

Numpy

```
In [70]: # now we will create a numpy ndarray object
```

```
In [71]: import numpy as np
```

```
In [72]: x=np.array([1,2,3,4,5,])
```

```
In [73]: print(x)
print(type(x))
```

```
[1 2 3 4 5]
<class 'numpy.ndarray'>
```

we can also pass a list, tuple or any array like object with array() . and it will be converted to ndarray

```
In [74]: y=np.array((1,2,3,4,5))
```

```
In [75]: print(y)
print(type(y))
```

```
[1 2 3 4 5]
<class 'numpy.ndarray'>
```

dimensions in array a dimensions in array is one level of array depth (nested array)

0-D arraya-- scalars,are the element in an array,each value in an array is 0-D array.

```
In [76]: # now will create 0-D array with value 42
```

```
In [77]: x=np.array(42)
```

```
In [78]: print(x)
```

```
42
```

```
In [79]: # now will create 1-D array
```

```
In [80]: x1=np.array([1,2,3,4,5])
```

```
In [81]: print(x1)
```

```
[1 2 3 4 5]
```

```
In [82]: # now will create 2-D array, with certain values
```

```
In [83]: x2=np.array([[1,2,3,4,5],[6,7,8,9,10]])
```

```
In [84]: print(x2)
```

```
[[ 1  2  3  4  5]
 [ 6  7  8  9 10]]
```

```
In [85]: # now will create 3-D array, with certain values
```

```
In [86]: x3=np.array([[[1,2,3],[4,5,6]], [[1,2,3],[4,5,6]]])
```

```
In [87]: print(x3)
```

```
[[[1 2 3]
   [4 5 6]]

 [[1 2 3]
   [4 5 6]]]
```

```
In [88]: # how many dimensions the array have : ndim attribute values
```

```
In [89]: x=np.array(42)
x1=np.array([1,2,3,4,5])
x2=np.array([[1,2,3,4,5],[6,7,8,9,10]])
x3=np.array([[[1,2,3],[4,5,6]], [[1,2,3],[4,5,6]]])
```

```
In [90]: print(x.ndim)
print(x1.ndim)
print(x2.ndim)
print(x3.ndim)
```

```
0
1
2
3
```

```
In [91]: # now will create 5-D array, and verify that it has 5 dimensions
```

```
In [92]: x5=np.array([1,2,3,4,5], ndmin=5)
```

```
In [93]: print(x5)
```

```
[[[[[1 2 3 4 5]]]]]
```

```
In [94]: print(x5.ndim)
```

```
5
```

Array indexing

```
In [95]: #start with 0, second 1
```

```
In [96]: x1=np.array([1,2,3,4,5,6,7])
```

```
In [97]: x1[0]
```

```
Out[97]: 1
```

```
In [98]: x1[4]
```

```
Out[98]: 5
```

```
In [99]: x1[6]
```

```
Out[99]: 7
```

```
In [100]: # we can third and fourth element from adding them.
```

```
In [101]: x1=np.array([1,2,3,4,5,6,7])
```

```
In [102]: x1[2]+ x1[4]
```

```
Out[102]: 8
```

```
In [103]: #Accessing the 2-d it is like a row and col.
```

```
In [104]: x1=np.array([[1,2,3,4,5,6,7],[8,9,10,11,12,13,14]])
```

```
In [105]: print("2nd element in the 1st rows",x1[0,1])
```

```
2nd element in the 1st rows 2
```

```
In [106]: print("5nd element in the 2st rows",x1[1,4])
```

5nd element in the 2st rows 12

```
In [107]: #Accessing the 3-d same as accessing
```

```
In [108]: x1=np.array([[[1,2,3],[4,5,6]], [[1,2,3],[4,5,6]]])
```

```
In [109]: print(x1[0,1,2])
```

6

```
In [110]: print(x1[1,0,1])
```

2

numpy slicing array

slicing in python means taking elements from one give index to another index

```
In [111]: #[start:end],[start:end:step]
```

```
In [112]: # now we will slice an element from 1 to 5
```

```
In [113]: x1=np.array([1,2,3,4,5,6,7,8,9,10])
```

```
In [114]: x1[1:5]
```

```
Out[114]: array([2, 3, 4, 5])
```

```
In [115]: x1[4:]
```

```
Out[115]: array([ 5,  6,  7,  8,  9, 10])
```

```
In [116]: x1[:4]
```

```
Out[116]: array([1, 2, 3, 4])
```

```
In [117]: x1[:-1]
```

```
Out[117]: array([1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
In [118]: x1[-1:]
```

```
Out[118]: array([10])
```

```
In [119]: x1[-3:-1]
```

```
Out[119]: array([8, 9])
```

```
In [120]: x1[2:-3]
```

```
Out[120]: array([3, 4, 5, 6, 7])
```

```
In [121]: x1[:,2]
```

```
Out[121]: array([1, 3, 5, 7, 9])
```

```
In [122]: x1[2:7:2]
```

```
Out[122]: array([3, 5, 7])
```

```
In [123]: # slicing 2-d array #print 8,9,10
```

```
In [124]: x1=np.array([[1,2,3,4,5,6,7],[8,9,10,11,12,13,14]])
```

```
In [125]: x1[1,0:3]
```

```
Out[125]: array([ 8,  9, 10])
```

numpy array datatype

```
In [126]: #data type in np
```

bool, int , uint , float , complex , timedelta , unsigned , datetime , object , string , unicode

```
In [127]: #checking the data type of numpy array
```

```
In [128]: x1=np.array([1,2,3,4,5,6,7,8,9,10])
```

```
In [129]: x1.dtype
```

```
Out[129]: dtype('int32')
```

```
In [130]: #checking the data type of numpy array --string
```

```
In [131]: x1=np.array(['a','s','j','d'])
```

```
In [132]: x1.dtype
```

```
Out[132]: dtype('<U1')
```

```
In [133]: #checking array with a defined data type
```

```
In [134]: x1=np.array([1,2,3,4,5,6,7,8,9,10], dtype='S')
```

```
In [135]: x1
```

```
Out[135]: array([b'1', b'2', b'3', b'4', b'5', b'6', b'7', b'8', b'9', b'10'],  
              dtype='<S2')
```

```
In [136]: x1=np.array(['a','s','j','4','5','6'], dtype='i')
```

```
-----  
ValueError                                Traceback (most recent call last)  
Cell In[136], line 1  
----> 1 x1=np.array(['a','s','j','4','5','6'], dtype='i')  
  
ValueError: invalid literal for int() with base 10: 'a'
```

numpy [copy, view]

```
In [137]: #difference between np copy and view
```

```
In [138]: # we will make a copy first
```

```
In [139]: x1=np.array([1,2,3,4,5])
```

```
In [140]: x2=x1.copy()
```

```
In [141]: print(x1)  
          print(x2)
```

```
[1 2 3 4 5]  
[1 2 3 4 5]
```

```
In [142]: #now we will make a view, change original, display both
```

```
In [143]: x1=np.array([1,2,3,4,5])
```

```
In [144]: x2=x1.view()
```

```
In [145]: x1[0]=6
```

```
In [146]: print(x1)
          print(x2)
```

```
[6 2 3 4 5]
[6 2 3 4 5]
```

numpy array shape

```
In [147]: #shape of an array
```

```
In [148]: #now we will try to get the shape of an array
```

```
In [149]: x1=np.array([[1,2,3,4],[6,7,8,9]])
```

```
In [150]: x1.shape #2 dimension and 4 element
```

```
Out[150]: (2, 4)
```

```
In [151]: #now we will create a 5-d array using .ndmin
```

```
In [152]: x1=np.array([1,2,3,4],ndmin=5)
```

```
In [153]: x1
```

```
Out[153]: array([[[[[[1, 2, 3, 4]]]])])
```

```
In [154]: x1.shape
```

```
Out[154]: (1, 1, 1, 1, 4)
```

```
In [155]: x3=np.array([[[1,2,3],[4,5,6]], [[1,2,3],[4,5,6]]])
```

```
In [156]: x3.shape
```

```
Out[156]: (2, 2, 3)
```

numpy array reshape

```
In [157]: # means changing the shape of an array, like adding or removing the element
```

```
In [158]: #reshaping from 1-d to 2-d
```

```
In [159]: x1=np.array([1,2,3,4,5,6,7,8,9,10,11,12])
```

```
In [160]: x2=x1.reshape(2,6)
```

```
In [161]: x2
```

```
Out[161]: array([[ 1,  2,  3,  4,  5,  6],
                 [ 7,  8,  9, 10, 11, 12]])
```

```
In [162]: #reshaping from 1-d to 3-d
```

```
In [163]: x3=x1.reshape(2,3,2)
```

```
In [164]: x3
```

```
Out[164]: array([[[ 1,  2],
                  [ 3,  4],
                  [ 5,  6]],

                 [[ 7,  8],
                  [ 9, 10],
                  [11, 12]]])
```

```
In [165]: x4=x1.reshape(4,3)
```

```
In [166]: x4
```

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



```
In [167]: x4=x1.reshape(4,4)
```

```
-----  
ValueError                                Traceback (most recent call last)  
Cell In[167], line 1  
----> 1 x4=x1.reshape(4,4)  
  
ValueError: cannot reshape array of size 12 into shape (4,4)
```

```
In [168]: # return copy or view
```

```
In [169]: x1=np.array([1,2,3,4,5,6,7,8,9,10,11,12])
```

```
In [170]: x1.reshape(3,4)
```

```
Out[170]: array([[ 1,  2,  3,  4],  
                [ 5,  6,  7,  8],  
                [ 9, 10, 11, 12]])
```

```
In [171]: x1.reshape(3,4).base
```

```
Out[171]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [172]: #unknown dimensions
```

```
In [173]: x1=np.array([1,2,3,4,5,6,7,8])
```

```
In [174]: x1.reshape(2,2,-1)
```

```
Out[174]: array([[1, 2],  
                [3, 4]],  
                [[5, 6],  
                [7, 8]])
```

```
In [175]: #flattening the array by converting multidimensional array in 1-D
```

```
In [176]: x1=np.array([[1,2,3],[4,5,6]])
```

```
In [177]: x1
```

```
Out[177]: array([[1, 2, 3],  
                [4, 5, 6]])
```

```
In [178]: x1.reshape(-1)
```

```
Out[178]: array([1, 2, 3, 4, 5, 6])
```

numpy Iterating

```
In [179]: #going to element step by step like loop
```

```
In [180]: #Iterating the element of 1-d
```

```
In [181]: x1=np.array([1,2,3,4])
```

```
In [182]: for i in x1:  
           print(i)
```

```
1  
2  
3  
4
```

```
In [183]: #Iterating the element of 2-d
```

```
In [184]: x1=np.array([[1,2,3],[4,5,6]])
```

```
In [185]: for i in x1:  
           print(i)
```

```
[1 2 3]  
[4 5 6]
```

```
In [186]: #Iterating on each scalar element of the 2-d
```

```
In [187]: x1=np.array([[1,2,3],[4,5,6]])  
for i in x1:  
    for a in i:  
        print(a)
```

```
1  
2  
3  
4  
5  
6
```

```
In [188]: #Iterating the element of 3-d
```

```
In [189]: x1=np.array([[[1,2,3],[4,5,6]],[[7,8,9],[9,10,11]]])
```

```
In [190]: print(x1.ndim)
```

3

```
In [191]:
```

```
for i in x1:
    for a in i:
        for b in a:
            print(b)
```

1
2
3
4
5
6
7
8
9
9
10
11

```
In [192]:
```

```
for i in x1:
    for a in i:
        for b in a:
            print(b,end=" ")
```

1 2 3 4 5 6 7 8 9 9 10 11

nditer()

```
In [193]: #Iterating arrays using the nditer() function.
```

```
In [194]: # now we will iterate on each scalar problem
```

```
In [195]: x1=np.array([[[1,2,3],[4,5,6]],[[7,8,9],[9,10,11]]])
```

```
In [196]: for i in np.nditer(x1):
            print(i,end=" ")
```

1 2 3 4 5 6 7 8 9 9 10 11

numpy array joining

In [197]: *#heer for this we will pass concatenate.*

concatenate()

In [198]: `x=np.array([1,2,3])`
`y=np.array([4,5,6])`

In [199]: `np.concatenate((x,y))`

Out[199]: `array([1, 2, 3, 4, 5, 6])`

In [200]: *#join of 2-d along with axis 1*

In [201]: `x = np.array([[1,2],[3,4]])`
`y = np.array([[5,6],[7,8]])`

In [202]: `np.concatenate((x,y),axis=1)`

Out[202]: `array([[1, 2, 5, 6],
[3, 4, 7, 8]])`

In [203]: *# joining array using the stack function.*

In [204]: `x=np.array([1,2,3])`
`y=np.array([4,5,6])`

In [205]: `np.stack((x,y),axis=1)`

Out[205]: `array([[1, 4],
[2, 5],
[3, 6]])`

In [206]: *# stacking along with rows : hstack()*

In [207]: `x=np.array([1,2,3])`
`y=np.array([4,5,6])`

In [208]: `np.hstack((x,y))`

Out[208]: `array([1, 2, 3, 4, 5, 6])`

```
In [209]: # stacking along with col.
```

```
In [210]: x=np.array([1,2,3])  
y=np.array([4,5,6])
```

```
In [211]: np.vstack((x,y))
```

```
Out[211]: array([[1, 2, 3],  
                [4, 5, 6]])
```

```
In [212]: # stacking along with depth.
```

```
In [213]: x=np.array([1,2,3])  
y=np.array([4,5,6])
```

```
In [214]: np.dstack((x,y))
```

```
Out[214]: array([[[1, 4],  
                  [2, 5],  
                  [3, 6]]])
```

numpy splitting

```
In [215]: #it is reverse to joining, breacking the array
```

```
In [216]: # arr_split()
```

```
In [217]: # splite the array in the tree parts.
```

```
In [218]: x1=np.array([1, 2, 3, 4, 5, 6])
```

```
In [219]: np.split(x1,2)
```

```
Out[219]: [array([1, 2, 3]), array([4, 5, 6])]
```

```
In [220]: np.split(x1,3)
```

```
Out[220]: [array([1, 2]), array([3, 4]), array([5, 6])]
```

```
In [221]: # now we will splite in 4 parts.
```

```
In [222]: np.split(x1,4)
```

```
-----  
ValueError                                Traceback (most recent call last)  
Cell In[222], line 1  
----> 1 np.split(x1,4)  
  
File <__array_function__ internals>:180, in split(*args, **kwargs)  
  
File ~\anaconda3\Lib\site-packages\numpy\lib\shape_base.py:872, in split(ary,  
indices_or_sections, axis)  
    870     N = ary.shape[axis]  
    871     if N % sections:  
--> 872         raise ValueError(  
    873             'array split does not result in an equal division') from  
None  
    874 return array_split(ary, indices_or_sections, axis)  
  
ValueError: array split does not result in an equal division
```

```
In [223]: np.array_split(x1,4)
```

```
Out[223]: [array([1, 2]), array([3, 4]), array([5]), array([6])]
```

```
In [224]: #split into array with index
```

```
In [225]: x1=np.array([1, 2, 3, 4, 5, 6])
```

```
In [226]: x2=np.array_split(x1,3)
```

```
In [227]: x2
```

```
Out[227]: [array([1, 2]), array([3, 4]), array([5, 6])]
```

```
In [228]: print(x2[0])  
print(x2[1])  
print(x2[2])
```

```
[1 2]  
[3 4]  
[5 6]
```

```
In [229]: # splitting the 2-d array
```

```
In [230]: x1=np.array([[1,2,3],[4,5,6],[7,8,9],[11,12,13],[14,15,16]])
```

```
In [231]: x2=np.array_split(x1,3)
```

```
In [232]: x2
```

```
Out[232]: [array([[1, 2, 3],
                  [4, 5, 6]]),
          array([[ 7,  8,  9],
                  [11, 12, 13]]),
          array([[14, 15, 16]])]
```

```
In [233]: x2[1]
```

```
Out[233]: array([[ 7,  8,  9],
                  [11, 12, 13]])
```

```
In [234]: # split the 2-D into three 2-d arrays.
```

```
In [235]: x1=np.array([[1,2,3],[4,5,6],[7,8,9],[11,12,13],[14,15,16]])
```

```
In [236]: np.array_split(x1,2)
```

```
Out[236]: [array([[1, 2, 3],
                  [4, 5, 6],
                  [7, 8, 9]]),
          array([[11, 12, 13],
                  [14, 15, 16]])]
```

```
In [237]: #splitting the 2-d into three 2-d along with rows.
```

```
In [238]: x1=np.array([[1,2,3],[4,5,6],[7,8,9],[11,12,13],[14,15,16]])
```

```
In [239]: np.array_split(x1,3)
```

```
Out[239]: [array([[1, 2, 3],
                  [4, 5, 6]]),
          array([[ 7,  8,  9],
                  [11, 12, 13]]),
          array([[14, 15, 16]])]
```

```
In [240]: np.array_split(x1,3,axis=1)
```

```
Out[240]: [array([[ 1],
                  [ 4],
                  [ 7],
                  [11],
                  [14]]),
          array([[ 2],
                  [ 5],
                  [ 8],
                  [12],
                  [15]]),
          array([[ 3],
                  [ 6],
                  [ 9],
                  [13],
                  [16]])]
```

```
In [241]: # alternate sol using hsplrit, opposite hstack ()
```

```
In [242]: x1=np.array([[1,2,3],[4,5,6],[7,8,9],[11,12,13],[14,15,16]])
```

```
In [243]: np.hsplrit(x1,3)
```

```
Out[243]: [array([[ 1],
                  [ 4],
                  [ 7],
                  [11],
                  [14]]),
          array([[ 2],
                  [ 5],
                  [ 8],
                  [12],
                  [15]]),
          array([[ 3],
                  [ 6],
                  [ 9],
                  [13],
                  [16]])]
```

numpy searching array

you can search an array for a certain value and return the indexes that get the match

```
In [244]: #using where()
```

```
In [245]: x1=np.array([1,2,3,4,5,6,3,5,2])
```



```
In [246]: np.where(x1==2)
```

```
Out[246]: (array([1, 8], dtype=int64),)
```

```
In [247]: #now we will find the indexes where the values are even.
```

```
In [248]: x1=np.array([1,2,3,4,5,6,3,5,2])
```

```
In [249]: np.where(x1%2==0)
```

```
Out[249]: (array([1, 3, 5, 8], dtype=int64),)
```

```
In [250]: #now we will find the indexes where the values are odd.
```

```
In [251]: np.where(x1%2==1)
```

```
Out[251]: (array([0, 2, 4, 6, 7], dtype=int64),)
```

```
In [252]: # searchsorted()-perform binary search in array
```

```
In [253]: #we willnow find the index where the value 7 should be insterted
```

```
In [254]: x1=np.array([1,7,3,4,2])
```

```
In [255]: np.searchsorted(x1,7)
```

```
Out[255]: 5
```

```
In [256]: #now we search right side.
```

```
In [257]: np.searchsorted(x1,7,side="left")
```

```
Out[257]: 5
```

```
In [258]: # how to insert multiple values.
```

```
In [259]: x1=np.array([1,7,3,4,2])
```

```
In [260]: np.searchsorted(x1,[2,4,6])
```

```
Out[260]: array([1, 3, 5], dtype=int64)
```

numpy sorting array

```
In [261]: #sort()- numpy n-d array object has a fun which is called sort ()  
# and this is sort a specified array
```

```
In [262]: x1=np.array([1,7,3,4,2])
```

```
In [263]: np.sort(x1)# ths method like a copy
```

```
Out[263]: array([1, 2, 3, 4, 7])
```

```
In [264]: # sort the array alphabetically.
```

```
In [265]: x1=np.array(['a','e','c','w','g','s','q'])
```

```
In [266]: x1.sort()
```

```
In [267]: x1
```

```
Out[267]: array(['a', 'c', 'e', 'g', 'q', 's', 'w'], dtype='<U1')
```

```
In [268]: x1=np.array(['a','e','c','w','g','s','q'])
```

```
In [269]: np.sort(x1)
```

```
Out[269]: array(['a', 'c', 'e', 'g', 'q', 's', 'w'], dtype='<U1')
```

```
In [270]: x1
```

```
Out[270]: array(['a', 'e', 'c', 'w', 'g', 's', 'q'], dtype='<U1')
```

```
In [271]: # sort the boolen value
```

```
In [272]: x1=np.array(["False","True","True"])
```

```
In [273]: np.sort(x1)
```

```
Out[273]: array(['False', 'True', 'True'], dtype='<U5')
```

```
In [274]: # sortthe 2-d array
```

```
In [275]: x1=np.array([[1,5,3],[4,3,6]])
```

```
In [276]: np.sort(x1)
```

```
Out[276]: array([[1, 3, 5],  
                [3, 4, 6]])
```

numpy filter array

getting some element out of an existing array and creating a new array is called filtering

```
In [277]: # create an array from the element on index 0 to 2:
```

```
In [278]: x1=np.array([1,2,3,4])
```

```
In [279]: x2=[True,False,True,False]
```

```
In [280]: x1[x2]
```

```
Out[280]: array([1, 3])
```

```
In [281]: # now will creating a filter array
```

```
In [282]: # that will return only values higher than 42.
```

```
In [283]: x1=np.array([41,42,43,44])
```

```
In [284]: x2=[]
```

```
In [285]: for i in x1:  
            if i>42:  
                x2.append(True)  
  
            else :  
                x2.append(False)
```

```
In [286]: x2
```

```
Out[286]: [False, False, True, True]
```

```
In [287]: x1[x2]
```

```
Out[287]: array([43, 44])
```

```
In [288]: # you can also filter directly array.
```

```
In [289]: #that will return only values higher than 42.
```

```
In [290]: x1=np.array([41,42,43,44])
```

```
In [291]: x1>42
```

```
Out[291]: array([False, False,  True,  True])
```

```
In [292]: x1%2==0
```

```
Out[292]: array([False,  True, False,  True])
```

numpy random no..

```
In [293]: # that can not be predict logically.
```

```
In [294]: # we will generate a random no.. from 0 to 100
```

```
In [295]: from numpy import random
```

```
In [296]: x1=random(100)
```

```
-----  
TypeError                                Traceback (most recent call last)  
Cell In[296], line 1  
----> 1 x1=random(100)  
  
TypeError: 'module' object is not callable
```

```
In [297]: x1=random.randint(100)
```

```
In [298]: x1
```

```
Out[298]: 51
```

```
In [299]: #you can also enetrate float() via rand () 0 to 1
```

```
In [300]: x1=random.rand()
```

```
In [301]: x1
```

```
Out[301]: 0.4030845633982648
```

```
In [302]: #you can also generate random array.
```

```
In [303]: #we will generate 1-D cntaining 5 random int from 0 to 100
```

```
In [304]: x1=random.randint(100,size=(5))
```

```
In [305]: x1
```

```
Out[305]: array([13, 59, 91,  0, 32])
```

we will generate 2-D with tree 3 row is as cntaining 5 random int from 0 to 100

```
In [306]: x1=random.randint(100,size=(3,5))
```

```
In [307]: x1
```

```
Out[307]: array([[ 0, 65, 40, 75, 22],
                 [ 5, 31, 47, 97, 69],
                 [94, 38, 32, 42, 92]])
```

```
In [308]: #we will generate 1-D cntaining 5 random float
```

```
In [309]: x1=random.rand(5)
```

```
In [310]: x1
```

```
Out[310]: array([0.11060362, 0.73933935, 0.40229079, 0.54873645, 0.99017427])
```

we will generate 2-D with tree 3 row is as cntaining 5 random int from 0 to 100

```
In [311]: x1=random.rand(3,5)
```

```
In [312]: x1
```

```
Out[312]: array([[0.24479687, 0.08292316, 0.62108097, 0.77535091, 0.13119865],
                 [0.31778486, 0.7882957 , 0.46009349, 0.21399335, 0.45736771],
                 [0.32654685, 0.96756688, 0.73864213, 0.12319227, 0.26034713]])
```

```
In [313]: #you can also generate randm no from an array
```

```
In [314]: #choice()
```

```
In [315]: x1=random.choice([3,4,5,6,2,8,6,1])
```

```
In [316]: x1
```

```
Out[316]: 8
```

```
In [317]: #you can also generate randm no from an 2-D array
```

```
In [318]: x1=random.choice([3,4,5,6,2,8,6,1],size=(3,5))
```

```
In [319]: x1
```

```
Out[319]: array([[6, 5, 3, 3, 2],
                 [4, 5, 5, 6, 8],
                 [6, 4, 4, 4, 3]])
```

```
In [320]: x1
```

```
Out[320]: array([[6, 5, 3, 3, 2],
                 [4, 5, 5, 6, 8],
                 [6, 4, 4, 4, 3]])
```

numpy datadistribution

```
In [321]: #List of all possible value and how to often each value occur
```

```
In [322]: #such Lists are important when working with static and datascience
```

```
In [323]: #random distribu...-- probability function.
```

```
In [324]: #now w will generate 1-d 100 values where values has to be 3,5,7,9
```

the probability for the value 3 is set to be 0.1 like that other value

```
In [325]: #the some of all proba.. no should be "1"
```

```
In [326]: x1=random.choice([3,5,7,9],p=[0.1,0.3,0.6,0.0],size=(100))
```

```
In [327]: x1
```

```
Out[327]: array([5, 5, 7, 7, 3, 7, 7, 7, 7, 5, 7, 7, 7, 7, 7, 7, 5, 7, 7, 3, 5, 7,
                5, 7, 7, 3, 7, 3, 7, 5, 7, 5, 7, 7, 3, 7, 7, 5, 7, 5, 3, 7, 5, 7,
                3, 7, 3, 3, 7, 7, 7, 7, 5, 5, 3, 7, 7, 7, 7, 7, 5, 7, 7, 7, 7, 5,
                5, 7, 7, 3, 7, 7, 7, 5, 7, 7, 5, 7, 5, 7, 7, 7, 7, 5, 5, 5, 5,
                5, 7, 5, 5, 3, 7, 7, 3, 7, 7, 7, 3])
```

```
In [328]: # now we will return 2-D with 3 rows each conta.. 5 values
```

```
In [329]: x1=random.choice([3,5,7,9],p=[0.1,0.3,0.6,0.0],size=(3,5))
```

```
In [330]: x1
```

```
Out[330]: array([[5, 7, 7, 7, 5],
                [7, 7, 5, 5, 7],
                [7, 5, 5, 7, 3]])
```

numpy random permutation

refers to an arrangement of element like[3,2,1] is permutation of [1,2,3] and vice versa

```
In [331]: # 1] shuffle 2]permutation.
```

```
In [332]: #now we will randomly suffle elements for the below array:
```

```
In [333]: x1=np.array([1,2,3,4,5])
```

```
In [334]: random.shuffle(x1) # shuffle make changes to the original array.
```

```
In [335]: x1
```

```
Out[335]: array([3, 4, 1, 5, 2])
```

```
In [336]: x1
```

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

```
In [337]: #now we will generate a permutation of elements for the below array.
```

```
In [338]: x1=np.array([1,2,3,4,5])
```

```
In [339]: random.permutation(x1) #the per.. method leaves the original array.
```

```
Out[339]: array([2, 5, 3, 4, 1])
```

numpy normal distribution

```
In [340]: #is same as gaussian distribution- very important.
```

```
In [341]: #random.normal method loc(mean), scale(sd),size()
```

```
In [342]: #we are generate a (r n d) of size 2,3
```

```
In [343]: x1=random.normal(size=(2,3))
```

```
In [344]: x1
```

```
Out[344]: array([[ 0.27639054, -0.47776171, -0.23014079],  
                 [-0.39670203,  0.59518891,  0.41809229]])
```

```
In [345]: #here we will generate (r n d) of size 2,3 with mean and sd of 2
```

```
In [346]: x1=random.normal(loc=1,scale=2,size=(2,3))
```

```
In [347]: x1
```

```
Out[347]: array([[ 0.01341061, -0.0058592 ,  0.71608327],  
                 [ 5.82726498,  1.7545631 ,  4.33422112]])
```

numpy binomial

```
In [348]: #is same as discreate distribution.
```

```
In [349]: # param:-n(no of trials), p(proba..), size(shape-return)
```



```
In [350]: # give 10 trial a coin which will generate 10 data points
```

```
In [351]: x1=random.binomial(n=10,p=0.5,size=10)
```

```
In [352]: x1
```

```
Out[352]: array([6, 6, 4, 2, 7, 8, 3, 5, 7, 7])
```

```
In [353]: # difference between normal and binomial.
```

```
In [354]: # normal(continuous)          binomial(discrete)
```

numpy poisson distribution

```
In [355]: # it estimate how many time an event can happen
```

```
In [356]: #param:- Lam(no of occuranc of rate) size()
```

```
In [357]: # generate a random 1*10 dist for the occurance 2
```

```
In [358]: random.poisson(size=10,lam=2)
```

```
Out[358]: array([4, 2, 4, 0, 2, 4, 4, 0, 1, 3])
```

```
In [359]: random.poisson(size=10,lam=2)
```

```
Out[359]: array([2, 0, 1, 5, 3, 2, 3, 2, 1, 0])
```

numpy U function

stands for universal fun and they are actually numpy fun that operates on the ndarray object

U fun also additional arguments like,where ,dtype and out

vectorization - converting the iterative statement into a vector based statement

```
In [360]: # ex without u fun.
```

```
In [361]: x=[1,2,3,4]
          y=[4,5,6,7]
          z=[]
          for i ,j in zip(x,y):
              z.append(i+j)
          print(z)
```

```
[5, 7, 9, 11]
```

```
In [362]: # with u fun.
```

```
In [363]: x=[1,2,3,4]
          y=[4,5,6,7]
          z=np.add(x,y)
```

```
In [364]: z
```

```
Out[364]: array([ 5,  7,  9, 11])
```

numpy create U fun...

```
In [365]: # create your own ufan..
```

```
In [366]: # arguments of frompyfun(): fun,input,output
```

```
In [367]: # create your own ufan.. for add
```

```
In [368]: def myadd(x,y):
          return x+y

          myadd =np.frompyfunc(myadd,2,1)
          print(myadd([1,2,3,4],[5,6,7,8]))
```

```
[6 8 10 12]
```

```
In [369]: # checking if tis function in ufun or not.
```

```
In [370]: print(type(np.add))
```

```
<class 'numpy.ufunc'>
```

```
In [371]: # concatenate ()
```

```
In [372]: print(type(np.concatenate))
```

```
<class 'function'>
```

numpy simple arithmetic operators

+, -, *, /

by using ufan additional arguments like ,where,dtype and out

here now we will use add fun..

```
In [373]: x=np.array([10,11,12,13,14,15])
x1=np.array([20,21,22,23,24,25])
```

```
In [374]: np.add(x,x1)#add
```

```
Out[374]: array([30, 32, 34, 36, 38, 40])
```

```
In [375]: np.subtract(x,x1)#sub
```

```
Out[375]: array([-10, -10, -10, -10, -10, -10])
```

```
In [376]: np.multiply(x,x1)#mul
```

```
Out[376]: array([200, 231, 264, 299, 336, 375])
```

```
In [377]: np.divide(x,x1)#div
```

```
Out[377]: array([0.5, 0.52380952, 0.54545455, 0.56521739, 0.58333333,
0.6])
```

#power() function raises the value from the 1 st array to the power pf the values of the 2 nd array and return the new array

```
In [378]: x=np.array([10,22,37,40,50,60])
x1=np.array([3,4,5,6,3,2])
```

```
In [379]: np.power(x,x1)#pow
```

```
Out[379]: array([1000, 234256, 69343957, -198967296, 125000,
3600])
```

remainder mode() reminder() functction return the reminder of the 1st array corresponding to the 2 nd array and result in the array

```
In [380]: np.mod(x,x1)#mod
```

```
Out[380]: array([1, 2, 2, 4, 2, 0])
```

```
In [381]: np.remainder(x,x1)#remainder
```

```
Out[381]: array([1, 2, 2, 4, 2, 0])
```

quotient and mod(rem) the divmod () function return both quotient and mod

```
In [382]: np.divmod(x,x1)#divmod
```

```
Out[382]: (array([ 3,  5,  7,  6, 16, 30]), array([1, 2, 2, 4, 2, 0]))
```

numpy rounding

#rounding decimals-: 1]truncation 2]fix 3]rounding 4]floor 5]ceil

```
In [383]: x=np.trunc([-3.1666,3.6667])#remove the decimal.
```

```
In [384]: x
```

```
Out[384]: array([-3.,  3.])
```

```
In [385]: np.fix([-3.1666,3.6667])# as trunc...
```

```
Out[385]: array([-3.,  3.])
```

rounding : the around() function preceding digit or decimal by nearest to 1: if n>5 or n<5 =0

```
In [386]: np.around([3.1144,2])
```

```
Out[386]: array([3., 2.])
```

```
In [387]: np.around([3.766,2])
```

```
Out[387]: array([4., 2.])
```

floor() - round off decimal to the lower integer

```
In [388]: x=np.floor([-3.1666,3.6667])
```

```
In [389]: x
```

```
Out[389]: array([-4.,  3.])
```

ceil() -upper integer

```
In [390]: x=np.ceil([-3.1666,3.6667])
```

```
In [391]: x
```

```
Out[391]: array([-3.,  4.])
```

numpy summation

add is done between two argument where as summation happens over n element.

```
In [392]: #add the 2 array
```

```
In [393]: x1=np.array([1,2,3,4])  
x2=np.array([1,2,3,4])  
np.add(x1,x2)
```

```
Out[393]: array([2, 4, 6, 8])
```

```
In [394]: #sum the values in two array..
```

```
In [395]: x1=np.array([1,2,3,4])  
x2=np.array([1,2,3,4])  
np.sum([x1,x2])
```

```
Out[395]: 20
```

```
In [396]: # summation over as axis..
```

```
In [397]: x1=np.array([1,2,3,4])  
x2=np.array([1,2,3,4])  
np.sum([x1,x2],axis=1)
```

```
Out[397]: array([10, 10])
```

```
In [398]: # cumulative sum: means partially adding the array..
```

```
In [399]: x1=np.array([1,2,3,4])  
np.cumsum(x1)
```

```
Out[399]: array([ 1,  3,  6, 10])
```

numpy product

products: prod() function

```
In [400]: #here we will find the product of the array element of the below array
```

```
In [401]: x1=np.array([1,2,3,4])  
np.prod(x1)
```

```
Out[401]: 24
```

```
In [402]: #here we will find the product of element in 2 differet array:
```

```
In [403]: x1=np.array([1,2,3,4])  
x2=np.array([7,6,5,4])
```

```
In [404]: np.prod([x1,x2])
```

```
Out[404]: 20160
```

```
In [405]: x1=np.array([1,2,3,4])  
x2=np.array([4,5,6,7])
```

```
In [406]: np.prod([x1,x2])
```

```
Out[406]: 20160
```

```
In [407]: #product over axis:
```

```
In [408]: np.prod([x1,x2],axis=1)
```

```
Out[408]: array([ 24, 840])
```

```
In [409]: #cumulative product:
```

```
In [410]: np.cumsum([x1,x2])
```

```
Out[410]: array([ 1,  3,  6, 10, 14, 19, 25, 32])
```

```
In [411]: np.cumsum([x1,x2],axis=1)
```

```
Out[411]: array([[ 1,  3,  6, 10],
                 [ 4,  9, 15, 22]])
```

numpy differences

```
In [412]: #use-: deff() function
```

```
In [413]: x1=np.array([1,2,3,4])
          np.diff(x1)
```

```
Out[413]: array([1, 1, 1])
```

```
In [414]: x1=np.array([1,5,3,8])
          np.diff(x1)
```

```
Out[414]: array([ 4, -2,  5])
```

```
In [415]: x1=np.array([1,2,3,4])
          x2=np.array([4,5,6,7])
          np.diff([x1,x2])
```

```
Out[415]: array([[1, 1, 1],
                 [1, 1, 1]])
```

```
In [416]: x1=np.array([1,2,3,4])
          x2=np.array([4,5,6,7])
          np.diff([x1,x2],axis=1)
```

```
Out[416]: array([[1, 1, 1],
                 [1, 1, 1]])
```

numpy GCD_HCF

GCD(GREATEST COMMON DNOMINATOR),ALSO KNOWN AS

HCF(HIGHEST COMMON FACTOR)

```
In [417]: x1=5  
          x2=7  
          np.gcd(x1,x2)
```

Out[417]: 1

Ans will be 1 because that is the highest number and both numbers can be divided by....

```
In [418]: x1=6  
          x2=9  
          np.gcd(x1,x2)
```

Out[418]: 3

```
In [419]: #finding the gcd in an array..
```

```
In [420]: x1=np.array([20,8,16,36,44])
```

```
In [421]: np.gcd.reduce(x1)
```

Out[421]: 4

it will return 4 because 4 is the highest number of all values that can be divided in the array..

numpy Trigonometric

numpy provides the ufuncs `sin()`, `cos()` and `tan()` that take values in radians and produce the corresponding `sin`, `cos`, `tan` values

```
In [422]: x1=np.sin(np.pi/2)  
          x1
```

Out[422]: 1.0

```
In [423]: #we will now find sin value of an array..
```

```
In [424]: x1=np.array([np.pi/2,np.pi/3,np.pi/4,np.pi/5])  
          x1
```

Out[424]: array([1.57079633, 1.04719755, 0.78539816, 0.62831853])

```
In [425]: np.sin(x1)
```

Out[425]: array([1.0, 0.8660254, 0.70710678, 0.58778525])


```
In [426]: # convert degree into radians
```

by default all of the function takes as parameter's.

```
In [427]: #radians value are pi/180 degree value
```

```
In [428]: x1=np.array([90,180,270,360])  
np.deg2rad(x1)
```

```
Out[428]: array([1.57079633, 3.14159265, 4.71238898, 6.28318531])
```

```
In [429]: #her we will convert rad to deg...
```

```
In [430]: x1=np.sin(np.pi/2)  
x1
```

```
Out[430]: 1.0
```

```
In [431]: x1=np.sin([np.pi/2,np.pi,1.5*np.pi,2*np.pi])
```

```
In [432]: np.rad2deg(x1)
```

```
Out[432]: array([ 5.72957795e+01,  7.01670930e-15, -5.72957795e+01, -1.40334186e-14])
```

numpy setoperation

collections of unique elements

```
In [433]: #here we will convert the array with repeated element to a set
```

```
In [434]: x1=np.array([11,1,1,3,2,4,5,3,2,6,4,7,5])
```

```
In [435]: np.unique(x1)
```

```
Out[435]: array([ 1,  2,  3,  4,  5,  6,  7, 11])
```

```
In [436]: # to find unique value of 2 1D array we will use unuon1d() method
```

```
In [437]: x1=([1,2,3,4])  
          x2=([3,4,5,6])
```

```
In [438]: np.union1d(x1,x2)
```

```
Out[438]: array([1, 2, 3, 4, 5, 6])
```

to find the only value tat are present in both array we will use interset1d() method

```
In [439]: np.intersect1d(x1,x2)
```

```
Out[439]: array([3, 4])
```

to find only values that are in 1st set and not present in the 2nd set: use setfdiffid()

```
In [440]: np.setdiff1d(x1,x2)
```

```
Out[440]: array([1, 2])
```

to find the only values that are not present in both the sets use setxor1d()

```
In [441]: np.setxor1d(x1,x2)
```

```
Out[441]: array([1, 2, 5, 6])
```

```
In [ ]:
```