Numpy

In [231…
```
import numpy as np
np.array([1,2,3,4])
```

Out[231…
```
array([1, 2, 3, 4])
```

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

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

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

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

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

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

In [6]:
```
a.dtype
```

Out[6]:
```
dtype('int32')
```

In [7]:
```
a = np.array([1,2,3,4],dtype = 'float32')
```

In [8]:
```
a
```

Out[8]:
```
array([1., 2., 3., 4.], dtype=float32)
```

In [9]:
```
a = np.array([1,2,3,4,5],dtype='bool')
a
```

Out[9]:
```
array([ True,  True,  True,  True,  True])
```

In [10]:
```
a = np.array([0,0,0,0],dtype='bool')
a
```

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

In [11]:
```
a = np.array([None,None,None],dtype='bool')
a
```

Out[11]:
```
array([False, False, False])
```

In [12]:
```
np.linspace(2,40,20)
```

Out[12]:
```
array([ 2.,  4.,  6.,  8., 10., 12., 14., 16., 18., 20., 22., 24., 26.,
       28., 30., 32., 34., 36., 38., 40.])
```

In [13]:
```
np.linspace(1,10)
```

Out[13]:
```
array([ 1.        ,  1.18367347,  1.36734694,  1.55102041,  1.73469388,
        1.91836735,  2.10204082,  2.28571429,  2.46938776,  2.65306122,
        2.83673469,  3.02040816,  3.20408163,  3.3877551 ,  3.57142857,
        3.75510204,  3.93877551,  4.12244898,  4.30612245,  4.48979592,
        4.67346939,  4.85714286,  5.04081633,  5.2244898 ,  5.40816327,
        5.59183673,  5.7755102 ,  5.95918367,  6.14285714,  6.32653061,
        6.51020408,  6.69387755,  6.87755102,  7.06122449,  7.24489796,
        7.42857143,  7.6122449 ,  7.79591837,  7.97959184,  8.16326531,
        8.34693878,  8.53061224,  8.71428571,  8.89795918,  9.08163265,
        9.26530612,  9.44897959,  9.63265306,  9.81632653, 10.        ])
```

In [14]:
```
np.linspace(3,50)
```

Out[14]:
```
array([ 3.        ,  3.95918367,  4.91836735,  5.87755102,  6.83673469,
        7.79591837,  8.75510204,  9.71428571, 10.67346939, 11.63265306,
       12.59183673, 13.55102041, 14.51020408, 15.46938776, 16.42857143,
       17.3877551 , 18.34693878, 19.30612245, 20.26530612, 21.2244898 ,
       22.18367347, 23.14285714, 24.10204082, 25.06122449, 26.02040816,
       26.97959184, 27.93877551, 28.89795918, 29.85714286, 30.81632653,
       31.7755102 , 32.73469388, 33.69387755, 34.65306122, 35.6122449 ,
       36.57142857, 37.53061224, 38.48979592, 39.44897959, 40.40816327,
       41.36734694, 42.32653061, 43.28571429, 44.24489796, 45.20408163,
       46.16326531, 47.12244898, 48.08163265, 49.04081633, 50.        ])
```

In [15]:
```
np.linspace(2,6,num=10)
```

Out[15]:
```
array([2.        , 2.44444444, 2.88888889, 3.33333333, 3.77777778,
       4.22222222, 4.66666667, 5.11111111, 5.55555556, 6.        ])
```

In [16]:
```
np.linspace(-6,6,8)
```

Out[16]:
```
array([-6.        , -4.28571429, -2.57142857, -0.85714286,  0.85714286,
        2.57142857,  4.28571429,  6.        ])
```

In [17]:
```
np.linspace(-5,5,11)
```

Out[17]:
```
array([-5., -4., -3., -2., -1.,  0.,  1.,  2.,  3.,  4.,  5.])
```

In [18]:
```
np.linspace(-7,7,15)
```

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

In [19]:
```
np.linspace(-5,5,num=11,retstep=True)
```

Out[19]:
```
(array([-5., -4., -3., -2., -1.,  0.,  1.,  2.,  3.,  4.,  5.]), 1.0)
```

