Numpy

In [2]:
```
import numpy as np
```

In [8]:
```
np.__version__
```

Out[8]:
```
'2.1.3'
```

In [10]:
```
np.array([1,2,3])
```

Out[10]:
```
array([1, 2, 3])
```

In [11]:
```
my_list=[0,1,2,3,4,5]
my_list
```

Out[11]:
```
[0, 1, 2, 3, 4, 5]
```

In [12]:
```
type(my_list)
```

Out[12]:
```
list
```

In [13]:
```
arr=np.array(my_list)
```

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

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

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

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

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

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

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

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

In [18]:
```
np.arange(9)
```

Out[18]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8])
```

In [19]:
```
np.arange(0,5)
```

Out[19]:
```
array([0, 1, 2, 3, 4])
```

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

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

In [21]:
```
np.arange(10,20)
```

Out[21]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

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

Out[22]:
```
array([], dtype=int64)
```

In [23]:
```
np.arange(-16,10)
```

Out[23]:
```
array([-16, -15, -14, -13, -12, -11, -10,  -9,  -8,  -7,  -6,  -5,  -4,
        -3,  -2,  -1,   0,   1,   2,   3,   4,   5,   6,   7,   8,   9])
```

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

Out[24]:
```
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 [25]:
```
np.arange()
```

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

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

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

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

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

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

In [28]:
```
np.zeros(10)
```

Out[28]:
```
array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])
```

In [29]:
```
np.zeros(3, dtype=int)
```

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

In [30]:
```
np.zeros((2,2),dtype=int)
```

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

In [31]:
```
zero=np.zeros((2,2))
print(zero)
print(type(zero))
```

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

In [32]:
```
zero=np.zeros((2,2))
print(zero)
```

```
print('####')

print(type(zero))
```

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

In [34]:
```
np.zeros((2,10))
```

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

In [35]:
```
np.zeros((10,10), dtype=int)
```

Out[35]:
```
array([[0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0]])
```

In [37]:
```
np.ones(3)
```

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

In [39]:
```
np.ones((3,3))
```

Out[39]:
```
array([[1., 1., 1.],
       [1., 1., 1.],
       [1., 1., 1.]])
```

In [40]:
```
np.ones((3,3),dtype=int)
```

Out[40]:
```
array([[1, 1, 1],
       [1, 1, 1],
       [1, 1, 1]])
```

In [41]:
```
np.ones((5,4),dtype=int)
```

Out[41]:
```
array([[1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1]])
```

In [42]:
```
np.twos(2,3) #no twos function
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[42], line 1
----> 1 np.twos(2,3)

File ~\anacon\Lib\site-packages\numpy\__init__.py:414, in __getattr__(attr)
    411     import numpy.char as char
    412     return char.chararray
--> 414 raise AttributeError("module {!r} has no attribute "
    415                       "{!r}".format(__name__, attr))

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

In [43]:
```
np.threes(2,3) #no threes function
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[43], line 1
----> 1 np.threes(2,3)

File ~\anacon\Lib\site-packages\numpy\__init__.py:414, in __getattr__(attr)
    411     import numpy.char as char
    412     return char.chararray
--> 414 raise AttributeError("module {!r} has no attribute "
    415                       "{!r}".format(__name__, attr))

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

Random

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

Out[44]:
```
array([0.74825798, 0.79004548, 0.97106257])
```

In [45]:
```
np.rand(4) #it will not execute
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[45], line 1
----> 1 np.rand(4)

File ~\anacon\Lib\site-packages\numpy\__init__.py:414, in __getattr__(attr)
    411     import numpy.char as char
    412     return char.chararray
--> 414 raise AttributeError("module {!r} has no attribute "
    415                       "{!r}".format(__name__, attr))

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

In [51]:
```
np.random.randint(10)
```

Out[51]:
```
8
```

In [54]:
```
np.random.rand(3,5)
```

Out[54]:
```
array([[0.41852809, 0.74737045, 0.1060404 , 0.89136365, 0.27035093],
       [0.77026961, 0.38057247, 0.75467899, 0.4269396 , 0.99743639],
       [0.84871509, 0.49663855, 0.36476365, 0.97404837, 0.42928916]])
```

In [60]:
```
np.random.randint(4,6)
```

Out[60]:
```
5
```

In [63]:
```
np.random.randint(0,10)
```

Out[63]:
```
3
```

In [64]:
```
np.random.randint(2,20,4)
```

Out[64]:
```
array([ 9, 10,  8,  6], dtype=int32)
```

In [65]:
```
np.random.randint(0,9,4)
```

Out[65]:
```
array([4, 8, 6, 4], dtype=int32)
```

In [66]:
```
np.random.randint(30,20,10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[66], line 1
----> 1 np.random.randint(30,20,10)

