Numpy crash course

In [6]:
```
import numpy as np
```

In [7]:
```
np.__version__
```

Out[7]:
```
'1.26.4'
```

In [8]:
```
import sys
sys.version
```

Out[8]:
```
'3.12.7 | packaged by Anaconda, Inc. | (main, Oct  4 2024, 13:17:27) [MSC v.192
9 64 bit (AMD64)]'
```

In [9]:
```
import numpy as np
```

In [10]:
```
np.__version__
```

Out[10]:
```
'1.26.4'
```

Creating Arrays

In [12]:
```
my_list=[0,1,2,3,4,5]
my_list
```

Out[12]:
```
[0, 1, 2, 3, 4, 5]
```

In [13]:
```
type(my_list)
```

Out[13]:
```
list
```

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

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

In [15]:
```
type(arr)
```

Out[15]:
```
numpy.ndarray
```

In [16]:
```
type(my_list)
```

Out[16]:
```
list
```

In [17]:
```
l=[1,2,3]
```

In [18]:
```
l
```

Out[18]:
```
[1, 2, 3]
```

In [19]:
```
arr=np.array(l)
```

In [20]:
```
arr
```

Out[20]:
```
array([1, 2, 3])
```

In [21]:
```
np.arange(10)
```

Out[21]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [22]:
```
np.arange(3.0)
```

Out[22]:
```
array([0., 1., 2.])
```

In [23]:
```
np.arange(9)
```

Out[23]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8])
```

In [24]:
```
np.arange(0,5)
```

Out[24]:
```
array([0, 1, 2, 3, 4])
```

In [25]:
```
np.arange(10,20)
```

Out[25]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [26]:
```
np.arange(20,10)
```

Out[26]:
```
array([], dtype=int32)
```

In [27]:
```
np.arange(-20,10)
```

Out[27]:
```
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 [80]:
```
np.arange()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[80], line 1
----> 1 np.arange()

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

In [82]:
```
np.arange(10,30,5) # 10-starting fro 30-end point 5-step count
```

Out[82]:
```
array([10, 15, 20, 25])
```

In [84]:
```
np.arange(0,10,3)
```

Out[84]:
```
array([0, 3, 6, 9])
```

In [86]:
```
np.arange(10,30,5,8)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[86], line 1
----> 1 np.arange(10,30,5,8)

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

In [88]:
```
np.zeros(3)
```

Out[88]:
```
array([0., 0., 0.])
```

In [90]:
```
np.zeros(5)   #parameter tunning
```

Out[90]:
```
array([0., 0., 0., 0., 0.])
```

In [92]:
```
np.zeros(3,dtype=int) #hyperparametertunning
```

Out[92]:
```
array([0, 0, 0])
```

In [94]:
```
np.zeros((2,2),dtype=int)
```

Out[94]:
```
array([[0, 0],
       [0, 0]])
```

In [96]:
```
zero = np.zeros([2,2])
print(zero)
print(type(zero))
```

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

In [98]:
```
zero = np.zeros([2,2])
print(zero)
print('####')
print(type(zero))
```

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

In [100…
```
np.zeros((2,10))
```

Out[100…
```
array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

In [102…
```
np.zeros((5,10))
```

Out[102…
```
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 [104…
```
np.ones(3)
```

Out[104…
```
array([1., 1., 1.])
```

In [106…
```
np.ones(3,dtype=int)
```

Out[106…
```
array([1, 1, 1])
```

In [108…
```
np.ones((5,4),dtype=int)
```

Out[108…
```
array([[1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1]])
```

In [110…
```
rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[110], line 1
----> 1 rand(3,2)

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

In [112…
```
random.rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[112], line 1
----> 1 random.rand(3,2)

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

In [114…
```
np.random.rand(5)
```

Out[114…
```
array([0.21159224, 0.74050329, 0.25375375, 0.12798956, 0.69300222])
```

In [116…
```
np.random.rand(10)
```

Out[116…
```
array([0.55366395, 0.95507641, 0.55775316, 0.09348229, 0.56264906,
       0.16085214, 0.21852121, 0.17603415, 0.22247944, 0.33181191])
```

In [118…
```
np.random.rand(3,5)
```

Out[118…
```
array([[0.03442026, 0.26721949, 0.24979319, 0.21732316, 0.65376758],
       [0.49786765, 0.43974845, 0.27901866, 0.17440398, 0.43212163],
       [0.08586615, 0.82103503, 0.00734968, 0.00951871, 0.0229371 ]])
```

In [120…
```
np.random.randint(5)
```

Out[120…
```
2
```

In [122…
```
range(5)
```

Out[122…
```
range(0, 5)
```

In [124…
```
r=range(5)
r
```

Out[124…
```
range(0, 5)
```

In [126…
```
for i in r:
    print(i)
```

```
0
1
2
3
4
```

In [128…
```
len(r)
```

Out[128…
```
5
```

In [130…
```
list(range(5))
```

Out[130…
```
[0, 1, 2, 3, 4]
```

In [132…
```
range(1,10)
```

Out[132…
```
range(1, 10)
```

In [134…
```
list(range(1,10))
```

Out[134…
```
[1, 2, 3, 4, 5, 6, 7, 8, 9]
```

In [136…
```
list(range(1,10,3))
```

Out[136…
```
[1, 4, 7]
```

In [138…
```
y = list(range(12))
y
```

Out[138…
```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
```

In [140…
```
np.random.rand(2,4)
```

Out[140…
```
array([[0.6837153 , 0.58087011, 0.86503116, 0.4501487 ],
       [0.38180464, 0.27690123, 0.1653641 , 0.58791113]])
```

In [142…
```
np.random.randint(2,4)
```

Out[142…
```
3
```

In [144…
```
np.random.randint(2,20)
```

Out[144…
```
10
```

In [146…
```
np.random.randint(4,2)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[146], line 1
----> 1 np.random.randint(4,2)

File numpy\\random\\mtrand.pyx:780, in numpy.random.mtrand.RandomState.randint()

File numpy\\random\\_bounded_integers.pyx:1425, in numpy.random._bounded_integers._rand_int32()

ValueError: low >= high
```

In [148…
```
np.random.randint(10,20,3)
```

Out[148…
```
array([11, 17, 14])
```

In [150…
```
np.random.randint(-30,20,(5,10))
```

Out[150…
```
array([[ -9, -22,  18,  -9, -25,  -6,   9, -20,  -9, -30],
       [  6, -17, -15, -25,  15, -21,  19,  13, -19, -20],
       [ 16,  17,   1, -30, -25, -16, -15, -10, -11, -19],
       [-30, -18, -17, -27, -19, -18,   4, -13,   6, -22],
       [ 19,  -7, -14, -23, -15, -24,  14,  11,  -3, -12]])
```

In [152…
```
np.random.randint(-30,20,10)
```

Out[152…
```
array([ -3, -20,  13, -12,  10,  -7, -19, -11,  -8, -19])
```

In [154…
```
np.random.randint(1,12,10)
```

Out[154…
```
array([ 1, 11, 10,  8,  7,  1, 11,  3,  7,  3])
```

In [156…
```
np.random.randint(10,40,(10,10))#10-in,40-ex(10 -row,10-col)
```

Out[156…
```
array([[24, 38, 21, 34, 24, 30, 11, 17, 14, 36],
       [20, 27, 13, 33, 24, 36, 16, 24, 37, 24],
       [10, 14, 39, 15, 31, 12, 12, 22, 33, 25],
       [34, 17, 30, 30, 25, 35, 13, 29, 20, 17],
       [24, 10, 16, 20, 15, 16, 20, 14, 34, 38],
       [36, 33, 31, 26, 38, 27, 21, 21, 14, 26],
       [17, 19, 19, 18, 20, 30, 34, 28, 23, 20],
       [21, 19, 11, 23, 25, 22, 39, 13, 15, 19],
       [19, 13, 26, 17, 37, 30, 15, 38, 14, 15],
       [38, 29, 24, 23, 16, 32, 21, 37, 32, 31]])
```

In [158…
```
np.random.randint(1,100,(12,12))
```

Out[158…
```
array([[22, 40, 35, 12, 58, 50, 69, 28, 40, 40, 70, 32],
       [54, 78, 59, 53, 81,  3, 59, 55, 97, 58, 39, 74],
       [91, 50, 53, 59, 42, 76, 90, 71, 67, 93, 17, 47],
       [85, 39, 20,  1, 80, 70, 53, 47, 70, 96, 33, 63],
       [78, 35, 74, 67, 92, 21, 94,  9, 44, 33, 10, 86],
       [42, 52, 53, 72, 48, 76, 54, 48, 76, 32, 26, 48],
       [81, 87, 47, 85, 61, 45, 65, 94,  5, 84, 55, 92],
       [51, 43, 92, 21, 30,  5, 16, 27, 10, 71, 30, 99],
       [ 3, 15, 41, 55, 76,  9, 13, 22, 30, 14, 88, 93],
       [90,  3, 27,  4, 82, 28, 18, 85, 41, 46, 50, 87],
       [23, 72, 70, 20, 92, 90, 70,  5, 11, 65, 14, 42],
       [73, 90, 74, 55, 98, 26, 99, 69, 90, 55, 55,  7]])
```

In [160…
```
np.arange(1,13).reshape(3,4)
```

Out[160…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [162…
```
np.arange(2,12).reshape(2,5)
```

Out[162…
```
array([[ 2,  3,  4,  5,  6],
       [ 7,  8,  9, 10, 11]])
```

In [164…
```
np.arange(1,13).reshape(12,1)
```

Out[164…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [166…
```
np.arange(1,13).reshape(12,1)
```

Out[166…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [168…
```
b=np.random.randint(10,20,(5,4))
b
```

Out[168…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

In [170…
```
type(b)
```

Out[170…
```
numpy.ndarray
```

In [172…
```
b
```

Out[172…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

In [174…
```
b[:]
```

Out[174…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

In [176…
```
b[1:3]
```

Out[176…
```
array([[14, 12, 16, 18],
       [17, 18, 11, 14]])
```

In [178…
```
b[0:4]
```

Out[178…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12]])
```

In [180…
```
b[0:2]
```

Out[180…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18]])
```

In [182…
```
b
```

Out[182…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

In [184…
```
b[1,2]
```

Out[184…
```
16
```

In [186…
```
b[3,1]
```

Out[186…
```
19
```

In [188…
```
b[-3,]
```

Out[188…
```
array([17, 18, 11, 14])
```

In [190…
```
b[-3,0]
```

Out[190…
```
17
```

In [192…
```
b[-3,-2]
```

Out[192…
```
11
```

In [194…
```
a=np.arange(1,10).reshape(3,3)
```

In [196…
```
a
```

Out[196…
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [198…
```
a[-2,-2]
```

Out[198…
```
5
```

In [200…
```
a[-2,-1]
```

Out[200…
```
6
```

In [202…
```
a[-3,-1]
```

Out[202…
```
3
```

In [204…
```
a[1,1]
```

Out[204…
```
5
```

In [206…
```
a[-3,-2]
```

Out[206…
```
2
```

In [208…
```
a[-3,-1]
```

Out[208…
```
3
```

In [210…
```
b
```

Out[210…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

In [212…
```
b[0,-2]
```

Out[212…
```
18
```

In [214…
```
b[0,2]
```

Out[214…
```
18
```

In [216…
```
np.random.randint(10,20,(4,4))
```

Out[216…
```
array([[14, 12, 16, 15],
       [15, 15, 19, 17],
       [10, 18, 18, 14],
       [19, 17, 11, 19]])
```

In [218…
```
b
```

Out[218…
```
array([[17, 19, 18, 19],
       [14, 12, 16, 18],
       [17, 18, 11, 14],
       [16, 19, 19, 12],
       [18, 18, 16, 16]])
```