In [20]:
```
np.linspace(-6,6,num=13,retstep=True)
```

Out[20]:
```
(array([-6., -5., -4., -3., -2., -1.,  0.,  1.,  2.,  3.,  4.,  5.,  6.]), 1.0)
```

In [21]:
```
np.linspace(1,6,num=13,retstep=True)
```

Out[21]:
```
(array([1.        , 1.41666667, 1.83333333, 2.25      , 2.66666667,
        3.08333333, 3.5       , 3.91666667, 4.33333333, 4.75      ,
        5.16666667, 5.58333333, 6.        ]),
 0.4166666666666667)
```

np.full

In [22]:
```
np.full((4,4),100)
```

Out[22]:
```
array([[100, 100, 100, 100],
       [100, 100, 100, 100],
       [100, 100, 100, 100],
       [100, 100, 100, 100]])
```

In [23]:
```
np.full((5,5),100,dtype='float32')
```

Out[23]:
```
array([[100., 100., 100., 100., 100.],
       [100., 100., 100., 100., 100.],
       [100., 100., 100., 100., 100.],
       [100., 100., 100., 100., 100.],
       [100., 100., 100., 100., 100.]], dtype=float32)
```

np.random

In [24]:
```
a = np.random.rand(5)
a
```

Out[24]:
```
array([0.25611107, 0.80062959, 0.51807117, 0.49992898, 0.29896438])
```

In [25]:
```
b = np.random.rand(4,4)
b
```

Out[25]:
```
array([[0.78618763, 0.43909743, 0.03988086, 0.50983664],
       [0.66633602, 0.30840411, 0.88409113, 0.01181845],
       [0.37033066, 0.83425809, 0.77394011, 0.69236921],
       [0.01704907, 0.2550377 , 0.7391794 , 0.78248719]])
```

In [26]:
```
b.shape
```

Out[26]:
```
(4, 4)
```

In [27]:
```
b.shape[0]
```

Out[27]:
```
4
```

In [28]:
```
b.shape[1]
```

Out[28]:
```
4
```

In [29]:
```
b.size
```

Out[29]:
```
16
```

In [30]:
```
b.ndim
```

Out[30]:
```
2
```

In [31]:
```
x = np.random.rand(4,4)
x
```

Out[31]:
```
array([[0.11065637, 0.03914474, 0.12472568, 0.68490875],
       [0.59393491, 0.41356787, 0.31531306, 0.63247699],
       [0.86251031, 0.20724296, 0.46817693, 0.07291235],
       [0.90855594, 0.50068433, 0.12038564, 0.98302534]])
```

In [32]:
```
x*100
```

Out[32]:
```
array([[11.0656369 ,  3.91447365, 12.47256814, 68.49087529],
       [59.39349072, 41.35678727, 31.53130607, 63.24769935],
       [86.25103099, 20.72429605, 46.81769281,  7.29123543],
       [90.85559372, 50.0684326 , 12.0385642 , 98.30253385]])
```

In [33]:
```
np.random.randint(3,size=14)
```

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

In [34]:
```
np.random.randint(3,12,size=12,dtype='int8')
```

Out[34]:
```
array([ 3,  3,  7,  5,  7,  8,  3, 11,  6,  8,  9,  6], dtype=int8)
```

In [35]:
```
a = np.random.randint(2,12,size=12,dtype='int')
a
```

Out[35]:
```
array([11,  5,  7,  3,  4,  4,  2,  8,  7,  9,  7,  7])
```

In [36]:
```
a.dtype
```

Out[36]:
```
dtype('int32')
```

In [37]:
```
np.random.randint(18,36,50)
```

Out[37]:
```
array([27, 26, 24, 25, 31, 20, 34, 34, 26, 19, 27, 32, 34, 30, 28, 19, 21,
       20, 34, 28, 23, 26, 18, 32, 32, 26, 33, 26, 27, 23, 34, 34, 18, 23,
       20, 28, 34, 29, 35, 26, 23, 30, 35, 27, 34, 24, 27, 18, 29, 19])
```

In [38]:
```
x
```

Out[38]:
```
array([[0.11065637, 0.03914474, 0.12472568, 0.68490875],
       [0.59393491, 0.41356787, 0.31531306, 0.63247699],
       [0.86251031, 0.20724296, 0.46817693, 0.07291235],
       [0.90855594, 0.50068433, 0.12038564, 0.98302534]])
```

In [39]:
```
id(x)
```

Out[39]:
```
2111379829648
```

In [40]:
```
y = x
```

In [41]:
```
y
```

Out[41]:
```
array([[0.11065637, 0.03914474, 0.12472568, 0.68490875],
       [0.59393491, 0.41356787, 0.31531306, 0.63247699],
       [0.86251031, 0.20724296, 0.46817693, 0.07291235],
       [0.90855594, 0.50068433, 0.12038564, 0.98302534]])
```

In [42]:
```
id(y)
```

Out[42]:
```
2111379829648
```

In [43]:
```
z = np.copy(x)
z
```

Out[43]:
```
array([[0.11065637, 0.03914474, 0.12472568, 0.68490875],
       [0.59393491, 0.41356787, 0.31531306, 0.63247699],
       [0.86251031, 0.20724296, 0.46817693, 0.07291235],
       [0.90855594, 0.50068433, 0.12038564, 0.98302534]])
```

In [44]:
```
id(z)
```

Out[44]:
```
2111379916624
```

In [48]:
```
a = np.ones((4,4),dtype='bool')
```

In [49]:
```
a
```

Out[49]:
```
array([[ True,  True,  True,  True],
       [ True,  True,  True,  True],
       [ True,  True,  True,  True],
       [ True,  True,  True,  True]])
```

In [50]:
```
b = np.zeros((4,4),dtype='bool')
b
```

Out[50]:
```
array([[False, False, False, False],
       [False, False, False, False],
       [False, False, False, False],
       [False, False, False, False]])
```

In [51]:
```
c = np.eye((5),dtype='bool')
c
```

Out[51]:
```
array([[ True, False, False, False, False],
       [False,  True, False, False, False],
       [False, False,  True, False, False],
       [False, False, False,  True, False],
       [False, False, False, False,  True]])
```

In [52]:
```
a = np.array({1:100})
a
```

Out[52]:
```
array({1: 100}, dtype=object)
```

In [53]:
```
a.ndim
```

Out[53]:
```
0
```

In [54]:
```
a.size
```

Out[54]:
```
1
```

In [55]:
```
b = np.array(100)
b
```

Out[55]:
```
array(100)
```

In [56]:
```
b.ndim
```

Out[56]:
```
0
```

Indexing & slicing

In [57]:
```
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
a
```

Out[57]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [58]:
```
a.ndim
```

Out[58]:
```
2
```

In [59]:
```
a.shape
```

Out[59]:
```
(3, 4)
```

Indexing

In [60]:
```
a
```

Out[60]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [61]:
```
a[2]
```

Out[61]:
```
array([ 9, 10, 11, 12])
```

In [62]:
```
a[1]
```

Out[62]:
```
array([5, 6, 7, 8])
```

In [63]:
```
a[2][2]
```

Out[63]:
```
11
```

In [64]:
```
a[2,2]
```

Out[64]:
```
11
```

In [65]:
```
a[2,3]
```

Out[65]:
```
12
```

In [66]:
```
id(a)
```

Out[66]:
```
2111380804592
```

In [67]:
```
a[-1]
```

Out[67]:
```
array([ 9, 10, 11, 12])
```

In [68]:
```
a[-1][2]=21
```

In [69]:
```
a
```

Out[69]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [70]:
```
a[:,2]
```

Out[70]:
```
array([ 3,  7, 21])
```

In [71]:
```
a
```

Out[71]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [72]:
```
a[:2]
```

Out[72]:
```
array([[1, 2, 3, 4],
       [5, 6, 7, 8]])
```

In [73]:
```
a[:3]
```

Out[73]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [74]:
```
a[::2]
```

Out[74]:
```
array([[ 1,  2,  3,  4],
       [ 9, 10, 21, 12]])
```

In [75]:
```
a[:]
```

Out[75]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

columns access?

In [76]:
```
a[:,:]
```

Out[76]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [77]:
```
a[:,0]
```

Out[77]:
```
array([1, 5, 9])
```

In [78]:
```
a[:,1]
```

Out[78]:
```
array([ 2,  6, 10])
```

In [79]:
```
a[:,::2]
```

Out[79]:
```
array([[ 1,  3],
       [ 5,  7],
       [ 9, 21]])
```

In [80]:
```
a[:,1:3]
```

Out[80]:
```
array([[ 2,  3],
       [ 6,  7],
       [10, 21]])
```

In [81]:
```
a[:,1:4:2]
```

Out[81]:
```
array([[ 2,  4],
       [ 6,  8],
       [10, 12]])
```

In [82]:
```
a[:,1::2]
```

Out[82]:
```
array([[ 2,  4],
       [ 6,  8],
       [10, 12]])
```

In [83]:
```
a[:,::-1]
```

Out[83]:
```
array([[ 4,  3,  2,  1],
       [ 8,  7,  6,  5],
       [12, 21, 10,  9]])
```

In [84]:
```
a[:,::-2]
```

Out[84]:
```
array([[ 4,  2],
       [ 8,  6],
       [12, 10]])
```

Out[85]:
```
array([4, 3, 2, 1])
```

In [86]:
```
a[0,::-1]
```

Out[86]:
```
array([4, 3, 2, 1])
```

In [87]:
```
a[::-1,:]
```

Out[87]:
```
array([[ 9, 10, 21, 12],
       [ 5,  6,  7,  8],
       [ 1,  2,  3,  4]])
```

In [88]:
```
a
```

Out[88]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [89]:
```
a[[0,-1]][:,[0,-1]]
```

Out[89]:
```
array([[ 1,  4],
       [ 9, 12]])
```

In [90]:
```
a[1,1:3][::-1]
```

Out[90]:
```
array([7, 6])
```

In [91]:
```
a[1,2:0:-1]
```

Out[91]:
```
array([7, 6])
```

change the corner elements to 0

In [92]:
```
a
```

Out[92]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [93]:
```
a[::2,:4:3]=0
a
```

Out[93]:
```
array([[ 0,  2,  3,  0],
       [ 5,  6,  7,  8],
       [ 0, 10, 21,  0]])
```

In [94]:
```
a
```

Out[94]:
```
array([[ 0,  2,  3,  0],
       [ 5,  6,  7,  8],
       [ 0, 10, 21,  0]])
```

In [95]:
```
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
```

Out[95]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

access 6,7 10,21==>1,2,3,4

In [96]:
```
a[-1][2]=21
```

In [97]:
```
a
```

Out[97]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 21, 12]])
```

In [98]:
```
a[1::,1:3]=[1,2],[3,4]
```

In [99]:
```
a
```

Out[99]:
```
array([[ 1,  2,  3,  4],
       [ 5,  1,  2,  8],
       [ 9,  3,  4, 12]])
```

In [100…
```
a[:,[0,1,3]]
```

Out[100…
```
array([[ 1,  2,  4],
       [ 5,  1,  8],
       [ 9,  3, 12]])
```

In [101…
```
a[:,[0,2,3]]
```

Out[101…
```
array([[ 1,  3,  4],
       [ 5,  2,  8],
       [ 9,  4, 12]])
```

Conditional access to values

In [102…
```
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
a
```

Out[102…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [103…
```
a>6
```

Out[103…
```
array([[False, False, False, False],
       [False, False,  True,  True],
       [ True,  True,  True,  True]])
```

In [104…
```
a<6
```

Out[104…
```
array([[ True,  True,  True,  True],
       [ True, False, False, False],
       [False, False, False, False]])
```

```
a[a>6]
```

Out[105…
```
array([ 7,  8,  9, 10, 11, 12])
```

In [106…
```
a[a<6]
```

Out[106…
```
array([1, 2, 3, 4, 5])
```

In [107…
```
a
```

Out[107…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [108…
```
a==3
```

Out[108…
```
array([[False, False,  True, False],
       [False, False, False, False],
       [False, False, False, False]])
```

In [109…
```
a==4
```

Out[109…
```
array([[False, False, False,  True],
       [False, False, False, False],
       [False, False, False, False]])
```

In [110…
```
(a==4) | (a>6)
```

Out[110…
```
array([[False, False, False,  True],
       [False, False,  True,  True],
       [ True,  True,  True,  True]])
```

In [111…
```
4==4 or 4<5
```

Out[111…
```
True
```

In [112…
```
a[(a<20)&(a>6)]
```

Out[112…
```
array([ 7,  8,  9, 10, 11, 12])
```

In [113…
```
a[(a==3)|(a>6)]
```

Out[113…
```
array([ 3,  7,  8,  9, 10, 11, 12])
```

In [114…
```
x = np.array([[1,2],[3,3]])
x
```

Out[114…
```
array([[1, 2],
       [3, 3]])
```

In [115…
```
y = np.array([[2,2],[4,4]])
y
```

Out[115…
```
array([[2, 2],
       [4, 4]])
```

In [116…
```
x+y
```

Out[116…
```
array([[3, 4],
       [7, 7]])
```

In [117…
```
x*y
```

Out[117…
```
array([[ 2,  4],
       [12, 12]])
```

In [118…
```
np.add(x,y)
```

Out[118…
```
array([[3, 4],
       [7, 7]])
```

In [119…
```
np.multiply(x,y)
```

Out[119…
```
array([[ 2,  4],
       [12, 12]])
```

In [120…
```
x-y
```

Out[120…
```
array([[-1,  0],
       [-1, -1]])
```

In [121…
```
np.subtract(x,y)
```

Out[121…
```
array([[-1,  0],
       [-1, -1]])
```

In [122…
```
x/y
```

Out[122…
```
array([[0.5 , 1.  ],
       [0.75, 0.75]])
```

In [123…
```
np.divide(x,y)
```

Out[123…
```
array([[0.5 , 1.  ],
       [0.75, 0.75]])
```

In [124…
```
np.identity(5)
```

Out[124…
```
array([[1., 0., 0., 0., 0.],
       [0., 1., 0., 0., 0.],
       [0., 0., 1., 0., 0.],
       [0., 0., 0., 1., 0.],
       [0., 0., 0., 0., 1.]])
```

In [125…
```
np.eye(5)
```

Out[125…
```
array([[1., 0., 0., 0., 0.],
       [0., 1., 0., 0., 0.],
       [0., 0., 1., 0., 0.],
```

```
       [0., 0., 0., 1., 0.],
       [0., 0., 0., 0., 1.]])
```

In [126…
```
a = np.zeros((5,5))
```

In [127…
```
a
```

Out[127…
```
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.]])
```

In [128…
```
np.fill_diagonal(a,1)
a
```

Out[128…
```
array([[1., 0., 0., 0., 0.],
       [0., 1., 0., 0., 0.],
       [0., 0., 1., 0., 0.],
       [0., 0., 0., 1., 0.],
       [0., 0., 0., 0., 1.]])
```

In [129…
```
d = np.array([12,3,55,66,99,2,1,0,57])
d
```

Out[129…
```
array([12,  3, 55, 66, 99,  2,  1,  0, 57])
```

In [130…
```
d.sort()
d
```

Out[130…
```
array([ 0,  1,  2,  3, 12, 55, 57, 66, 99])
```

In [131…
```
d = np.array([12,3,55,66,99,2,1,0,57])
d
```

Out[131…
```
array([12,  3, 55, 66, 99,  2,  1,  0, 57])
```

In [132…
```
np.sort(d)
```

Out[132…
```
array([ 0,  1,  2,  3, 12, 55, 57, 66, 99])
```

In [133…
```
a = np.arange(20)
a
```

Out[133…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [134…
```
a.shape
```

Out[134…
```
(20,)
```

In [135…
```
a.reshape(4,5)
```

Out[135…
```
array([[ 0,  1,  2,  3,  4],
       [ 5,  6,  7,  8,  9],
       [10, 11, 12, 13, 14],
       [15, 16, 17, 18, 19]])
```

In [136…
```
a.reshape(5,4)
```

Out[136…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [137…
```
a
```

Out[137…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [138…
```
a.reshape(1,10,2)
```

Out[138…
```
array([[[ 0,  1],
        [ 2,  3],
        [ 4,  5],
        [ 6,  7],
        [ 8,  9],
        [10, 11],
        [12, 13],
        [14, 15],
        [16, 17],
        [18, 19]]])
```

In [139…
```
b = np.array([[[ 0,  1],
        [ 2,  3],
        [ 4,  5],
        [ 6,  7],
        [ 8,  9]],

       [[10, 11],
        [12, 13],
        [14, 15],
        [16, 17],
        [18, 19]]])
```

In [140…
```
b
```

Out[140…
```
array([[[ 0,  1],
        [ 2,  3],
        [ 4,  5],
        [ 6,  7],
        [ 8,  9]],

       [[10, 11],
        [12, 13],
        [14, 15],
        [16, 17],
        [18, 19]]])
```

In [141…
```
b.shape
```

Out[141…
```
(2, 5, 2)
```

In [142…
```
b.size
```

Out[142…
```
20
```

In [143…
```
b.reshape(20)
```

Out[143…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [144…
```
b[0]
```

Out[144…
```
array([[0, 1],
       [2, 3],
       [4, 5],
       [6, 7],
       [8, 9]])
```

In [145…
```
b[0].reshape(10)
```

Out[145…
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [146…
```
b[0][[0,-1]]
```

Out[146…
```
array([[0, 1],
       [8, 9]])
```

In [147…
```
b[0][::4]
```

Out[147…
```
array([[0, 1],
       [8, 9]])
```

In [148…
```
a
```

Out[148…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [149…
```
a.reshape(4,-1)
```

Out[149…
```
array([[ 0,  1,  2,  3,  4],
       [ 5,  6,  7,  8,  9],
       [10, 11, 12, 13, 14],
       [15, 16, 17, 18, 19]])
```

In [150…
```
a.reshape(2,2,-1)
```

Out[150…
```
array([[[ 0,  1,  2,  3,  4],
        [ 5,  6,  7,  8,  9]],

       [[10, 11, 12, 13, 14],
        [15, 16, 17, 18, 19]]])
```

In [151…
```
b.reshape(-1)
```

Out[151…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

Loading [MathJax]/extensions/Safe.js to 1 Dim always?

In [152…
```
b
```

Out[152…
```
array([[[ 0,  1],
        [ 2,  3],
        [ 4,  5],
        [ 6,  7],
        [ 8,  9]],

       [[10, 11],
        [12, 13],
        [14, 15],
        [16, 17],
        [18, 19]]])
```

In [153…
```
b.ravel()
```

Out[153…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [154…
```
b.flatten()
```

Out[154…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [155…
```
a
```

Out[155…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [156…
```
a.reshape(2,10)
```

Out[156…
```
array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9],
       [10, 11, 12, 13, 14, 15, 16, 17, 18, 19]])
```

In [157…
```
a
```

Out[157…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [158…
```
a.resize(2,10)
```

In [159…
```
a
```

Out[159…
```
array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9],
       [10, 11, 12, 13, 14, 15, 16, 17, 18, 19]])
```

In [160…
```
a.resize(4,5)
```

In [161…
```
a
```

Out[161…
```
array([[ 0,  1,  2,  3,  4],
       [ 5,  6,  7,  8,  9],
       [10, 11, 12, 13, 14],
       [15, 16, 17, 18, 19]])
```

In [162…
```
a.shape
```

Out[162…
```
(4, 5)
```

In [163…
```
a.shape = 20
```

In [164…
```
a
```

Out[164…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [165…
```
a
```

Out[165…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [166…
```
a.shape=(5,4)
```

In [167…
```
a
```

Out[167…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [168…
```
a.T
```

Out[168…
```
array([[ 0,  4,  8, 12, 16],
       [ 1,  5,  9, 13, 17],
       [ 2,  6, 10, 14, 18],
       [ 3,  7, 11, 15, 19]])
```

Adding /Removing elements from array

In [169…
```
a
```

Out[169…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [170…
```
a[0]
```

Out[170…
```
array([0, 1, 2, 3])
```

In [171…
```
a[4]
```

Out[171…
```
array([16, 17, 18, 19])
```

In [173…
```
a=np.array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
```

```
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
a
```

Out[173…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [174…
```
a[4]
```

Out[174…
```
array([16, 17, 18, 19])
```

In [175…
```
np.append(a,[10,20,30,40,50])
```

Out[175…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19, 10, 20, 30, 40, 50])
```

In [176…
```
a
```

Out[176…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [177…
```
a[1]
```

Out[177…
```
array([4, 5, 6, 7])
```

In [178…
```
a[2]
```

Out[178…
```
array([ 8,  9, 10, 11])
```

In [179…
```
a[3]
```

Out[179…
```
array([12, 13, 14, 15])
```

In [180…
```
a[4]
```

Out[180…
```
array([16, 17, 18, 19])
```

In [182…
```
np.append(a,[[10],[20],[30],[40],[50]],axis=1)
```

Out[182…
```
array([[ 0,  1,  2,  3, 10],
       [ 4,  5,  6,  7, 20],
       [ 8,  9, 10, 11, 30],
       [12, 13, 14, 15, 40],
       [16, 17, 18, 19, 50]])
```

In [183…
```
np.append(a,[[10,20,30,40]],axis=0)
```

Out[183…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
```

```
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19],
       [10, 20, 30, 40]])
```

In [184…
```
a.ravel()
```

Out[184…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [185…
```
np.insert(a,2,300)
```

Out[185…
```
array([  0,   1, 300,   2,   3,   4,   5,   6,   7,   8,   9,  10,  11,
        12,  13,  14,  15,  16,  17,  18,  19])
```

In [186…
```
np.insert(a,4,600)
```

Out[186…
```
array([  0,   1,   2,   3, 600,   4,   5,   6,   7,   8,   9,  10,  11,
        12,  13,  14,  15,  16,  17,  18,  19])
```

In [187…
```
np.insert(a,6,800)
```

Out[187…
```
array([  0,   1,   2,   3,   4,   5, 800,   6,   7,   8,   9,  10,  11,
        12,  13,  14,  15,  16,  17,  18,  19])
```

In [188…
```
np.insert(a,8,1000)
```

Out[188…
```
array([   0,    1,    2,    3,    4,    5,    6,    7, 1000,    8,    9,
         10,   11,   12,   13,   14,   15,   16,   17,   18,   19])
```

In [189…
```
a
```

Out[189…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [190…
```
np.delete(a,2)
```

Out[190…
```
array([ 0,  1,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16, 17,
       18, 19])
```

In [191…
```
np.delete(a,10)
```

Out[191…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 11, 12, 13, 14, 15, 16, 17,
       18, 19])
```

In [192…
```
a.ravel()
```

Out[192…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19])
```

In [193…
```
np.delete(a,np.s_[:5])
```

Out[193…
```
array([ 5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [194…
```
a
```

Out[194…
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [195…
```
np.delete(a,[2,10,7])
```

Out[195…
```
array([ 0,  1,  3,  4,  5,  6,  8,  9, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [196…
```
a = np.arange(24)
a
```

Out[196…
```
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])
```

In [197…
```
a.resize(4,6)
```

In [198…
```
a
```

Out[198…
```
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]])
```

In [199…
```
np.where(a<10,a+100,a-10)
```

Out[199…
```
array([[100, 101, 102, 103, 104, 105],
       [106, 107, 108, 109,   0,   1],
       [  2,   3,   4,   5,   6,   7],
       [  8,   9,  10,  11,  12,  13]])
```

In [200…
```
np.where(a<10)
```

Out[200…
```
(array([0, 0, 0, 0, 0, 0, 1, 1, 1, 1], dtype=int64),
 array([0, 1, 2, 3, 4, 5, 0, 1, 2, 3], dtype=int64))
```

In [201…
```
a
```

Out[201…
```
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]])
```

In [202…
```
a[1,3]
```

Out[202…
```
9
```

In [203…
```
a[a<10]
```

Out[203…
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [204…
```
da x:x<10,a.ravel()))
```

Out[204… [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

In [205…
```
np.array(list(filter(lambda x:x<10,a.ravel())))
```

Out[205… array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])

In [206…
```
b= np.arange(1,22)
b
```

Out[206… array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17,
       18, 19, 20, 21])

In [207…
```
b.cumsum
```

Out[207… <function ndarray.cumsum>

In [208…
```
b.cumsum()
```

Out[208… array([1,   3,   6, 10, 15, 21, 28, 36, 45, 55, 66, 78, 91,
       105, 120, 136, 153, 171, 190, 210, 231], dtype=int32)

In [209…
```
runs = np.array([0,10,2,4,6,10,23])
runs#runs per over
```

Out[209… array([0, 10, 2, 4, 6, 10, 23])

In [210…
```
runs.cumsum()
```

Out[210… array([0, 10, 12, 16, 22, 32, 55], dtype=int32)

In [211…
```
runs.cumprod()
```

Out[211… array([0, 0, 0, 0, 0, 0, 0], dtype=int32)

In [212…
```
np.fill_diagonal
```

Out[212… <function numpy.fill_diagonal(a, val, wrap=False)>

In [213…
```
np.loadtxt
```

Out[213… <function numpy.loadtxt(fname, dtype=<class 'float'>, comments='#', delimiter=None, converters=None, skiprows=0, usecols=None, unpack=False, ndmin=0, encoding='bytes', max_rows=None, *, like=None)>

In [214…
```
v = np.array(['HR','Admin','Dev','Dev','Admin','MD','CEO','Dev','Tester'])
v
```

Out[214… array(['HR', 'Admin', 'Dev', 'Dev', 'Admin', 'MD', 'CEO', 'Dev', 'Tester'],
      dtype='<U6')

Out[215… array(['Admin', 'CEO', 'Dev', 'HR', 'MD', 'Tester'], dtype='<U6')

In [216…
```
len(np.unique(v))
```

Out[216… 6

In [217…
```
len(v)
```

Out[217… 9

In [218…
```
np.unique(v).size
```

Out[218… 6

In [219…
```
list(a)
```

Out[219…
```
[array([0, 1, 2, 3, 4, 5]),
 array([ 6,  7,  8,  9, 10, 11]),
 array([12, 13, 14, 15, 16, 17]),
 array([18, 19, 20, 21, 22, 23])]
```

In [220…
```
a
```

Out[220…
```
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]])
```

In [221…
```
a = np.arange(24)
a
```

Out[221…
```
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])
```

In [224…
```
a.resize(4,6)
```

In [225…
```
a
```

Out[225…
```
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]])
```

In [226…
```
list(a)
```

Out[226…
```
[array([0, 1, 2, 3, 4, 5]),
 array([ 6,  7,  8,  9, 10, 11]),
 array([12, 13, 14, 15, 16, 17]),
 array([18, 19, 20, 21, 22, 23])]
```

In [227…
```
print(list(a.ravel()))
```

[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23]

In [228…

```
a.tolist()
```

Out[228…

```
[[0, 1, 2, 3, 4, 5],
 [6, 7, 8, 9, 10, 11],
 [12, 13, 14, 15, 16, 17],
 [18, 19, 20, 21, 22, 23]]
```

In [229…

```
a.itemsize
```

Out[229…

```
4
```

In [230…

```
a.dtype
```

Out[230…

```
dtype('int32')
```