File numpy\\random\\mtrand.pyx:796, in numpy.random.mtrand.RandomState.randint()

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

ValueError: low >= high
```

In [67]:
```
np.random.randint(-30,20,10)
```

Out[67]:
```
array([ -8, -16, -20,   7,  16,   1,  -6, -30, -19,  -9], dtype=int32)
```

In [69]:
```
np.random.randint(10,40,(10,10))
```

Out[69]:
```
array([[35, 25, 11, 23, 17, 18, 27, 38, 31, 28],
       [14, 18, 37, 25, 28, 28, 16, 28, 15, 27],
       [31, 37, 39, 24, 10, 19, 18, 29, 36, 37],
       [38, 31, 16, 24, 12, 21, 16, 21, 13, 37],
       [32, 26, 14, 17, 26, 24, 23, 16, 17, 12],
       [28, 16, 11, 35, 28, 17, 33, 31, 20, 30],
       [24, 11, 20, 21, 15, 38, 16, 34, 36, 30],
       [16, 37, 27, 10, 17, 34, 16, 22, 37, 24],
       [36, 11, 17, 24, 34, 29, 38, 12, 34, 38],
       [18, 13, 10, 32, 14, 11, 29, 20, 13, 13]], dtype=int32)
```

In [70]:
```
arr
```

Out[70]:
```
array([0, 1, 2, 3, 4, 5])
```

Reshape

In [71]:
```
np.arange(1,13).reshape(3,4)
```

Out[71]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [73]:
```
np.arange(1,16).reshape(3,5)
```

Out[73]:
```
array([[ 1,  2,  3,  4,  5],
       [ 6,  7,  8,  9, 10],
       [11, 12, 13, 14, 15]])
```

In [74]:
```
np.arange(1,21).reshape(5,4)
```

Out[74]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12],
       [13, 14, 15, 16],
       [17, 18, 19, 20]])
```

In [75]:
```
np.arange(1,13).reshape(6,2)
```

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

Slicing in matrix

In [79]:
```
b=np.random.randint(10,20,(5,4))
b
```

Out[79]:
```
array([[10, 11, 11, 13],
       [11, 18, 11, 13],
       [13, 13, 10, 19],
       [13, 17, 19, 15],
       [16, 13, 13, 11]], dtype=int32)
```

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

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

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

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

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

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

In [84]:
```
b[0]
```

Out[84]:
```
array([10, 11, 11, 13], dtype=int32)
```

In [85]:
```
b[4]
```

Out[85]:
```
array([16, 13, 13, 11], dtype=int32)
```

In [86]:
```
b[0:3]
```

Out[86]:
```
array([[10, 11, 11, 13],
       [11, 18, 11, 13],
       [13, 13, 10, 19]], dtype=int32)
```

