Numpy Introduction

In [4]:
```
import numpy as np
```

In [6]:
```
np.__version__
```

Out[6]:
```
'1.26.4'
```

Array Creation

In [21]:
```
arr=np.array([1,2,3,4,5])
arr
```

Out[21]:
```
array([1, 2, 3, 4, 5])
```

In [23]:
```
type(arr)
```

Out[23]:
```
numpy.ndarray
```

In [25]:
```
np.arange(14)
```

Out[25]:
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13])
```

In [33]:
```
np.arange(3.4)
```

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

In [35]:
```
np.arange(0,5) #indexing
```

Out[35]:
```
array([0, 1, 2, 3, 4])
```

In [37]:
```
np.arange(10,40)
```

Out[37]:
```
array([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])
```

In [43]:
```
np.arange(10,50,2) #Slicing
```

Out[43]:
```
array([10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42,
       44, 46, 48])
```

In [45]:
```
np.arange(20,10)  #start index should be less than end index.
```

Out[45]:
```
array([], dtype=int32)
```

In [47]:
```
np.arange(-10,20)
```

Out[47]:
```
array([-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 [49]:
```
np.arange(0,50,3)
```

Out[49]:
```
array([ 0,  3,  6,  9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48])
```

Zeros

In [54]:
```
np.zeros(4)
```

Out[54]:
```
array([0., 0., 0., 0.])
```

In [66]:
```
np.zeros(5,dtype=int,order="F")
```

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

In [68]:
```
np.zeros(1)
```

Out[68]:
```
array([0.])
```

In [70]:
```
np.zeros(0)
```

Out[70]:
```
array([], dtype=float64)
```

In [80]:
```
np.zeros([2,3],dtype=int)
```

Out[80]:
```
array([[0, 0, 0],
       [0, 0, 0]])
```

In [84]:
```
np.zeros((10,30),dtype=int)
```

Out[84]:
```
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, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0],
       [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
        0, 0, 0, 0, 0, 0, 0, 0]])
```

Ones

In [87]:
```
np.ones(0,3)
```

Out[87]:
```
array([1., 1., 1.])
```

In [91]:
```
np.ones((3,4))
```

Out[91]:
```
array([[1., 1., 1., 1.],
       [1., 1., 1., 1.],
       [1., 1., 1., 1.]])
```

In [93]:
```
np.ones((0,3))
```

Out[93]:
```
array([], shape=(0, 3), dtype=float64)
```

In [97]:
```
n=(6,7)
n
```

Out[97]:
```
(6, 7)
```

In [101…
```
np.ones(n,dtype=int)
```

Out[101…
```
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]])
```

Range # BONUS

In [104…
```
range(5)
```

Out[104…
```
range(0, 5)
```

In [117…
```
for i in range(5):
    print(i,end=" ")
```

```
0 1 2 3 4
```

Random.rand

In [128…
```
np.random.rand(3,10) #Gives the matrix 3 by 10 with random values.
```

Out[128…
```
array([[0.37382788, 0.40601413, 0.95598433, 0.78893508, 0.51364667,
        0.16327415, 0.75916027, 0.52789155, 0.20758902, 0.97757017],
       [0.62425096, 0.05835525, 0.05797507, 0.51928113, 0.48023583,
        0.60836452, 0.28228944, 0.1301684 , 0.14534782, 0.08040686],
       [0.86584387, 0.38054714, 0.43961822, 0.25058313, 0.63466872,
        0.28799801, 0.34262555, 0.94455132, 0.96762314, 0.83618557]])
```

In [130…
```
np.random.rand(3,3)
```

Out[130…
```
array([[0.57450771, 0.65332631, 0.68451597],
       [0.74572768, 0.17301071, 0.80875037],
       [0.34151599, 0.50803568, 0.83556117]])
```

In [159…
```
np.random.randint(4,8) #random.randint function gives the random numbes between
```

Out[159…
```
4
```

In [161…
```
np.random.randint(10,15)
```

Out[161…
```
13
```

In [169…
```
np.random.randint(3)
```

Out[169…
```
2
```

In [177…
```
np.random.randint(0,10,4) #random values of format(start,end,columns)
```

Out[177…
```
array([3, 9, 5, 0])
```

In [183…
```
np.random.randint(3,15,3)
```

Out[183…
```
array([13, 13,  4])
```

In [187…
```
np.random.randint(3,15,(4,3)) # random values of format(start, end, (rows, colum
```

Out[187…
```
array([[11, 11, 10],
       [14,  3, 13],
       [ 8,  3, 13],
       [ 3, 12,  3]])
```

In [235…
```
b=np.random.randint(20,50,(5,8))
b
```

Out[235…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [42, 33, 42, 48, 33, 37, 38, 31]])
```

In [232…
```
np.random.randint(1,100,(12,12))
```

Out[232…
```
array([[32, 66, 19, 93, 72, 25, 62, 52, 68, 36, 23, 17],
       [98, 35, 29, 45, 57, 24, 28, 97, 66, 28, 88, 33],
       [19, 95, 65, 16, 67, 22, 75, 74, 60, 77, 96, 85],
       [56, 90, 16, 67, 12, 68, 44, 52,  6, 62, 60, 86],
       [70, 31, 60, 15, 21, 54, 51, 40, 92, 43, 92, 57],
       [ 4, 63, 72, 69, 57, 82, 55,  2, 15, 79, 66, 30],
       [95, 51, 20, 83, 38, 97,  5, 32, 70, 61, 28, 93],
       [21, 50, 58, 59,  2, 84, 92, 91, 49,  3,  8, 93],
       [99,  4, 46,  5, 24, 63,  6, 11,  5, 56, 77, 56],
       [98, 54, 65,  6, 93, 24, 20, 14, 42, 82, 39, 72],
       [11, 26, 12, 97, 83, 29, 78, 86, 32, 31, 31, 16],
       [44, 38, 87, 70, 72, 68, 42, 42, 24, 88, 36, 79]])
```

arange.reshape

In [206…
```
nn=np.arange(1,13)
```

In [200…
```
np.arange(1,13).reshape(2,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[200], line 1
----> 1 np.arange(1,13).reshape(2,3)

ValueError: cannot reshape array of size 12 into shape (2,3)
```

In [208…
```
len(nn)
```

Out[208…
```
12
```

In [210…
```
np.arange(1,13).reshape(3,4) #The length of array should be equal to the product
```

Out[210…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [218…
```
np.arange(2,12).reshape(2,5)
```

Out[218…
```
array([[ 2,  3,  4,  5,  6],
       [ 7,  8,  9, 10, 11]])
```

In [228…
```
np.arange(15,4).reshape(0,1) #In arange() start value is greater than end value
```

Out[228…
```
array([], shape=(0, 1), dtype=int32)
```

In [237…
```
b
```

Out[237…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [42, 33, 42, 48, 33, 37, 38, 31]])
```

Indexing and Slicing of the matrices

In [240…
```
b[1:3]
```

Out[240…
```
array([[30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34]])
```

In [242…
```
b[1,2]
```

Out[242…
```
29
```

In [244…
```
b[1,3]
```

Out[244…
```
48
```

In [246…
```
b[1,-1]
```

Out[246…
```
43
```

In [248…
```
b[2:3]
```

Out[248…
```
array([[45, 34, 38, 48, 24, 46, 46, 34]])
```

In [250…
```
b[0:-2]
```

Out[250…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34]])
```

In [252…
```
b
```

Out[252…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [42, 33, 42, 48, 33, 37, 38, 31]])
```

In [254…
```
b[0,2]
```

Out[254…
```
38
```

In [256…
```
b[-5,-3]
```

Out[256…
```
20
```

In [258…
```
b[-4,2]
```

Out[258…
```
29
```

In [260…
```
b[-4,-2]
```

Out[260…
```
20
```

In [262…
```
b[-4:2]
```

Out[262…
```
array([[30, 25, 29, 48, 23, 23, 20, 43]])
```

In [264…
```
b[:]
```

Out[264…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [42, 33, 42, 48, 33, 37, 38, 31]])
```

In [268…
```
b[-5,-5]
```

Out[268…
```
39
```

In [270…
```
b[::-1]
```

Out[270…
```
array([[42, 33, 42, 48, 33, 37, 38, 31],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [43, 47, 38, 39, 29, 20, 41, 43]])
```

In [272…
```
b[::-2]
```

Out[272…
```
array([[42, 33, 42, 48, 33, 37, 38, 31],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [43, 47, 38, 39, 29, 20, 41, 43]])
```

In [274…
```
b[::-3]
```

Out[274…
```
array([[42, 33, 42, 48, 33, 37, 38, 31],
       [30, 25, 29, 48, 23, 23, 20, 43]])
```

In [276…
```
b[:-3]
```

Out[276…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43]])
```

In [278…
```
b.max()
```

Out[278… 48

In [280…
```
b.min()
```

Out[280… 20

In [292…
```
arr.put(1,1)
arr
```

Out[292… array([0, 1, 3, 4, 5])

In [310…
```
arr.mean()
median(arr)
```

Out[310… 3.0

In [298…
```
from numpy import *
a=array([1,2,3,4,5])
a
```

Out[298… array([1, 2, 3, 4, 5])

In [306…
```
median(a)
```

Out[306… 3.0

In [320…
```
a=array([0,1,2,3,4,5])
a
```

Out[320… array([0, 1, 2, 3, 4, 5])

In [322…
```
a.reshape(3,2)
```

Out[322…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [324…
```
a.reshape(2,3)
```

Out[324…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [328…
```
a.reshape(1,6)
```

Out[328… array([[0, 1, 2, 3, 4, 5]])

In [330…
```
a.reshape(2,3,order='C') #C type order
```

Out[330…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [336…
```
a.reshape(3,2,order='F') #print element in fortran
```

Out[336…
```
array([[0, 3],
       [1, 4],
       [2, 5]])
```

In [334…
```
a.reshape(2,3,order='A') #A almost is as same as C
```

Out[334…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [340…
```
a.reshape(2,3)
```

Out[340…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [342…
```
a.reshape(2,6)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[342], line 1
----> 1 a.reshape(2,6)

ValueError: cannot reshape array of size 6 into shape (2,6)
```

In [346…
```
b
```

Out[346…
```
array([[43, 47, 38, 39, 29, 20, 41, 43],
       [30, 25, 29, 48, 23, 23, 20, 43],
       [45, 34, 38, 48, 24, 46, 46, 34],
       [30, 33, 23, 24, 39, 25, 26, 22],
       [42, 33, 42, 48, 33, 37, 38, 31]])
```

In [344…
```
b[:,6]
```

Out[344…
```
array([41, 20, 46, 26, 38])
```

In [348…
```
row=4
```

In [350…
```
b[row,:]
```

Out[350…
```
array([42, 33, 42, 48, 33, 37, 38, 31])
```

In [352…
```
col=-2
b[:,col]
```

Out[352…
```
array([41, 20, 46, 26, 38])
```

In [358…
```
mat=np.arange(0,100).reshape(10,10)
```

In [360…
```
mat
```

Out[360…
```
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 [362…
```
mat[:,8]
```

Out[362… array([8, 18, 28, 38, 48, 58, 68, 78, 88, 98])

In [364…
```
mat[1,4]
```

Out[364… 14

In [366…
```
mat[3:-3]
```

Out[366…
```
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 [368…
```
mat[6:]
```

Out[368…
```
array([[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 [370…
```
mat[5:7]
```

Out[370…
```
array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]])
```

In [372…
```
mat[0:10:3]
```

Out[372…
```
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 [374…
```
mat[::-1]
```

Out[374…
```
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 [376…
```
mat[::-5]
```

Out[376…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

In [378…
```
mat
```

Out[378…
```
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 [380…
```
mat[2:6,2:4]
```

Out[380…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [8]:
```
a=np.array([1,2,3,4])
print("Array a:" ,a)
```

```
Array a: [1 2 3 4]
```

In [14]:
```
d=np.zeros([2,3],dtype=int)
print(d)
```

```
[[0 0 0]
 [0 0 0]]
```

EYE function is used to get identity matrix

In [16]:
```
f=np.eye(4)
print(f)
```

```
[[1. 0. 0. 0.]
 [0. 1. 0. 0.]
 [0. 0. 1. 0.]
 [0. 0. 0. 1.]]
```

In [20]:
```
np.eye(4,6,dtype=int)
```

Out[20]:
```
array([[1, 0, 0, 0, 0, 0],
       [0, 1, 0, 0, 0, 0],
       [0, 0, 1, 0, 0, 0],
       [0, 0, 0, 1, 0, 0]])
```

In [26]:
```
np.eye(4,6,1,dtype=int)
```

Out[26]:
```
array([[0, 1, 0, 0, 0, 0],
       [0, 0, 1, 0, 0, 0],
       [0, 0, 0, 1, 0, 0],
       [0, 0, 0, 0, 1, 0]])
```

In [35]:
```
g=np.array([2,3])
```

In [39]:
```
g.reshape(1,2)
```

Out[39]:
```
array([[2, 3]])
```

In [ ]: