

```
In [4]: #1. Library: A library is a collection of functions and methods that allows us to perform various and plenty of actions without writing our own code.
```

```
In [5]: #There are many libraries in python. Some of them are: i) NumPy, ii) Pandas, iii) Matplotlib, etc.
```

```
In [6]: #A. NumPy: It stands for Numerical Python. It is the core library for numeric and scientific computing. It consists of single and multiple arrays as well as routines for processing those arrays.
```

```
In [7]: # a) Single - Dimensional Array:  
# i) With Tuple:
```

```
In [8]: #Example-01:
```

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

```
In [10]: n1 = np.array((10,20,30,40))
```

```
In [11]: n1
```

```
Out[11]: array([10, 20, 30, 40])
```

```
In [12]: #Example-02:
```

```
In [13]: n2 = np.array((923,987.675,'A','a','Mango',"ORANGE",True,9+6j))
```

```
In [14]: n2
```

```
Out[14]: array(['923', '987.675', 'A', 'a', 'Mango', 'ORANGE', 'True', '(9+6j)'],
```

```
dtype='<U32')
```

```
In [15]: #Example-03:
```

```
In [16]: n3 = np.array((-9,"*",'+',"%", '@'))  
n3
```

```
Out[16]: array(['-9', '*', '+', '%', '@'], dtype='<U11')
```

```
In [17]: # ii) with list:
```

```
In [18]: #Example-01:
```

```
In [19]: n1 = np.array([10,20,30,40,50])  
n1
```

```
Out[19]: array([10, 20, 30, 40, 50])
```

```
In [20]: #Example-02:
```

```
In [21]: n2 = np.array([12,34,56.78,'a',"P",'Pear',"PEOPLE",True,False,-9+7j])  
n2
```

```
Out[21]: array(['12', '34', '56.78', 'a', 'P', 'Pear', 'PEOPLE', 'True', 'False',  
                '(-9+7j)'], dtype='<U32')
```

```
In [22]: #Example-03:
```

```
In [23]: n3 = np.array([-98,-89.76,'*','+','=','#'])  
n3
```

```
Out[23]: array(['-98', '-89.76', '*', '+', '=', '#'], dtype='<U32')
```

```
In [24]: # iii) with dictionary:
```

```
In [25]: #Example-01:
```

```
In [26]: n1 = np.array({'k1':10,'k2':20,'k3':30})  
n1
```

```
Out[26]: array({'k1': 10, 'k2': 20, 'k3': 30}, dtype=object)
```

```
In [27]: #Example-02:
```

```
In [28]: n2 = np.array({'x':(10,20,30),'y':[76,86,96,56],'z':{'w1':5,'w2':15,'w3':25}})  
n2
```

```
Out[28]: array({'x': (10, 20, 30), 'y': [76, 86, 96, 56], 'z': {'w1': 5, 'w2': 15, 'w3': 25}},  
              dtype=object)
```

```
In [29]: #Example-03:
```

```
In [30]: n3 = np.array({'m1':{12,True,'Apple','Mango'},'m2':(9,19,29,39,49),'m3':  
:[33,44,55,'Pear',89+76j],'m4':{'x1':[-1,-2,-3,-4,-5],'x2':6+8j}})
```

```
In [31]: n3
```

```
Out[31]: array({'m1': {True, 'Mango', 12, 'Apple'}, 'm2': (9, 19, 29, 39, 49),  
              'm3': [33, 44, 55, 'Pear', (89+76j)], 'm4': {'x1': [-1, -2, -3, -4, -5], 'x2': (6+8j)}},  
              dtype=object)
```

```
In [32]: # iv) with set:
```

```
In [33]: #Example-01:
```

```
In [34]: n1 = np.array({10,34,45,89,76})  
n1
```

```
Out[34]: array({34, 10, 76, 45, 89}, dtype=object)
```

```
In [35]: #Example-02:
```

```
In [36]: n2 = {-5,-6,-7,'Money','WEAR',4+7j}  
np.array(n2)
```

```
Out[36]: array({'WEAR', 'Money', -7, -6, -5, (4+7j)}, dtype=object)
```

```
In [37]: #Example-03:
```

```
In [38]: n3 = {2,90.78,True,'*','&','Cloud',9-9j}  
n4 = np.array(n3)  
n4
```

```
Out[38]: array({'&', True, 2, (9-9j), 'Cloud', '*', 90.78}, dtype=object)
```

```
In [39]: #b.Multiple dimensional array:
```

```
In [40]: #Example-01:
```

```
In [41]: import numpy as np
```

```
In [42]: n1 = np.array(((10,20,30,40),('A',"b",'Cat',"DOG"),(90.5,True,"*", -8+9j  
)))  
n1
```

```
Out[42]: array([[ '10', '20', '30', '40'],  
               [ 'A', 'b', 'Cat', 'DOG'],  
               [ '90.5', 'True', '*', '(-8+9j)']], dtype='<U11')
```

```
In [43]: #Example-02:
```

```
In [44]: n2 = np.array([[12,32,42,52],[-9.8,6+4j,True,'Bike'],['*','M','SUN','qu  
een'],[-15,'+',-7+4j,'Capital']])
```

```
n2
```

```
Out[44]: array([[ '12', '32', '42', '52'],
                [ '-9.8', '(6+4j)', 'True', 'Bike'],
                [ '*', 'M', 'SUN', 'queen'],
                [ '-15', '+', '(-7+4j)', 'Capital']], dtype='<U64')
```

```
In [45]: #Example-03:
```

```
In [46]: n3 = np.array([{'k1':56,'k2':[12,13,14,15],'k3':{'m1':(True,90,34.67),
                'm2':[99,87,55],'m3':{'x':34,'y':54,'z':13}},'k4':{'A','B','C'}},{ 'p1':
                11,'p2':22,'p3':33},{ 's1':-9,'s2':-4,'s3':-8}])
```

```
In [47]: n3
```

```
Out[47]: array([{'k1': 56, 'k2': [12, 13, 14, 15], 'k3': {'m1': (True, 90, 34.6
7), 'm2': [99, 87, 55], 'm3': {'x': 34, 'y': 54, 'z': 13}}, 'k4': {'A',
'C', 'B'}},
                {'p1': 11, 'p2': 22, 'p3': 33}, {'s1': -9, 's2': -4, 's3': -8}],
                dtype=object)
```

```
In [48]: #c. Initialising numpy array with zeros:
```

```
In [49]: #Example-01:
```

```
In [50]: n1 = np.zeros((3,4))
n1
```

```
Out[50]: array([[0., 0., 0., 0.],
                [0., 0., 0., 0.],
                [0., 0., 0., 0.]])
```

```
In [51]: #Example-02:
```

```
In [52]: n2 = np.zeros((4,6))
n2
```

```
Out[52]: 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.]])
```

```
In [53]: #Example-03:
```

```
In [54]: n3 = np.zeros((8,2))
n3
```

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

```
In [55]: #d. Initialising numpy array with full:
```

```
In [56]: #Example-01:
```

```
In [57]: n1 = np.full((2,5),-7)
n1
```

```
Out[57]: array([[ -7,  -7,  -7,  -7,  -7],
                [ -7,  -7,  -7,  -7,  -7]])
```

```
In [58]: #Example-02:
```

```
In [59]: n2 = np.full((8,6),43)
n2
```

```
Out[59]: array([[43, 43, 43, 43, 43, 43],
                [43, 43, 43, 43, 43, 43],
                [43, 43, 43, 43, 43, 43],
```

```
[43, 43, 43, 43, 43, 43],  
[43, 43, 43, 43, 43, 43],  
[43, 43, 43, 43, 43, 43],  
[43, 43, 43, 43, 43, 43],  
[43, 43, 43, 43, 43, 43]])
```

```
In [60]: #Example-03:
```

```
In [61]: n3 = np.full((4,7), '*')
```

```
In [62]: n3
```

```
Out[62]: array([[ '*', ' ', ' ', ' ', ' ', ' ', ' '],  
               [ '*', ' ', ' ', ' ', ' ', ' ', ' '],  
               [ '*', ' ', ' ', ' ', ' ', ' ', ' '],  
               [ '*', ' ', ' ', ' ', ' ', ' ', ' ']], dtype='<U1')
```

```
In [63]: #e.Initialising numpy array with a range:
```

```
In [64]: #Example-01:
```

```
In [65]: n1 = np.arange(12,25)  
n1
```

```
Out[65]: array([12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24])
```

```
In [66]: #Example-02:
```

```
In [67]: n2 = np.arange(-19,-6)  
n2
```

```
Out[67]: array([-19, -18, -17, -16, -15, -14, -13, -12, -11, -10, -9, -8, -7])
```

```
In [68]: #Example-03:
```

```
In [69]: n3 = np.arange(-8,25)
n3
```

```
Out[69]: array([-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, 20, 21, 22, 23, 24])
```

```
In [70]: #Example-04:
```

```
In [71]: n4 = np.arange(5,29,4)
n4
```

```
Out[71]: array([ 5,  9, 13, 17, 21, 25])
```

```
In [72]: #Example-05:
```

```
In [73]: n5 = np.arange(-35,-6,5)
n5
```

```
Out[73]: array([-35, -30, -25, -20, -15, -10])
```

```
In [74]: #f.Initialising numpy array with random:
```

```
In [75]: #Example-01:
```

```
In [76]: n1 = np.random.randint(2,69,8)
n1
```

```
Out[76]: array([67, 22, 55,  3, 42, 54,  4, 39])
```

```
In [77]: #Example-02:
```

```
In [78]: n2 = np.random.randint(-25,90,20)
n2
```

```
Out[78]: array([ 49, -10, 86,  5, 75, 67, 11, 44, -12,  9, 49, 46,  4,
```



```
35, 20, 49, 64, 45, 37, 47])
```

```
In [79]: #Example-03:
```

```
In [80]: n3 = np.random.randint(-89,-4,7)
n3
```

```
Out[80]: array([-65, -15, -42, -14, -39, -44, -34])
```

```
In [81]: #g.Checking the shape of the numpy array:
```

```
In [82]: n1 = np.array(((10,20,30,40),('A',"b",'Cat',"DOG"),(90.5,True,"*",-8+9j)
))
n1
```

```
Out[82]: array([[ '10', '20', '30', '40'],
                [ 'A', 'b', 'Cat', 'DOG'],
                [ '90.5', 'True', '*', '(-8+9j)']], dtype='<U11')
```

```
In [83]: n1.shape
```

```
Out[83]: (3, 4)
```

```
In [84]: #Example-02:
```

```
In [85]: n2 = np.array([[12,32,42,52],[-9.8,6+4j,True,'Bike'],['*','M','SUN','qu
een'],[-15,'+','-7+4j','Capital']])
n2
```

```
Out[85]: array([[ '12', '32', '42', '52'],
                [ '-9.8', '(6+4j)', 'True', 'Bike'],
                [ '*', 'M', 'SUN', 'queen'],
                [ '-15', '+', '(-7+4j)', 'Capital']], dtype='<U64')
```

```
In [86]: n2.shape
```

```
Out[86]: (4, 4)
```

```
In [87]: #Example-03:
```

```
In [88]: n3 = np.array([[1,2,3,4,5,6,7],[99,88,77,66,55,44,33],[-9,-8,0,-6,5,76,43]])
```

```
In [89]: n3
```

```
Out[89]: array([[ 1,  2,  3,  4,  5,  6,  7],
                [99, 88, 77, 66, 55, 44, 33],
                [-9, -8,  0, -6,  5, 76, 43]])
```

```
In [90]: n3.shape
```

```
Out[90]: (3, 7)
```

```
In [91]: #h.Changing the shape of the numpy array:
```

```
In [92]: #Example-01:
```

```
In [93]: n1 = np.array([[1,2,3,4,5,6,7],[99,88,77,66,55,44,33],[-9,-8,0,-6,5,76,43]])
n1
```

```
Out[93]: array([[ 1,  2,  3,  4,  5,  6,  7],
                [99, 88, 77, 66, 55, 44, 33],
                [-9, -8,  0, -6,  5, 76, 43]])
```

```
In [94]: n1.shape
```

```
Out[94]: (3, 7)
```

```
In [95]: n1.shape = (7,3)
```

```
In [96]: n1
```

```
Out[96]: array([[ 1,  2,  3],
                [ 4,  5,  6],
                [ 7, 99, 88],
                [77, 66, 55],
                [44, 33, -9],
                [-8,  0, -6],
                [ 5, 76, 43]])
```

```
In [97]: #Example-02:
```

```
In [98]: n2 = np.array([[1,7,14],[32,90,76],[60,0,78],[31,54,65],[-9,-6,4]])
n2
```

```
Out[98]: array([[ 1,  7, 14],
                [32, 90, 76],
                [60,  0, 78],
                [31, 54, 65],
                [-9, -6,  4]])
```

```
In [99]: n2.shape
```

```
Out[99]: (5, 3)
```

```
In [100]: n2.shape = (3,5)
n2
```

```
Out[100]: array([[ 1,  7, 14, 32, 90],
                 [76, 60,  0, 78, 31],