In [87]:
```
b[-4]
```

Out[87]:
```
array([11, 18, 11, 13], dtype=int32)
```

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

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

In [1]:
```
b[:]
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[1], line 1
----> 1 b[:]

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

In [14]:
```
b[4,3]
```

Out[14]:
```
np.int32(18)
```

Operations

In [5]:
```
import numpy as np
```

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

Out[20]:
```
array([17, 15, 17, 11, 10, 15, 16, 13, 16, 12], dtype=int32)
```

In [16]:
```
arr2=np.random.randint(0,100,(10,10))
arr2
```

Out[16]:
```
array([[88, 46, 97, 14, 67, 41, 44, 92, 57, 51],
       [26, 75, 21, 25, 22, 45, 89, 14, 53, 23],
       [63, 16, 99, 87, 66, 66, 41,  6, 87, 69],
       [29, 42, 14, 54, 32, 58, 88, 18, 81, 38],
       [ 8, 84,  4, 58,  8, 97, 43, 80, 27, 18],
       [30, 55, 71, 70, 37, 88, 52, 73, 10, 74],
       [39, 71, 90, 20, 77,  0, 75,  6, 42, 87],
       [30, 23, 62, 58, 67, 11,  7, 34, 45, 47],
       [49, 51, 14, 31, 62,  3, 61, 87, 82, 57],
       [63, 97, 84, 17, 91, 78, 31, 27, 68,  6]], dtype=int32)
```

In [17]:
```
id(arr2)
```

Out[17]:
```
2248026002448
```

In [21]:
```
a[:]
```

Out[21]:
```
array([17, 15, 17, 11, 10, 15, 16, 13, 16, 12], dtype=int32)
```

In [23]:
```
arr2[0:5]
```

Out[23]:
```
array([[88, 46, 97, 14, 67, 41, 44, 92, 57, 51],
       [26, 75, 21, 25, 22, 45, 89, 14, 53, 23],
       [63, 16, 99, 87, 66, 66, 41,  6, 87, 69],
       [29, 42, 14, 54, 32, 58, 88, 18, 81, 38],
       [ 8, 84,  4, 58,  8, 97, 43, 80, 27, 18]], dtype=int32)
```

In [24]:
```
arr2[1,4]
```

Out[24]:
```
np.int32(22)
```

In [25]:
```
arr2[-5,-5]
```

Out[25]:
```
np.int32(88)
```

In [26]:
```
arr2[5,5]
```

Out[26]:
```
np.int32(88)
```

In [27]:
```
arr2[-5,5]
```

Out[27]:
```
np.int32(88)
```

In [28]:
```
arr2[::-1]
```

Out[28]:
```
array([[63, 97, 84, 17, 91, 78, 31, 27, 68,  6],
       [49, 51, 14, 31, 62,  3, 61, 87, 82, 57],
       [30, 23, 62, 58, 67, 11,  7, 34, 45, 47],
       [39, 71, 90, 20, 77,  0, 75,  6, 42, 87],
       [30, 55, 71, 70, 37, 88, 52, 73, 10, 74],
       [ 8, 84,  4, 58,  8, 97, 43, 80, 27, 18],
       [29, 42, 14, 54, 32, 58, 88, 18, 81, 38],
       [63, 16, 99, 87, 66, 66, 41,  6, 87, 69],
       [26, 75, 21, 25, 22, 45, 89, 14, 53, 23],
       [88, 46, 97, 14, 67, 41, 44, 92, 57, 51]], dtype=int32)
```

In [29]:
```
list=[0,1,2,3,4,5]
```

In [30]:
```
list
```

Out[30]:
```
[0, 1, 2, 3, 4, 5]
```

In [32]:
```
arr=np.array(list)
```

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

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

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

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

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

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

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

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

In [37]:
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[37], line 1
----> 1 arr.median()

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

In [41]:
```
from numpy import *
a=array([1,2,3,4,9])
median(a)
```

Out[41]:
```
np.float64(3.0)
```

Indexing

In [2]:
```
import numpy as np
```

In [4]:
```
mat=np.arange(0,100).reshape(10,10)
mat
```

Out[4]:
```
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 [9]:
```
row=5
```

```
col=6
```

In [6]:
```
col
```

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

In [10]:
```
mat[row,col]
```

Out[10]:
```
np.int64(56)
```

In [11]:
```
mat
```

Out[11]:
```
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 [12]:
```
mat[:,7]
```

Out[12]:
```
array([ 7, 17, 27, 37, 47, 57, 67, 77, 87, 97])
```

In [13]:
```
mat[:,-1]
```

Out[13]:
```
array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

In [14]:
```
mat[3,:]
```

Out[14]:
```
array([30, 31, 32, 33, 34, 35, 36, 37, 38, 39])
```

In [15]:
```
mat[:,8]
```

Out[15]:
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [16]:
```
mat[3:-3]
```

Out[16]:
```
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 [17]:
```
mat
```

Out[17]:
```
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 [18]:
```
mat[2:6,2:4]
```

Out[18]:
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [19]:
```
mat[1:2,2:4]
```

Out[19]:
```
array([[12, 13]])
```

In [20]:
```
mat[2:3,2:3]
```

Out[20]:
```
array([[22]])
```

Masking

In [21]:
```
mat
```

Out[21]:
```
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 [22]:
```
id(mat)
```

Out[22]:
```
3121004263728
```

In [23]:
```
mat[mat>=50]
```

Out[23]:
```
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 [24]:
```
mat>=50
```

Out[24]:
```
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,  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 [ ]: