array([[10, 11, 17, 17],
       [19, 11, 15, 11],
       [14, 14, 10, 18],
       [16, 19, 12, 14],
       [12, 16, 19, 15]])
```

In [75]:
```
b[1,-1]#1st row last ele
```

Out[75]: 11

In [76]:
```
b[4,-2]
```

Out[76]: 19

In [ ]:
```
# Numpy Operations
```

In [77]:
```
arr
```

Out[77]: array([0, 1, 2, 3, 4, 5])

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

Out[78]: 5

In [79]:
```
arr.min()
```

Out[79]: 0

In [80]:
```
from numpy import *
a = array([1,2,3,4,9])
median(a)
```

Out[80]: 3.0

In [81]:
```
from numpy import *
a = array([1,2,3,4,9])
mean(a)
```

Out[81]: 3.8

In [82]:
```
from numpy import *
a = array([1,2,3,4,9])
mode(a)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[82], line 3
      1 from numpy import *
      2 a = array([1,2,3,4,9])
----> 3 mode(a)

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

In [ ]:
```
# indexing
```

In [83]:
```
mat = np.arange(0,100).reshape(10,10)
```

In [84]:
```
mat
```

Out[84]:
```
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 [85]:
```
row = 4
col = 5
```

In [86]:
```
row
```

Out[86]:
```
4
```

In [87]:
```
col
```

Out[87]:
```
5
```

In [88]:
```
mat[row, col]#prints 4th row and 5th col element
```

Out[88]:
```
45
```

In [89]:
```
mat
```

Out[89]:
```
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 [90]:
```
row = 4
col = 6
```

In [91]:
```
mat[row, col]
```

Out[91]:
```
46
```

In [92]:
```
mat[1]
```

Out[92]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [93]:
```
mat[:,col]#prints the row
```

Out[93]:
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [96]:
```
mat[:,3]#prints 3rd col
```

Out[96]:
```
array([ 3, 13, 23, 33, 43, 53, 63, 73, 83, 93])
```

In [95]:
```
mat[3]
```

Out[95]:
```
array([30, 31, 32, 33, 34, 35, 36, 37, 38, 39])
```

In [97]:
```
mat[::-1]#reverse matrix
```

Out[97]:
```
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 [98]:
```
mat[::-2]
```

Out[98]:
```
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 [99]:
```
mat
```

Out[99]:
```
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 [100…
```
mat[2:6,2:4]
```

Out[100…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [101…
```
mat[1:2,2:4]
```

Out[101…
```
array([[12, 13]])
```

In [102…
```
mat[3:5,2:4]
```

Out[102…
```
array([[32, 33],
       [42, 43]])
```

In [ ]:
```
# masking and filter
```

In [103…
```
mat
```

Out[103…
```
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 [104…
```
mat>50
```

Out[104…
```
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 [105…
```
mat[mat>50]#filtering
```

Out[105…
```
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 [106…
```
mat[mat>=50]
```

Out[106…
```
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, 80, 81, 82, 83,
       84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99])
```

In [107…
```
mat[mat==50]
```

Out[107…
```
array([50])
```

In [108…
```
mat[mat<50]
```

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])
```

In [109…
```
mat[mat<=50]
```

Out[109…
```
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])
```

In [110…
```
mat[mat!=50]
```

Out[110…
```
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, 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 [ ]:
```
```