                 [54, 65, -9, -6,  4]])
```

```
In [101]: #Example-03:
```

```
In [102]: n3 = np.array([[ 'A', 'B', 'C', 'D', 'E'],[ 'p', 'q', 'r', 's', 't'],[ '@', '#', '$',
, '%', '+'],[ 'Ape', 'Ant', 'Cap', 'Cat', 'Dog']])
```

```
In [103]: n3
```

```
Out[103]: array([[ 'A', 'B', 'C', 'D', 'E'],
                 [ 'p', 'q', 'r', 's', 't'],
                 [ '@', '#', '$', '%', '+'],
                 [ 'Ape', 'Ant', 'Cap', 'Cat', 'Dog']], dtype='<U3')
```

```
In [104]: n3.shape
```

```
Out[104]: (4, 5)
```

```
In [105]: n3.shape = (5,4)
n3
```

```
Out[105]: array([[ 'A', 'B', 'C', 'D'],
                 [ 'E', 'p', 'q', 'r'],
                 [ 's', 't', '@', '#'],
                 [ '$', '%', '+', 'Ape'],
                 [ 'Ant', 'Cap', 'Cat', 'Dog']], dtype='<U3')
```

```
In [106]: #i.Joining the numpy arrays:
```

```
In [ ]: #i.(i).vstack():
```

```
In [110]: #Example-01:
```

```
In [134]: n1 = np.array([10,20,30,40,50])
n2 = np.array([5,4,3,2,1])
n1,n2
```

```
Out[134]: (array([10, 20, 30, 40, 50]), array([5, 4, 3, 2, 1]))
```

```
In [135]: np.vstack((n1,n2))
```

```
Out[135]: array([[10, 20, 30, 40, 50],
                 [ 5,  4,  3,  2,  1]])
```

```
In [136]: np.vstack((n2,n1))
```

```
Out[136]: array([[ 5,  4,  3,  2,  1],
                [10, 20, 30, 40, 50]])
```

```
In [137]: #Example-02:
```

```
In [139]: n3 = np.array(['a','b','c'])
          n4 = np.array(["X",'Y','Z'])
          n3,n4
```

```
Out[139]: (array(['a', 'b', 'c'], dtype='<U1'), array(['X', 'Y', 'Z'], dtype='<U1'))
```

```
In [140]: np.vstack((n3,n4))
```

```
Out[140]: array([[ 'a', 'b', 'c'],
                [ 'X', 'Y', 'Z']], dtype='<U1')
```

```
In [141]: np.vstack((n4,n3))
```

```
Out[141]: array([[ 'X', 'Y', 'Z'],
                [ 'a', 'b', 'c']], dtype='<U1')
```

```
In [142]: #Example-03:
```

```
In [143]: n5 = np.array((-3,9.7,'*',8+9j,"String"))
          n6 = np.array(('Apple',7+6j,'M','#',98))
          n5,n6
```

```
Out[143]: (array(['-3', '9.7', '*', '(8+9j)', 'String'], dtype='<U32'),
          array(['Apple', '(7+6j)', 'M', '#', '98'], dtype='<U6'))
```

```
In [144]: np.vstack((n5,n6))
```

```
Out[144]: array([[ '-3', '9.7', '*', '(8+9j)', 'String'],
                [ 'Apple', '(7+6j)', 'M', '#', '98']], dtype='<U32')
```

```
In [145]: np.vstack((n6,n5))
```

```
Out[145]: array([[ 'Apple', '(7+6j)', 'M', '#', '98'],
                 ['-3', '9.7', '*', '(8+9j)', 'String']], dtype='<U32')
```

```
In [127]: #Exempl-04:
```

```
In [146]: n7 = np.array({12,34,67,89})
          n8 = np.array({98,90,66,-56})
          n7,n8
```

```
Out[146]: (array({89, 34, 67, 12}, dtype=object), array({-56, 98, 66, 90}, dtype=
object))
```

```
In [147]: np.vstack((n7,n8))
```

```
Out[147]: array([[{89, 34, 67, 12}],
                 [{-56, 98, 66, 90}]], dtype=object)
```

```
In [148]: np.vstack((n8,n7))
```

```
Out[148]: array([[{-56, 98, 66, 90}],
                 [{89, 34, 67, 12}]], dtype=object)
```

```
In [131]: #EXample-05:
```

```
In [150]: n9 = np.array({'k1':10,'k2':29,'k3':45})
          n10 = np.array({'m1':(144,244,344,444),'m2':['A','B','C'],'m3':{234,345,
          456,567,789},'m4':{'x':11,'y':22,'z':33}})
          n9,n10
```

```
Out[150]: (array({'k1': 10, 'k2': 29, 'k3': 45}, dtype=object),
          array({'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456,
          234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}},
          dtype=object))
```

```
In [152]: np.vstack((n9,n10))
```

```
Out[152]: array([[{'k1': 10, 'k2': 29, 'k3': 45}],
```

```
[{'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456, 234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}}],  
dtype=object)
```

```
In [153]: np.vstack((n10,n9))
```

```
Out[153]: array([[{'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456, 234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}}],  
                [{'k1': 10, 'k2': 29, 'k3': 45}]], dtype=object)
```

```
In [154]: #i.(ii).hstack():
```

```
In [160]: #Example-01:
```

```
In [161]: n1
```

```
Out[161]: array([10, 20, 30, 40, 50])
```

```
In [162]: n2
```

```
Out[162]: array([5, 4, 3, 2, 1])
```

```
In [163]: np.hstack((n1,n2))
```

```
Out[163]: array([10, 20, 30, 40, 50, 5, 4, 3, 2, 1])
```

```
In [164]: np.hstack((n2,n1))
```

```
Out[164]: array([ 5, 4, 3, 2, 1, 10, 20, 30, 40, 50])
```

```
In [165]: #Example-02:
```

```
In [166]: n3
```

```
Out[166]: array(['a', 'b', 'c'], dtype='<U1')
```

```
In [167]: n4
Out[167]: array(['X', 'Y', 'Z'], dtype='<U1')

In [169]: np.hstack((n3,n4))
Out[169]: array(['a', 'b', 'c', 'X', 'Y', 'Z'], dtype='<U1')

In [170]: np.hstack((n4,n3))
Out[170]: array(['X', 'Y', 'Z', 'a', 'b', 'c'], dtype='<U1')

In [171]: #Example-03:

In [172]: n5
Out[172]: array(['-3', '9.7', '*', '(8+9j)', 'String'], dtype='<U32')

In [173]: n6
Out[173]: array(['Apple', '(7+6j)', 'M', '#', '98'], dtype='<U6')

In [175]: np.hstack((n5,n6))
Out[175]: array(['-3', '9.7', '*', '(8+9j)', 'String', 'Apple', '(7+6j)', 'M',
                '#',
                '98'], dtype='<U32')

In [176]: np.hstack((n6,n5))
Out[176]: array(['Apple', '(7+6j)', 'M', '#', '98', '-3', '9.7', '*', '(8+9j)',
                'String'], dtype='<U32')

In [177]: #Example-04:

In [178]: n7
```



```
Out[178]: array({89, 34, 67, 12}, dtype=object)
```

```
In [179]: n8
```

```
Out[179]: array({-56, 98, 66, 90}, dtype=object)
```

```
In [180]: np.hstack((n7,n8))
```

```
Out[180]: array([ {89, 34, 67, 12}, {-56, 98, 66, 90}], dtype=object)
```

```
In [181]: np.hstack((n8,n7))
```

```
Out[181]: array([ {-56, 98, 66, 90}, {89, 34, 67, 12}], dtype=object)
```

```
In [182]: #Example-05:
```

```
In [183]: n9
```

```
Out[183]: array({'k1': 10, 'k2': 29, 'k3': 45}, dtype=object)
```

```
In [184]: n10
```

```
Out[184]: array({'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456, 234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}},  
               dtype=object)
```

```
In [186]: np.hstack((n9,n10))
```

```
Out[186]: array([ {'k1': 10, 'k2': 29, 'k3': 45},  
                  {'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456,  
234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}}],  
               dtype=object)
```

```
In [187]: np.hstack((n10,n9))
```

```
Out[187]: array([ {'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456,  
234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}},  
                  {'k1': 10, 'k2': 29, 'k3': 45}],  
               dtype=object)
```

```
 {'k1': 10, 'k2': 29, 'k3': 45}], dtype=object)
```

```
In [188]: #i.(iii).column_stack():
```

```
In [189]: #Example-01:
```

```
In [190]: n1
```

```
Out[190]: array([10, 20, 30, 40, 50])
```

```
In [191]: n2
```

```
Out[191]: array([5, 4, 3, 2, 1])
```

```
In [193]: np.column_stack((n1,n2))
```

```
Out[193]: array([[10,  5],
                 [20,  4],
                 [30,  3],
                 [40,  2],
                 [50,  1]])
```

```
In [194]: np.column_stack((n2,n1))
```

```
Out[194]: array([[ 5, 10],
                 [ 4, 20],
                 [ 3, 30],
                 [ 2, 40],
                 [ 1, 50]])
```

```
In [195]: #Example-02:
```

```
In [196]: n3
```

```
Out[196]: array(['a', 'b', 'c'], dtype='<U1')
```

```
In [197]: n4
Out[197]: array(['X', 'Y', 'Z'], dtype='<U1')
```

```
In [198]: np.column_stack((n3,n4))
Out[198]: array([[ 'a', 'X'],
                 [ 'b', 'Y'],
                 [ 'c', 'Z']], dtype='<U1')
```

```
In [199]: np.column_stack((n4,n3))
Out[199]: array([[ 'X', 'a'],
                 [ 'Y', 'b'],
                 [ 'Z', 'c']], dtype='<U1')
```

```
In [200]: #Example-03:
```

```
In [201]: n5
Out[201]: array(['-3', '9.7', '*', '(8+9j)', 'String'], dtype='<U32')
```

```
In [202]: n6
Out[202]: array(['Apple', '(7+6j)', 'M', '#', '98'], dtype='<U6')
```

```
In [203]: np.column_stack((n5,n6))
Out[203]: array([[ '-3', 'Apple'],
                 [ '9.7', '(7+6j)'],
                 [ '*', 'M'],
                 [ '(8+9j)', '#'],
                 [ 'String', '98']], dtype='<U32')
```

```
In [204]: np.column_stack((n6,n5))
Out[204]: array([[ 'Apple', '-3'],
                 [ '(7+6j)', '9.7'],
```

```
['M', '*'],  
['#', '(8+9j)'],  
['98', 'String']], dtype='<U32')
```

```
In [209]: #Example-04:
```

```
In [210]: n7
```

```
Out[210]: array({89, 34, 67, 12}, dtype=object)
```

```
In [213]: n8
```

```
Out[213]: array({-56, 98, 66, 90}, dtype=object)
```

```
In [215]: np.column_stack((n7,n8))
```

```
Out[215]: array([[{89, 34, 67, 12}, {-56, 98, 66, 90}]], dtype=object)
```

```
In [216]: np.column_stack((n8,n7))
```

```
Out[216]: array([[{-56, 98, 66, 90}, {89, 34, 67, 12}]], dtype=object)
```

```
In [217]: #Example-05:
```

```
In [218]: n9
```

```
Out[218]: array({'k1': 10, 'k2': 29, 'k3': 45}, dtype=object)
```

```
In [219]: n10
```

```
Out[219]: array({'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456, 2  
34, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}},  
dtype=object)
```

```
In [221]: np.column_stack((n9,n10))
```

```
Out[221]: array([[{'k1': 10, 'k2': 29, 'k3': 45},
```

```
        {'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456,
234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}}]],
        dtype=object)
```

```
In [222]: np.column_stack((n10,n9))
```

```
Out[222]: array([[{'m1': (144, 244, 344, 444), 'm2': ['A', 'B', 'C'], 'm3': {456,
234, 789, 567, 345}, 'm4': {'x': 11, 'y': 22, 'z': 33}},
                {'k1': 10, 'k2': 29, 'k3': 45}]], dtype=object)
```

```
In [223]: #Some more examples of hstack, vstack and column_stack:
```

```
In [233]: n1 = np.array([11,22,33,44,55,66,77,88])
n2 = np.array([-10,-20,-30,-40,-50,-60,-70,-80])
n3 = np.array(['A','B','C','D','E','F','G','H'])
n4 = np.array(['p','q','r','s','t','u','v','w'])
```

```
In [234]: np.hstack((n1,n2,n3))
```

```
Out[234]: array(['11', '22', '33', '44', '55', '66', '77', '88', '-10', '-20',
                '-30', '-40', '-50', '-60', '-70', '-80', 'A', 'B', 'C', 'D',
                'E',
                'F', 'G', 'H'], dtype='<U11')
```

```
In [235]: np.hstack((n1,n2,n3,n4))
```

```
Out[235]: array(['11', '22', '33', '44', '55', '66', '77', '88', '-10', '-20',
                '-30', '-40', '-50', '-60', '-70', '-80', 'A', 'B', 'C', 'D',
                'E',
                'F', 'G', 'H', 'p', 'q', 'r', 's', 't', 'u', 'v', 'w'],
                dtype='<U11')
```

```
In [236]: np.vstack((n1,n3,n2))
```

```
Out[236]: array([[ '11', '22', '33', '44', '55', '66', '77', '88'],
                [ 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H'],
                [ '-10', '-20', '-30', '-40', '-50', '-60', '-70', '-80']],
                dtype='<U11')
```

```
In [237]: np.vstack((n2,n1,n4,n3))
```

```
Out[237]: array([[ '-10', '-20', '-30', '-40', '-50', '-60', '-70', '-80'],  
                ['11', '22', '33', '44', '55', '66', '77', '88'],  
                ['p', 'q', 'r', 's', 't', 'u', 'v', 'w'],  
                ['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H']], dtype='<U11')
```

```
In [239]: np.column_stack((n1,n2,n3))
```

```
Out[239]: array([[ '11', '-10', 'A'],  
                ['22', '-20', 'B'],  
                ['33', '-30', 'C'],  
                ['44', '-40', 'D'],  
                ['55', '-50', 'E'],  
                ['66', '-60', 'F'],  
                ['77', '-70', 'G'],  
                ['88', '-80', 'H']], dtype='<U11')
```

```
In [240]: np.column_stack((n4,n1,n3,n2))
```

```
Out[240]: array([[ 'p', '11', 'A', '-10'],  
                ['q', '22', 'B', '-20'],  
                ['r', '33', 'C', '-30'],  
                ['s', '44', 'D', '-40'],  
                ['t', '55', 'E', '-50'],  
                ['u', '66', 'F', '-60'],  
                ['v', '77', 'G', '-70'],  
                ['w', '88', 'H', '-80']], dtype='<U11')
```

```
In [262]: #j.Union of numpy arrays:
```

```
In [271]: #Example-01:
```

```
In [273]: n1 = np.array([1,2,3,4,5,6,7,8])
```

```
In [274]: n2 = np.array([5,6,7,8,9,10,11,12])
```

```
In [275]: np.union1d(n1,n2)
```

```
Out[275]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [276]: np.union1d(n2,n1)
```

```
Out[276]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [277]: #Example-02:
```

```
In [279]: n3 = np.array(["A","B","C","D","E","F"])  
n4 = np.array(["D","E","F","G","H","K","L"])  
n5 = np.array(["D","F","K","X","Y","Z"])
```

```
In [282]: np.union1d(n3,n4)
```

```
Out[282]: array(['A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'K', 'L'], dtype='<U1')
```

```
In [283]: np.union1d(n4,n5)
```

```
Out[283]: array(['D', 'E', 'F', 'G', 'H', 'K', 'L', 'X', 'Y', 'Z'], dtype='<U1')
```

```
In [284]: #Example-03:
```

```
In [285]: n6 = np.array(['Apple','Ball','Cat','Dog','Egg'])  
n7 = np.array(['Ball','Egg','Fish','God','Hen'])  
n8 = np.array(['Ball','Cat','Egg','Hen','Ink','Job'])
```

```
In [286]: np.union1d(n6,n7)
```

```
Out[286]: array(['Apple', 'Ball', 'Cat', 'Dog', 'Egg', 'Fish', 'God', 'Hen'],  
               dtype='<U5')
```

```
In [287]: np.union1d(n7,n8)
```

```
Out[287]: array(['Ball', 'Cat', 'Egg', 'Fish', 'God', 'Hen', 'Ink', 'Job'],  
              dtype='<U4')
```

```
In [290]: #k.Intersection of numpy arrays:
```

```
In [291]: #Example-01:
```

```
In [292]: n1
```

```
Out[292]: array([1, 2, 3, 4, 5, 6, 7, 8])
```

```
In [293]: n2
```

```
Out[293]: array([ 5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [294]: np.intersect1d(n1,n2)
```

```
Out[294]: array([5, 6, 7, 8])
```

```
In [296]: np.intersect1d(n2,n1)
```

```
Out[296]: array([5, 6, 7, 8])
```

```
In [297]: #Example-02:
```

```
In [298]: n3
```

```
Out[298]: array(['A', 'B', 'C', 'D', 'E', 'F'], dtype='<U1')
```

```
In [299]: n4
```

```
Out[299]: array(['D', 'E', 'F', 'G', 'H', 'K', 'L'], dtype='<U1')
```

```
In [300]: n5
```

```
Out[300]: array(['D', 'F', 'K', 'X', 'Y', 'Z'], dtype='<U1')
```



```
In [301]: np.intersect1d(n3,n4)
```

```
Out[301]: array(['D', 'E', 'F'], dtype='<U1')
```

```
In [302]: np.intersect1d(n4,n5)
```

```
Out[302]: array(['D', 'F', 'K'], dtype='<U1')
```

```
In [303]: np.intersect1d(n3,n5)
```

```
Out[303]: array(['D', 'F'], dtype='<U1')
```

```
In [307]: #Example-03:
```

```
In [308]: n6
```

```
Out[308]: array(['Apple', 'Ball', 'Cat', 'Dog', 'Egg'], dtype='<U5')
```

```
In [309]: n7
```

```
Out[309]: array(['Ball', 'Egg', 'Fish', 'God', 'Hen'], dtype='<U4')
```

```
In [310]: n8
```

```
Out[310]: array(['Ball', 'Cat', 'Egg', 'Hen', 'Ink', 'Job'], dtype='<U4')
```

```
In [311]: np.intersect1d(n6,n7)
```

```
Out[311]: array(['Ball', 'Egg'], dtype='<U5')
```

```
In [312]: np.intersect1d(n7,n8)
```

```
Out[312]: array(['Ball', 'Egg', 'Hen'], dtype='<U4')
```

```
In [313]: np.intersect1d(n6,n8)
```

```
Out[313]:
```

```
array(['Ball', 'Cat', 'Egg'], dtype='<U5')
```

```
In [314]: #l.Intersection of numpy arrays:
```

```
In [319]: #Example-01:
```

```
In [320]: n1
```

```
Out[320]: array([1, 2, 3, 4, 5, 6, 7, 8])
```

```
In [321]: n2
```

```
Out[321]: array([ 5,  6,  7,  8,  9, 10, 11, 12])
```

```
In [322]: np.setdiff1d(n1,n2)
```

```
Out[322]: array([1, 2, 3, 4])
```

```
In [323]: np.setdiff1d(n2,n1)
```

```
Out[323]: array([ 9, 10, 11, 12])
```

```
In [324]: #Example-02:
```

```
In [325]: n3
```

```
Out[325]: array(['A', 'B', 'C', 'D', 'E', 'F'], dtype='<U1')
```

```
In [326]: n4
```

```
Out[326]: array(['D', 'E', 'F', 'G', 'H', 'K', 'L'], dtype='<U1')
```

```
In [327]: n5
```

```
Out[327]: array(['D', 'F', 'K', 'X', 'Y', 'Z'], dtype='<U1')
```

```
In [328]: np.setdiff1d(n3,n4)
```

```
Out[328]: array(['A', 'B', 'C'], dtype='<U1')
```

```
In [329]: np.setdiff1d(n4,n5)
```

```
Out[329]: array(['E', 'G', 'H', 'L'], dtype='<U1')
```

```
In [330]: np.setdiff1d(n3,n5)
```

```
Out[330]: array(['A', 'B', 'C', 'E'], dtype='<U1')
```

```
In [331]: np.setdiff1d(n5,n4)
```

```
Out[331]: array(['X', 'Y', 'Z'], dtype='<U1')
```

```
In [332]: np.setdiff1d(n4,n3)
```

```
Out[332]: array(['G', 'H', 'K', 'L'], dtype='<U1')
```

```
In [333]: np.setdiff1d(n5,n3)
```

```
Out[333]: array(['K', 'X', 'Y', 'Z'], dtype='<U1')
```

```
In [334]: #Example-03:
```

```
In [335]: n6
```

```
Out[335]: array(['Apple', 'Ball', 'Cat', 'Dog', 'Egg'], dtype='<U5')
```

```
In [336]: n7
```

```
Out[336]: array(['Ball', 'Egg', 'Fish', 'God', 'Hen'], dtype='<U4')
```

```
In [337]: n8
```

```
Out[337]: array(['Ball', 'Cat', 'Egg', 'Hen', 'Ink', 'Job'], dtype='<U4')
```

```
In [338]: np.setdiff1d(n6,n7)
```

```
Out[338]: array(['Apple', 'Cat', 'Dog'], dtype='<U5')
```

```
In [339]: np.setdiff1d(n7,n8)
```

```
Out[339]: array(['Fish', 'God'], dtype='<U4')
```

```
In [340]: np.setdiff1d(n6,n8)
```

```
Out[340]: array(['Apple', 'Dog'], dtype='<U5')
```

```
In [341]: np.setdiff1d(n8,n7)
```

```
Out[341]: array(['Cat', 'Ink', 'Job'], dtype='<U4')
```

```
In [342]: np.setdiff1d(n7,n6)
```

```
Out[342]: array(['Fish', 'God', 'Hen'], dtype='<U4')
```

```
In [343]: np.setdiff1d(n8,n6)
```

```
Out[343]: array(['Hen', 'Ink', 'Job'], dtype='<U4')
```

```
In [495]: #m.Addition(finding sum) of numpy arrays:
```

```
In [496]: #Example-01:
```

```
In [497]: n1 = np.array([10,20,30,40])  
          n2 = np.array([100,200,300,400])
```

```
In [498]: np.sum([n1,n2])
```

```
Out[498]: 1100
```

```
In [499]: np.sum([n2,n1])
```

```
Out[499]: 1100
```

```
In [500]: #Example-02:
```

```
In [501]: n1
```

```
Out[501]: array([10, 20, 30, 40])
```

```
In [502]: n2
```

```
Out[502]: array([100, 200, 300, 400])
```

```
In [503]: n3 = np.array([1,2,3,4])
```

```
In [504]: np.sum([n1,n2,n3])
```

```
Out[504]: 1110
```

```
In [505]: np.sum([n2,n3])
```

```
Out[505]: 1010
```

```
In [506]: np.sum([n3,n1])
```

```
Out[506]: 110
```

```
In [507]: #Example-03:
```

```
In [508]: n1
```

```
Out[508]: array([10, 20, 30, 40])
```

```
In [509]: n2
```

```
Out[509]:
```

```
array([100, 200, 300, 400])
```

```
In [510]: n3
```

```
Out[510]: array([1, 2, 3, 4])
```

```
In [511]: n4 = np.array([1000,2000,3000,4001])  
n4
```

```
Out[511]: array([1000, 2000, 3000, 4001])
```

```
In [512]: np.sum([n1,n2,n3,n4])
```

```
Out[512]: 11111
```

```
In [513]: #m.(i).Adding vertically(columnar-addition) the elements of numpy array  
s:
```

```
In [514]: #Example-01:
```

```
In [515]: n1
```

```
Out[515]: array([10, 20, 30, 40])
```

```
In [516]: n2
```

```
Out[516]: array([100, 200, 300, 400])
```

```
In [517]: np.sum([n1,n2],axis=0)
```

```
Out[517]: array([110, 220, 330, 440])
```

```
In [518]: np.sum([n2,n1],axis=0)
```

```
Out[518]: array([110, 220, 330, 440])
```

```
In [519]: #Example-02:
```

```
In [520]: n3
```

```
Out[520]: array([1, 2, 3, 4])
```

```
In [521]: n4
```

```
Out[521]: array([1000, 2000, 3000, 4001])
```

```
In [522]: n5 = np.array([9,8,7,5])  
n5
```

```
Out[522]: array([9, 8, 7, 5])
```

```
In [523]: np.sum([n3,n4,n5],axis=0)
```

```
Out[523]: array([1010, 2010, 3010, 4010])
```

```
In [524]: np.sum([n5,n3,n4],axis=0)
```

```
Out[524]: array([1010, 2010, 3010, 4010])
```

```
In [525]: #Example-03:
```

```
In [526]: n1
```

```
Out[526]: array([10, 20, 30, 40])
```

```
In [527]: n2
```

```
Out[527]: array([100, 200, 300, 400])
```

```
In [528]: n3
```

```
Out[528]: array([1, 2, 3, 4])
```

```
In [529]: n4
Out[529]: array([1000, 2000, 3000, 4001])

In [530]: n5
Out[530]: array([9, 8, 7, 5])

In [531]: np.sum([n1,n2,n3,n4,n5],axis=0)
Out[531]: array([1120, 2230, 3340, 4450])

In [532]: #m.(ii).Adding horizontally(row-addition) the elements of numpy arrays:

In [537]: #Example-01:

In [538]: n1,n2
Out[538]: (array([10, 20, 30, 40]), array([100, 200, 300, 400]))

In [539]: np.sum([n1,n2],axis=1)
Out[539]: array([ 100, 1000])

In [540]: np.sum([n2,n1],axis=1)
Out[540]: array([1000, 100])

In [541]: #Example-02:

In [542]: n3,n4,n5
Out[542]: (array([1, 2, 3, 4]), array([1000, 2000, 3000, 4001]), array([9, 8, 7, 5]))

In [543]: np.sum([n3,n4,n5],axis=1)
```



```
Out[543]: array([ 10, 10001, 29])
```

```
In [544]: np.sum([n3,n5,n4],axis=1)
```

```
Out[544]: array([ 10, 29, 10001])
```

```
In [545]: np.sum([n5,n3,n4],axis=1)
```

```
Out[545]: array([ 29, 10, 10001])
```

```
In [546]: #n.Numpy arrays basic mathematics:
```

```
In [547]: #n.i) Basic Addition:
```

```
In [548]: #Example-01:
```

```
In [549]: n1
```

```
Out[549]: array([10, 20, 30, 40])
```

```
In [551]: n1 = n1 + 10  
n1
```

```
Out[551]: array([30, 40, 50, 60])
```

```
In [552]: #Example-02:
```

```
In [553]: n1
```

```
Out[553]: array([30, 40, 50, 60])
```

```
In [554]: n2
```

```
Out[554]: array([100, 200, 300, 400])
```

```
In [555]: x = n2 + n1
```

```
In [556]:
```

```
x
```

```
Out[556]: array([130, 240, 350, 460])
```

```
In [557]: y = n1 + n2
```

```
In [558]: y
```

```
Out[558]: array([130, 240, 350, 460])
```

```
In [559]: #Example-03:
```

```
In [560]: n1
```

```
Out[560]: array([30, 40, 50, 60])
```

```
In [561]: n2
```

```
Out[561]: array([100, 200, 300, 400])
```

```
In [562]: n3
```

```
Out[562]: array([1, 2, 3, 4])
```

```
In [563]: n4
```

```
Out[563]: array([1000, 2000, 3000, 4001])
```

```
In [564]: n5
```

```
Out[564]: array([9, 8, 7, 5])
```

```
In [565]: z = (n1 + 25)  
z
```

```
Out[565]: array([55, 65, 75, 85])
```

```
In [566]: w = n1 + n2 + n3 + n4 + n5  
w
```

```
Out[566]: array([1140, 2250, 3360, 4470])
```

```
In [567]: n4 = n4 + 30
```

```
In [568]: n4
```

```
Out[568]: array([1030, 2030, 3030, 4031])
```

```
In [569]: n5
```

```
Out[569]: array([9, 8, 7, 5])
```

```
In [570]: n5 = n5+7
```

```
In [571]: n5
```

```
Out[571]: array([16, 15, 14, 12])
```

```
In [572]: #n.ii) Basic subtraction:
```

```
In [573]: #Example-01:
```

```
In [574]: n1
```

```
Out[574]: array([30, 40, 50, 60])
```

```
In [575]: n1 = n1 - 15
```

```
In [576]: n1
```

```
Out[576]: array([15, 25, 35, 45])
```

```
In [577]: n2
```

```
Out[577]: array([100, 200, 300, 400])
```

```
In [578]: x = n2 - n1  
x
```

```
Out[578]: array([ 85, 175, 265, 355])
```

```
In [579]: y = n1 - n2
```

```
In [580]: y
```

```
Out[580]: array([ -85, -175, -265, -355])
```

```
In [581]: #Example-02:
```

```
In [582]: n3
```

```
Out[582]: array([1, 2, 3, 4])
```

```
In [583]: n3 = n3 - 1  
n3
```

```
Out[583]: array([0, 1, 2, 3])
```

```
In [585]: #Example-02:
```

```
In [586]: n4
```

```
Out[586]: array([1030, 2030, 3030, 4031])
```

```
In [587]: n5
```

```
Out[587]: array([16, 15, 14, 12])
```

```
In [588]: x = n4 - n5  
x
```

```
Out[588]: array([1014, 2015, 3016, 4019])
```

```
In [589]: n4 = n4 - 30  
n4
```

```
Out[589]: array([1000, 2000, 3000, 4001])
```

```
In [590]: y = n5 - n4  
y
```

```
Out[590]: array([ -984, -1985, -2986, -3989])
```

```
In [591]: #Example-03:
```

```
In [597]: n1
```

```
Out[597]: array([15, 25, 35, 45])
```

```
In [598]: n2
```

```
Out[598]: array([100, 200, 300, 400])
```

```
In [599]: n3
```

```
Out[599]: array([0, 1, 2, 3])
```

```
In [600]: x = n1 - n2 - n3  
x
```

```
Out[600]: array([ -85, -176, -267, -358])
```

```
In [601]: y = n3 - n2 - n1  
y
```

```
Out[601]:
```

```
array([-115, -224, -333, -442])
```

```
In [602]: z = n2 - n3 - n1  
z
```

```
Out[602]: array([ 85, 174, 263, 352])
```

```
In [603]: #n.iii) Basic multipliaion:
```

```
In [604]: #Example-01:
```

```
In [605]: n1
```

```
Out[605]: array([15, 25, 35, 45])
```

```
In [606]: n1 = n1 * 2  
n1
```

```
Out[606]: array([30, 50, 70, 90])
```

```
In [607]: #Example -02:
```

```
In [608]: n1
```

```
Out[608]: array([30, 50, 70, 90])
```

```
In [609]: n2
```

```
Out[609]: array([100, 200, 300, 400])
```

```
In [610]: x = n1 * n2  
x
```

```
Out[610]: array([ 3000, 10000, 21000, 36000])
```

```
In [611]: #Example-03:
```

```
In [612]: n1
```

```
Out[612]: array([30, 50, 70, 90])
```

```
In [613]: n2
```

```
Out[613]: array([100, 200, 300, 400])
```

```
In [614]: n3
```

```
Out[614]: array([0, 1, 2, 3])
```

```
In [615]: n3 = n3 * 5  
n3
```

```
Out[615]: array([ 0,  5, 10, 15])
```

```
In [616]: x = n1 * n2 * n3  
x
```

```
Out[616]: array([ 0, 50000, 210000, 540000])
```

```
In [617]: #n.iv) Basic division:
```

```
In [618]: #Example-01:
```

```
In [619]: n1
```

```
Out[619]: array([30, 50, 70, 90])
```

```
In [620]: n1 = n1/10  
n1
```

```
Out[620]: array([3., 5., 7., 9.])
```

```
In [621]: #Example-02:
```

```
In [624]: n2
```

```
Out[624]: array([100, 200, 300, 400])
```

```
In [628]: n1
```

```
Out[628]: array([3., 5., 7., 9.])
```

```
In [629]: x = n2/n1  
x
```

```
Out[629]: array([33.33333333, 40.          , 42.85714286, 44.44444444])
```

```
In [630]: #Example-03:
```

```
In [631]: n4
```

```
Out[631]: array([1000, 2000, 3000, 4001])
```

```
In [632]: n5
```

```
Out[632]: array([16, 15, 14, 12])
```

```
In [633]: x = n4/25  
x
```

```
Out[633]: array([ 40.   ,  80.   , 120.   , 160.04])
```

```
In [634]: y = n4/n5  
y
```

```
Out[634]: array([ 62.5          , 133.33333333, 214.28571429, 333.41666667])
```

```
In [635]: #n.v) Basic statistics:
```

```
In [636]: #n.v) a).Mean:
```



```
In [637]: #Examples:
```

```
In [638]: n1
```

```
Out[638]: array([3., 5., 7., 9.])
```

```
In [639]: np.mean(n1)
```

```
Out[639]: 6.0
```

```
In [640]: n2
```

```
Out[640]: array([100, 200, 300, 400])
```

```
In [641]: np.mean(n2)
```

```
Out[641]: 250.0
```

```
In [642]: n3
```

```
Out[642]: array([ 0,  5, 10, 15])
```

```
In [643]: np.mean(n3)
```

```
Out[643]: 7.5
```

```
In [644]: n4
```

```
Out[644]: array([1000, 2000, 3000, 4001])
```

```
In [645]: np.mean(n4)
```

```
Out[645]: 2500.25
```

```
In [646]: n5
```

```
Out[646]: array([16, 15, 14, 12])
```

```
In [647]: np.mean(n5)
```

```
Out[647]: 14.25
```

```
In [648]: #n.v) b).Median:
```

```
In [652]: #Examples:
```

```
In [653]: n1
```

```
Out[653]: array([3., 5., 7., 9.])
```

```
In [655]: np.median(n1)
```

```
Out[655]: 6.0
```

```
In [656]: n2
```

```
Out[656]: array([100, 200, 300, 400])
```

```
In [657]: np.median(n2)
```

```
Out[657]: 250.0
```

```
In [658]: n3
```

```
Out[658]: array([ 0,  5, 10, 15])
```

```
In [659]: np.median(n3)
```

```
Out[659]: 7.5
```

```
In [660]: n4
```

```
Out[660]:
```

```
array([1000, 2000, 3000, 4001])
```

```
In [661]: np.median(n4)
```

```
Out[661]: 2500.0
```

```
In [662]: n5
```

```
Out[662]: array([16, 15, 14, 12])
```

```
In [663]: np.median(n5)
```

```
Out[663]: 14.5
```

```
In [664]: #n.v) c).Standard Deviation:
```

```
In [667]: #Examples:
```

```
In [668]: n1
```

```
Out[668]: array([3., 5., 7., 9.])
```

```
In [669]: np.std(n1)
```

```
Out[669]: 2.23606797749979
```

```
In [670]: n2
```

```
Out[670]: array([100, 200, 300, 400])
```

```
In [671]: np.std(n2)
```

```
Out[671]: 111.80339887498948
```

```
In [672]: n3
```

```
Out[672]:
```

```
array([ 0,  5, 10, 15])
```

```
In [673]: np.std(n3)
```

```
Out[673]: 5.5901699437494745
```

```
In [674]: n4
```

```
Out[674]: array([1000, 2000, 3000, 4001])
```

```
In [675]: np.std(n4)
```

```
Out[675]: 1118.3694324774797
```

```
In [676]: n5
```

```
Out[676]: array([16, 15, 14, 12])
```

```
In [677]: np.std(n5)
```

```
Out[677]: 1.479019945774904
```

```
In [678]: #m.Saving & loading numpy arrays:
```

```
In [680]: # Example-01:
```

```
In [681]: n1
```

```
Out[681]: array([3., 5., 7., 9.])
```

```
In [682]: np.save("my_numpy1",n1)
```

```
In [685]: a = np.load("my_numpy1.npy")
```

```
In [686]: a
```

```
Out[686]: array([3., 5., 7., 9.])
```

```
In [687]: # Example-02:
```

```
In [688]: n2
```

```
Out[688]: array([100, 200, 300, 400])
```

```
In [689]: np.save('my_array2',n2)
```

```
In [690]: b = np.load("my_array2.npy")  
b
```

```
Out[690]: array([100, 200, 300, 400])
```

```
In [691]: # Example-03:
```

```
In [692]: n3
```

```
Out[692]: array([ 0,  5, 10, 15])
```

```
In [693]: np.save('my_array3',n3)
```

```
In [694]: c = np.load("my_array3.npy")  
c
```

```
Out[694]: array([ 0,  5, 10, 15])
```

```
In [ ]:
```