Operations

In [225…
```
a=np.random.randint(10,20,10)
a
```

Out[225…
```
array([16, 17, 15, 13, 13, 14, 19, 19, 18, 16])
```

In [229…
```
id(a)
```

Out[229…
```
2410555327472
```

In [233…
```
arr
```

Out[233…
```
array([1, 2, 3])
```

In [235…
```
arr2=np.random.randint(0,100,(10,10))
```

In [237…
```
arr2
```

Out[237…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94],
       [63, 30, 62, 64,  6, 16, 80, 36, 93, 45],
       [ 9,  5, 92, 81, 41, 72,  4, 99, 94, 78],
       [71,  5, 35, 58, 28, 91, 45, 44, 18, 24]])
```

In [239…
```
arr
```

Out[239…
```
array([1, 2, 3])
```

In [241…
```
arr[:]
```

Out[241…
```
array([1, 2, 3])
```

In [243…
```
arr[:4]
```

Out[243…
```
array([1, 2, 3])
```

In [245…
```
arr[:0]
```

Out[245…
```
array([], dtype=int32)
```

In [247…
```
arr2[:]
```

Out[247…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94],
       [63, 30, 62, 64,  6, 16, 80, 36, 93, 45],
       [ 9,  5, 92, 81, 41, 72,  4, 99, 94, 78],
       [71,  5, 35, 58, 28, 91, 45, 44, 18, 24]])
```

In [249…
```
arr2[0:5]
```

Out[249…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30]])
```

In [251…
```
arr2
```

Out[251…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94],
       [63, 30, 62, 64,  6, 16, 80, 36, 93, 45],
       [ 9,  5, 92, 81, 41, 72,  4, 99, 94, 78],
       [71,  5, 35, 58, 28, 91, 45, 44, 18, 24]])
```

In [253…
```
arr2[1,4]
```

Out[253…
```
2
```

In [255…
```
arr2[-5,5]
```

Out[255…
```
52
```

In [257…
```
arr2[-1,-2]
```

Out[257…
```
18
```

In [259…
```
arr2
```

Out[259…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94],
       [63, 30, 62, 64,  6, 16, 80, 36, 93, 45],
       [ 9,  5, 92, 81, 41, 72,  4, 99, 94, 78],
       [71,  5, 35, 58, 28, 91, 45, 44, 18, 24]])
```

In [261…
```
arr2[::-2]
```

Out[261…
```
array([[71,  5, 35, 58, 28, 91, 45, 44, 18, 24],
       [63, 30, 62, 64,  6, 16, 80, 36, 93, 45],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25]])
```

In [263…
```
arr2[::-3]
```

Out[263…
```
array([[71,  5, 35, 58, 28, 91, 45, 44, 18, 24],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [71, 54, 73, 51, 91, 38, 61, 14, 57, 10]])
```

In [265…
```
arr2[:-3]
```

Out[265…
```
array([[71, 54, 73, 51, 91, 38, 61, 14, 57, 10],
       [ 1, 16, 39, 46,  2, 70, 85, 60, 28, 25],
       [45, 83,  3, 82, 70, 68, 69,  3, 72, 41],
       [45, 72, 14, 77, 18, 36, 39, 62, 16, 33],
       [75, 79, 75,  0, 46, 21, 20, 67, 47, 30],
       [ 9, 63, 97, 92, 80, 52, 27, 12, 18,  5],
       [48, 97, 62,  4, 20, 29, 25, 70, 76, 94]])
```

In [267…
```
arr
```

Out[267…
```
array([1, 2, 3])
```

In [269…
```
arr.max()
```

Out[269…
```
3
```

In [271…
```
arr.min()
```

Out[271…
```
1
```

In [273…
```
arr
```

Out[273…
```
array([1, 2, 3])
```

In [275…
```
arr.mean()
```

Out[275…
```
2.0
```

In [277…
```
arr
```

Out[277…
```
array([1, 2, 3])
```

In [279…
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[279], line 1
----> 1 arr.median()

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

In [281…
```
from numpy import *
a = array([1,2,3,4,9])
```

```
median(a)
```

Out[281… 3.0

In [ ]: