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

In [2]:
```
np.__version__
```

Out[2]:
```
'1.26.4'
```

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

Out[3]:
```
'3.12.7 | packaged by Anaconda, Inc. | (main, Oct  4 2024, 13:17:27) [MSC v.192
9 64 bit (AMD64)]'
```

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

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

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

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

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

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

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

Out[7]:
```
numpy.ndarray
```

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(10,20,3)
```

Out[10]:
```
array([10, 13, 16, 19])
```

In [11]:
```
np.arange(10,30,3)
```

Out[11]:
```
array([10, 13, 16, 19, 22, 25, 28])
```

In [12]:
```
np.arange(20,8)
```

Out[12]:
```
array([], dtype=int32)
```

In [13]:
```
np.arange(-20,7)
```

Out[13]:
```
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])
```

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

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

In [15]:
```
np.zeros(3)
```

Out[15]:
```
array([0., 0., 0.])
```

In [16]:
```
np.zeros(3,dtype=int)
```

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

In [17]:
```
np.zeros(5)
```

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

In [18]:
```
np.zeros((2,2))
```

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

In [19]:
```
np.zeros((10,10))
```

Out[19]:
```
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 [20]:
```
np.zeros((2,2),dtype=int)
```

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

In [22]:
```
n=np.zeros((10,3))
n
```

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.]])
```

In [23]:
```
len(n)
```

Out[23]:
```
10
```

In [25]:
```
n1=np.ones((10,10))
n1
```

Out[25]:
```
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 [26]:
```
n2=np.ones((5,5),dtype=int)
n2
```

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

In [27]:
```
np.tan(20)
```

Out[27]:
```
2.237160944224742
```

In [28]:
```
arr
```

Out[28]:
```
array([1, 2, 3, 4, 5])
```

In [29]:
```
type(arr)
```

Out[29]:
```
numpy.ndarray
```

Random Numbers with Numpy

In [30]:
```
rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[30], line 1
----> 1 rand(3,2)

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

In [31]:
```
random.rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[31], line 1
----> 1 random.rand(3,2)

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

In [32]:
```
np.random.rand(3,2)
```

Out[32]:
```
array([[0.80734553, 0.0502697 ],
       [0.90272088, 0.57320264],
       [0.59951414, 0.72604299]])
```

In [33]:
```
np.random.rand(2,3)
```

Out[33]:
```
array([[0.17776303, 0.71541143, 0.16597072],
       [0.1404788 , 0.33973166, 0.6232118 ]])
```

In [34]:
```
np.random.rand(4)
```

Out[34]:
```
array([0.73047524, 0.8998059 , 0.69126754, 0.98212606])
```

In [36]:
```
np.random.randint(3)
```

Out[36]:
```
2
```

In [37]:
```
np.random.randint(2,20)
```

Out[37]:
```
6
```

In [38]:
```
np.random.randint(2,10,3)
```

Out[38]:
```
array([6, 8, 6])
```

In [39]:
```
np.random.randint(2,20,15)
```

Out[39]:
```
array([13, 11, 10,  5, 11, 13, 19,  9,  7, 17, 16, 18,  8, 14,  8])
```

In [40]:
```
np.random.randint(-30,10,17)
```

Out[40]:
```
array([-30, -28,   3,  -5,   5,   0, -23,   1, -30,   6,  -1,  -2,   8,
       -21,   7,  -8,   7])
```

In [41]:
```
np.random.randint(10,15,(3,4))
```

Out[41]:
```
array([[12, 14, 14, 13],
       [10, 13, 12, 11],
       [14, 11, 13, 12]])
```

In [43]:
```
m=np.random.randint(10,100,(3,3))
m
```

Out[43]:
```
array([[40, 78, 73],
       [52, 24, 72],
       [25, 22, 41]])
```

In [44]:
```
arr
```

Out[44]:
```
array([1, 2, 3, 4, 5])
```

Reshaping and Flattening

In [48]:
```
l=[10,20,30,40]
l
```

Out[48]:
```
[10, 20, 30, 40]
```

In [50]:
```
arr=np.array(l)
arr
```

Out[50]:
```
array([10, 20, 30, 40])
```

In [51]:
```
arr
```

Out[51]:
```
array([10, 20, 30, 40])
```

In [52]:
```
arr.reshape(2,2)
```

Out[52]:
```
array([[10, 20],
       [30, 40]])
```

In [53]:
```
l=[2,3,4,5,6,7,8,10,1,1,11,12,13,14,15,16]
l
```

Out[53]:
```
[2, 3, 4, 5, 6, 7, 8, 10, 1, 1, 11, 12, 13, 14, 15, 16]
```

In [54]:
```
arr=np.array(l)
arr
```

Out[54]:
```
array([ 2,  3,  4,  5,  6,  7,  8, 10,  1,  1, 11, 12, 13, 14, 15, 16])
```

In [55]:
```
arr.reshape(4,4)
```

Out[55]:
```
array([[ 2,  3,  4,  5],
       [ 6,  7,  8, 10],
       [ 1,  1, 11, 12],
       [13, 14, 15, 16]])
```

In [56]:
```
m
```

Out[56]:
```
array([[40, 78, 73],
       [52, 24, 72],
       [25, 22, 41]])
```

Array Indexing and Slicing

In [57]:
```
b=np.random.randint(10,20,(5,4))
b
```

Out[57]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18],
       [17, 16, 19, 14]])
```

In [58]:
```
b[::-1]
```

Out[58]:
```
array([[17, 16, 19, 14],
       [15, 15, 18, 18],
       [19, 10, 15, 13],
       [16, 16, 16, 11],
       [13, 13, 12, 14]])
```

In [59]:
```
b[1:4]
```

Out[59]:
```
array([[16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18]])
```

In [60]:
```
b[-1:]
```

Out[60]:
```
array([[17, 16, 19, 14]])
```

In [61]:
```
b
```

Out[61]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18],
       [17, 16, 19, 14]])
```

In [62]:
```
b[:-1]
```

Out[62]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18]])
```

In [63]:
```
b[:-2]
```

Out[63]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13]])
```

In [64]:
```
b[1,2]
```

Out[64]:
```
16
```

In [65]:
```
b
```

Out[65]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18],
       [17, 16, 19, 14]])
```

In [66]:
```
b[1,2]
```

Out[66]:
```
16
```

In [67]:
```
b[1,3]
```

Out[67]:
```
11
```

In [68]:
```
b
```

Out[68]:
```
array([[13, 13, 12, 14],
       [16, 16, 16, 11],
       [19, 10, 15, 13],
       [15, 15, 18, 18],
       [17, 16, 19, 14]])
```

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

Out[69]: 11

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

Out[70]: 15

numpy Operations

In [73]:
```
import numpy as np
from numpy import*
```

In [74]:
```
arr1=[1,2,3,4,5]
arr1
```

Out[74]: [1, 2, 3, 4, 5]

In [75]:
```
arr2=[5,6,7,8,9]
arr2
```

Out[75]: [5, 6, 7, 8, 9]

In [76]:
```
np.add(arr1,arr2)
```

Out[76]: array([6, 8, 10, 12, 14])

In [77]:
```
np.subtract(arr1,arr2)
```

Out[77]: array([-4, -4, -4, -4, -4])

In [78]:
```
np.multiply(arr1,arr2)
```

Out[78]: array([5, 12, 21, 32, 45])

In [79]:
```
np.divide(arr1,arr2)
```

Out[79]: array([0.2   , 0.33333333, 0.42857143, 0.5   , 0.55555556])

In [80]:
```
arr1
```

Out[80]: [1, 2, 3, 4, 5]

In [81]:
```
mean(arr1)
```

Out[81]: 3.0

In [82]:
```
min(arr1)
```

Out[82]: 1

In [83]:
```
max(arr1)
```

Out[83]: 5

In [84]:
```
sum(arr1)
```

Out[84]: 15

In [85]:
```
average(arr1)
```

Out[85]: 3.0

In [86]:
```
median(arr1)
```

Out[86]: 3.0

In [87]:
```
sqrt(arr1)
```

Out[87]:
```
array([1.        , 1.41421356, 1.73205081, 2.        , 2.23606798])
```

In [88]:
```
add(arr1,2)
```

Out[88]:
```
array([3, 4, 5, 6, 7])
```

In [90]:
```
mat=arange(0,100)
mat
```

Out[90]:
```
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 [91]:
```
matt=mat.reshape(10,10)
matt
```

Out[91]:
```
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 [92]:
```
row=4
col=5
```

In [93]:
```
col
```

Out[93]: 5

In [94]:
```
matt[row,col]
```

Out[94]: 45

In [95]:
```
matt
```

Out[95]:
```
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 [96]:
```
matt[1]
```

Out[96]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [97]:
```
matt[:,col]
```

Out[97]:
```
array([ 5, 15, 25, 35, 45, 55, 65, 75, 85, 95])
```

In [98]:
```
matt[:,4]
```

Out[98]:
```
array([ 4, 14, 24, 34, 44, 54, 64, 74, 84, 94])
```

In [99]:
```
matt[:,3]
```

Out[99]:
```
array([ 3, 13, 23, 33, 43, 53, 63, 73, 83, 93])
```

In [100…
```
matt
```

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…
```
matt[::-1]
```

Out[101…
```
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 [102…
```
matt[::-2]
```

Out[102…
```
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 [103…
```
matt
```

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…
```
matt[2:6,2:3]
```

Out[104…
```
array([[22],
       [32],
       [42],
       [52]])
```

In [105…
```
matt[2:6,2:5]
```

Out[105…
```
array([[22, 23, 24],
       [32, 33, 34],
       [42, 43, 44],
       [52, 53, 54]])
```

In [106…
```
matt[1:2,2:4]
```

Out[106…
```
array([[12, 13]])
```

In [107…
```
matt[3:5,2:4]
```

Out[107…
```
array([[32, 33],
       [42, 43]])
```

Masking

In [108…
```
matt
```

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…
```
matt<50
```

Out[109…
```
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 [110…
```
matt>50
```

Out[110…
```
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 [111…
```
matt[matt>50]
```

Out[111…
```
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 [112…
```
matt[matt>=50]
```

Out[112…
```
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 [113…
```
matt[matt<50]
```

Out[113…
```
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 [114…
```
matt[matt<=50]
```

Out[114…
```
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 [ ]:
```

```