```
In [ ]:

In [7]:  pick()

Out[7]:  'Αιμίλιος'

In [1]:  import numpy as np

In [88]: a = [1,2,3]
         b = [4,5,6]

In [93]: a+b

Out[93]: [1, 2, 3, 4, 5, 6]

In [94]: [x+y for x,y in zip(a,b)]

Out[94]: [5, 7, 9]

In [95]: k = np.array([1,2,3])
         l = np.array([4,5,6])

In [96]: [x+y for x,y in zip(k,l)]

Out[96]: [5, 7, 9]

In [10]: pick()

Out[10]: 'Δανάη'

In [97]: k+l

Out[97]: array([5, 7, 9])

In [ ]:

In [12]: k-l

Out[12]: array([-3, -3, -3])

In [14]: k*l

Out[14]: array([ 4, 10, 18])

In [15]: np.ones((3,5))

Out[15]: array([[1., 1., 1., 1., 1.],
                [1., 1., 1., 1., 1.],
                [1., 1., 1., 1., 1.]])

In [16]: np.zeros((3,5))

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

```
In [17]: np.eye(4)

Out[17]: array([[1., 0., 0., 0.],
                [0., 1., 0., 0.],
                [0., 0., 1., 0.],
                [0., 0., 0., 1.]])
```

```
In [22]: 5 * np.ones((3,5))

Out[22]: array([[5., 5., 5., 5., 5.],
                [5., 5., 5., 5., 5.],
                [5., 5., 5., 5., 5.]])
```

```
In [51]: np.random.random((3,5))

Out[51]: array([[0.28129879, 0.25115837, 0.95955411, 0.83891957, 0.79746329],
                [0.92672196, 0.23412539, 0.22402467, 0.71647053, 0.81329022],
                [0.99763149, 0.87738875, 0.99753076, 0.05930613, 0.80920023]])
```

```
In [64]: a = np.array([1,2,3])
```

```
In [65]: a.shape

Out[65]: (3,)
```

```
In [66]: a = np.array([[1,2,3]])
```

```
In [78]: for x in a.shape:
             print (x)

         1
         3
```

```
In [56]: a

Out[56]: array([1, 2, 3])
```

```
In [57]: a.shape

Out[57]: (3,)
```

```
In [58]: a = np.array([[1,2,3], [4,5,6]])
```

```
In [60]: a

Out[60]: array([[1, 2, 3],
                [4, 5, 6]])
```

```
In [62]: a.shape

Out[62]: (2, 3)
```

```
In [63]: np.zeros((1,3))

Out[63]: array([[0., 0., 0.]])
```

```
In [70]: np.zeros((2,3,4))

Out[70]: 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 [72]: np.zeros((2,))

Out[72]: array([0., 0.])
```

```
In [73]: np.zeros((2,3))

Out[73]: array([[0., 0., 0.],
                [0., 0., 0.]])
```

```
In [74]: np.zeros((2,3,4))

Out[74]: 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 [76]: (2)

Out[76]: 2
```

```
In [77]: (2,)

Out[77]: (2,)
```

```
In [75]: pick()

Out[75]: 'Αιμίλιος'
```

```
In [81]: #np.zeros((2,3,4,5))
```

```
In [84]: a = np.array([1,2,3])
```

```
In [86]: a

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

```
In [87]: for x in a:
             print (x)

         1
         2
         3
```

```
In [103]: a=np.zeros((2,3))
```

```
In [104]: a.shape

Out[104]: (2, 3)
```

```
In [105]: a.ndim

Out[105]: 2
```

```
In [106]: np.empty((2,4))

Out[106]: array([[0., 0., 0., 0.],
                 [0., 0., 0., 0.]])
```

```
In [107]: np.arange(2,7,1.23)

Out[107]: array([2.  , 3.23, 4.46, 5.69, 6.92])
```

```
In [108]: np.arange(2,7)

Out[108]: array([2, 3, 4, 5, 6])
```

```
In [109]: np.linspace(2,8,23)

Out[109]: array([2.        , 2.27272727, 2.54545455, 2.81818182, 3.09090909,
                 3.36363636, 3.63636364, 3.90909091, 4.18181818, 4.45454545,
                 4.72727273, 5.        , 5.27272727, 5.54545455, 5.81818182,
                 6.09090909, 6.36363636, 6.63636364, 6.90909091, 7.18181818,
                 7.45454545, 7.72727273, 8.        ])
```

```
In [111]: a = np.random.random((2,3))
```

```
In [112]: a

Out[112]: array([[0.24988513, 0.40299517, 0.64983593],
                 [0.92957128, 0.84806696, 0.36388759]])
```

```
In [113]: np.sin(a)

Out[113]: array([[0.24729266, 0.39217533, 0.60505578],
                 [0.80136357, 0.75000323, 0.35590995]])
```

```
In [114]: np.log(a)

Out[114]: array([[-1.38675393, -0.9088307 , -0.43103537],
                 [-0.07303179, -0.16479569, -1.01091027]])
```

```
In [115]: np.log10(a)

Out[115]: array([[-0.60225958, -0.39470016, -0.18719628],
                 [-0.0317173 , -0.07156986, -0.43903275]])
```

```
In [120]: 0 * np.empty((4,5))

Out[120]: array([[-0., -0.,  0.,  0.,  0.],
                 [ 0.,  0.,  0.,  0.,  0.],
                 [ 0.,  0.,  0.,  0., -0.],
                 [-0.,  0.,  0.,  0.,  0.]])
```

```
In [136]: a

Out[136]: array([[0.24988513, 0.40299517, 0.64983593],
                 [0.92957128, 0.84806696, 0.36388759]])
```

```
In [137]: a.T

Out[137]: array([[0.24988513, 0.92957128],
                 [0.40299517, 0.84806696],
                 [0.64983593, 0.36388759]])
```

```
In [138]: a=np.random.random((2,3))
          b=np.random.random((3,4))
```

```
In [139]: np.dot(a,b).shape

Out[139]: (2, 4)
```

```
In [140]: np.dot(a,b)

Out[140]: array([[1.41437208, 0.62736471, 0.85506078, 0.57683707],
                 [0.60173116, 0.26168594, 0.40367507, 0.21030461]])
```

```
In [142]: np.dot(a,b.T)

          ---------------------------------------------------------------------------
          ValueError                                Traceback (most recent call last)
          <ipython-input-142-7fec0b349caa> in <module>()
          ----> 1 np.dot(a,b.T)

          ValueError: shapes (2,3) and (4,3) not aligned: 3 (dim 1) != 4 (dim 0)
```

```
In [143]: b.transpose()

Out[143]: array([[0.74996295, 0.83768124, 0.6998975 ],
                 [0.2340339 , 0.38109705, 0.41952811],
                 [0.64107732, 0.57198844, 0.0657638 ],
                 [0.36020224, 0.23027974, 0.41520684]])
```

```
In [145]: b.T

Out[145]: array([[0.74996295, 0.83768124, 0.6998975 ],
                 [0.2340339 , 0.38109705, 0.41952811],
                 [0.64107732, 0.57198844, 0.0657638 ],
                 [0.36020224, 0.23027974, 0.41520684]])
```

```
In [146]: a

Out[146]: array([[0.57281722, 0.80139093, 0.44788021],
                 [0.18320495, 0.49180511, 0.07480856]])
```

```
In [147]: a

Out[147]: array([[0.57281722, 0.80139093, 0.44788021],
                 [0.18320495, 0.49180511, 0.07480856]])
```

```
In [148]: a.reshape((3,2))

Out[148]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])
```

```
In [150]: a.reshape((1,6))

Out[150]: array([[0.57281722, 0.80139093, 0.44788021, 0.18320495, 0.49180511,
                  0.07480856]])
```

```
In [151]: a.reshape((6,1))

Out[151]: array([[0.57281722],
                 [0.80139093],
                 [0.44788021],
                 [0.18320495],
                 [0.49180511],
                 [0.07480856]])

In [154]: a

Out[154]: array([[0.57281722, 0.80139093, 0.44788021],
                 [0.18320495, 0.49180511, 0.07480856]])

In [156]: a.reshape((3,2))

Out[156]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [157]: a

Out[157]: array([[0.57281722, 0.80139093, 0.44788021],
                 [0.18320495, 0.49180511, 0.07480856]])

In [158]: a.resize((3,2))

In [160]: a

Out[160]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [163]: a.reshape((2,-1))

Out[163]: array([[0.57281722, 0.80139093, 0.44788021],
                 [0.18320495, 0.49180511, 0.07480856]])

In [171]: a

Out[171]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [167]: np.min(a)

Out[167]: 0.07480855840420098

In [168]: np.min(a, axis=0)

Out[168]: array([0.44788021, 0.07480856])

In [169]: np.min(a, axis=1)

Out[169]: array([0.57281722, 0.18320495, 0.07480856])

In [172]: np.argmin(a)

Out[172]: 5
```

```
In [173]: np.argmin(a, axis=1)

Out[173]: array([0, 1, 1])

In [174]: a

Out[174]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [179]: a.flatten()

Out[179]: array([0.57281722, 0.80139093, 0.44788021, 0.18320495, 0.49180511,
                 0.07480856])

In [180]: a

Out[180]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [182]: a.ravel()

Out[182]: array([0.57281722, 0.80139093, 0.44788021, 0.18320495, 0.49180511,
                 0.07480856])

In [183]: a

Out[183]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [184]: a

Out[184]: array([[0.57281722, 0.80139093],
                 [0.44788021, 0.18320495],
                 [0.49180511, 0.07480856]])

In [187]: a[1,1]=8

In [191]: a = np.random.random((3,2))

In [192]: a

Out[192]: array([[0.30108509, 0.48136782],
                 [0.83803744, 0.33442825],
                 [0.85585883, 0.51620516]])

In [196]: a[1,1]

Out[196]: 0.3344282548481834

In [207]: a = np.random.random((10,3))
In [202]: a
```

```
Out[202]: array([[0.2806964 , 0.23277277, 0.0706953 ],
                 [0.26925711, 0.34939174, 0.42477915],
                 [0.17888812, 0.70971179, 0.83278028],
                 [0.44204471, 0.44184568, 0.85222204],
                 [0.9352659 , 0.42097401, 0.02064571],
                 [0.74823549, 0.07660413, 0.76635586],
                 [0.10760722, 0.56960881, 0.95255679],
                 [0.7819288 , 0.78921431, 0.11604667],
                 [0.23467811, 0.0114578 , 0.63399707],
                 [0.9523032 , 0.00631813, 0.83921476]])
```

```
In [204]: a[2,2]
```

```
Out[204]: 0.8327802843991542
```

```
In [209]: a[2,2]=8
```

```
In [211]: a
```

```
Out[211]: array([[0.83724916, 0.69022625, 0.80458583],
                 [0.99257468, 0.71831592, 0.12463175],
                 [0.95091182, 0.38957084, 8.        ],
                 [0.28590518, 0.72022548, 0.81208324],
                 [0.51675905, 0.06079717, 0.69837097],
                 [0.20057339, 0.16587228, 0.03287879],
                 [0.30896879, 0.70300246, 0.88215047],
                 [0.13788942, 0.97791414, 0.52212733],
                 [0.72827619, 0.70647457, 0.79640447],
                 [0.89403342, 0.63230437, 0.55619169]])
```

```
In [215]: a[0,:]
```

```
Out[215]: array([0.83724916, 0.69022625, 0.80458583])
```

```
In [214]: a[:,0]
```

```
Out[214]: array([0.83724916, 0.99257468, 0.95091182, 0.28590518, 0.51675905,
                 0.20057339, 0.30896879, 0.13788942, 0.72827619, 0.89403342])
```

```
In [216]: a[0:2, 0:2]
```

```
Out[216]: array([[0.83724916, 0.69022625],
                 [0.99257468, 0.71831592]])
```

```
In [217]: a
```

```
Out[217]: array([[0.83724916, 0.69022625, 0.80458583],
                 [0.99257468, 0.71831592, 0.12463175],
                 [0.95091182, 0.38957084, 8.        ],
                 [0.28590518, 0.72022548, 0.81208324],
                 [0.51675905, 0.06079717, 0.69837097],
                 [0.20057339, 0.16587228, 0.03287879],
                 [0.30896879, 0.70300246, 0.88215047],
                 [0.13788942, 0.97791414, 0.52212733],
                 [0.72827619, 0.70647457, 0.79640447],
                 [0.89403342, 0.63230437, 0.55619169]])
```

```
In [218]: a[0:10:2, :]

Out[218]: array([[0.83724916, 0.69022625, 0.80458583],
                 [0.95091182, 0.38957084, 8.        ],
                 [0.51675905, 0.06079717, 0.69837097],
                 [0.30896879, 0.70300246, 0.88215047],
                 [0.72827619, 0.70647457, 0.79640447]])
```

```
In [219]: a[0:10:2, 1:10:2]

Out[219]: array([[0.69022625],
                 [0.38957084],
                 [0.06079717],
                 [0.70300246],
                 [0.70647457]])
```

```
In [220]: a

Out[220]: array([[0.83724916, 0.69022625, 0.80458583],
                 [0.99257468, 0.71831592, 0.12463175],
                 [0.95091182, 0.38957084, 8.        ],
                 [0.28590518, 0.72022548, 0.81208324],
                 [0.51675905, 0.06079717, 0.69837097],
                 [0.20057339, 0.16587228, 0.03287879],
                 [0.30896879, 0.70300246, 0.88215047],
                 [0.13788942, 0.97791414, 0.52212733],
                 [0.72827619, 0.70647457, 0.79640447],
                 [0.89403342, 0.63230437, 0.55619169]])
```

```
In [222]: a[:2, :2] = 14
```

```
In [223]: a

Out[223]: array([[14.        , 14.        ,  0.80458583],
                 [14.        , 14.        ,  0.12463175],
                 [ 0.95091182,  0.38957084,  8.        ],
                 [ 0.28590518,  0.72022548,  0.81208324],
                 [ 0.51675905,  0.06079717,  0.69837097],
                 [ 0.20057339,  0.16587228,  0.03287879],
                 [ 0.30896879,  0.70300246,  0.88215047],
                 [ 0.13788942,  0.97791414,  0.52212733],
                 [ 0.72827619,  0.70647457,  0.79640447],
                 [ 0.89403342,  0.63230437,  0.55619169]])
```

```
In [224]: a = np.random.random((10,3))
```

```
In [225]: a

Out[225]: array([[0.63601601, 0.73637663, 0.01943411],
                 [0.9645354 , 0.93956582, 0.93281756],
                 [0.78536771, 0.04728499, 0.55425404],
                 [0.74313098, 0.76819659, 0.19052115],
                 [0.59109448, 0.44840511, 0.17250865],
                 [0.28930838, 0.30064116, 0.21126103],
                 [0.89953073, 0.76706003, 0.37330168],
                 [0.69301682, 0.55995326, 0.54013518],
                 [0.71797115, 0.19593474, 0.24715356],
                 [0.64938923, 0.50834024, 0.37233108]])
```

```
In [226]: b = np.ones((2,2))
          b

Out[226]: array([[1., 1.],
                 [1., 1.]])
```

```
In [227]: a[:2, :2] = b
```

```
In [228]: a
```

```
Out[228]: array([[1.        , 1.        , 0.01943411],
                 [1.        , 1.        , 0.93281756],
                 [0.78536771, 0.04728499, 0.55425404],
                 [0.74313098, 0.76819659, 0.19052115],
                 [0.59109448, 0.44840511, 0.17250865],
                 [0.28930838, 0.30064116, 0.21126103],
                 [0.89953073, 0.76706003, 0.37330168],
                 [0.69301682, 0.55995326, 0.54013518],
                 [0.71797115, 0.19593474, 0.24715356],
                 [0.64938923, 0.50834024, 0.37233108]])
```

```
In [229]: a = np.random.random((10,3))
```

```
In [230]: a
```

```
Out[230]: array([[0.48514953, 0.1748363 , 0.11208088],
                 [0.70092503, 0.76986171, 0.61094559],
                 [0.14756307, 0.86972086, 0.03764793],
                 [0.98035436, 0.26540311, 0.52760642],
                 [0.96437774, 0.13138818, 0.89595856],
                 [0.2197132 , 0.15667866, 0.4767832 ],
                 [0.69823457, 0.73803479, 0.29578811],
                 [0.60191847, 0.70845381, 0.33685442],
                 [0.70275653, 0.34348129, 0.34454846],
                 [0.1480243 , 0.89706713, 0.65810787]])
```

```
In [231]: a>0.5
```

```
Out[231]: array([[False, False, False],
                 [ True,  True,  True],
                 [False,  True, False],
                 [ True, False,  True],
                 [ True, False,  True],
                 [False, False, False],
                 [ True,  True, False],
                 [ True,  True, False],
                 [ True, False, False],
                 [False,  True,  True]])
```

```
In [232]: a[a>0.5]
```

```
Out[232]: array([0.70092503, 0.76986171, 0.61094559, 0.86972086, 0.98035436,
                 0.52760642, 0.96437774, 0.89595856, 0.69823457, 0.73803479,
                 0.60191847, 0.70845381, 0.70275653, 0.89706713, 0.65810787])
```

```
In [233]: a
```

```
Out[233]: array([[0.48514953, 0.1748363 , 0.11208088],
                 [0.70092503, 0.76986171, 0.61094559],
                 [0.14756307, 0.86972086, 0.03764793],
                 [0.98035436, 0.26540311, 0.52760642],
                 [0.96437774, 0.13138818, 0.89595856],
                 [0.2197132 , 0.15667866, 0.4767832 ],
                 [0.69823457, 0.73803479, 0.29578811],
                 [0.60191847, 0.70845381, 0.33685442],
                 [0.70275653, 0.34348129, 0.34454846],
                 [0.1480243 , 0.89706713, 0.65810787]])
```

```
In [234]: a[a>0.5] = 7
In [235]: a
```

```
Out[235]: array([[0.48514953, 0.1748363 , 0.11208088],
                 [7.        , 7.        , 7.        ],
                 [0.14756307, 7.        , 0.03764793],
                 [7.        , 0.26540311, 7.        ],
                 [7.        , 0.13138818, 7.        ],
                 [0.2197132 , 0.15667866, 0.4767832 ],
                 [7.        , 7.        , 0.29578811],
                 [7.        , 7.        , 0.33685442],
                 [7.        , 0.34348129, 0.34454846],
                 [0.1480243 , 7.        , 7.        ]])
```

```
In [236]: a[a<0.5] = 10
```

```
In [237]: a
```

```
Out[237]: array([[10., 10., 10.],
                 [ 7.,  7.,  7.],
                 [10.,  7., 10.],
                 [ 7., 10.,  7.],
                 [ 7., 10.,  7.],
                 [10., 10., 10.],
                 [ 7.,  7., 10.],
                 [ 7.,  7., 10.],
                 [ 7., 10., 10.],
                 [10.,  7.,  7.]])
```

```
In [238]: a = np.random.random((10,3))
```

```
In [239]: a
```

```
Out[239]: array([[0.94088994, 0.28853124, 0.43121885],
                 [0.63553077, 0.66448446, 0.9333945 ],
                 [0.89050694, 0.62234206, 0.41085625],
                 [0.67756917, 0.60942108, 0.25906782],
                 [0.54362425, 0.96250972, 0.44180218],
                 [0.22484399, 0.76195941, 0.92886175],
                 [0.20969095, 0.77321561, 0.44424516],
                 [0.37858545, 0.63309592, 0.19253616],
                 [0.47241695, 0.55872057, 0.42975697],
                 [0.83557823, 0.02431363, 0.16464272]])
```

```
In [241]: a[[1,2,7],:]
```

```
Out[241]: array([[0.63553077, 0.66448446, 0.9333945 ],
                 [0.89050694, 0.62234206, 0.41085625],
                 [0.37858545, 0.63309592, 0.19253616]])
```

```
In [243]: a[[0,0,0,2,2,2],:]
```

```
Out[243]: array([[0.94088994, 0.28853124, 0.43121885],
                 [0.94088994, 0.28853124, 0.43121885],
                 [0.94088994, 0.28853124, 0.43121885],
                 [0.89050694, 0.62234206, 0.41085625],
                 [0.89050694, 0.62234206, 0.41085625],
                 [0.89050694, 0.62234206, 0.41085625]])
```

```
In [244]: a
```

```
Out[244]: array([[0.94088994, 0.28853124, 0.43121885],
                 [0.63553077, 0.66448446, 0.9333945 ],
                 [0.89050694, 0.62234206, 0.41085625],
                 [0.67756917, 0.60942108, 0.25906782],
                 [0.54362425, 0.96250972, 0.44180218],
                 [0.22484399, 0.76195941, 0.92886175],
                 [0.20969095, 0.77321561, 0.44424516],
                 [0.37858545, 0.63309592, 0.19253616],
                 [0.47241695, 0.55872057, 0.42975697],
                 [0.83557823, 0.02431363, 0.16464272]])
```

```
In [246]: [y for x in a for y in x]
```

```
Out[246]: [0.9408899350153811,
           0.28853124003622055,
           0.4312188455237307,
           0.6355307670371619,
           0.6644844570502142,
           0.9333944995298579,
           0.8905069448156778,
           0.6223420559479907,
           0.4108562506555494,
           0.6775691690981421,
           0.6094210794834357,
           0.2590678249942284,
           0.543624251579262,
           0.9625097206721267,
           0.44180217590445303,
           0.22484399284618883,
           0.7619594064049912,
           0.9288617527097626,
           0.20969095101893742,
           0.7732156112213533,
           0.4442451649738183,
           0.3785854485640474,
           0.6330959190010553,
           0.19253615621754117,
           0.47241695290166197,
           0.5587205697500002,
           0.42975696606119684,
           0.8355782265408671,
           0.024313625525120175,
           0.16464272288818138]
```

```
In [247]: a.flatten()
```

```
Out[247]: array([0.94088994, 0.28853124, 0.43121885, 0.63553077, 0.66448446,
                 0.9333945 , 0.89050694, 0.62234206, 0.41085625, 0.67756917,
                 0.60942108, 0.25906782, 0.54362425, 0.96250972, 0.44180218,
                 0.22484399, 0.76195941, 0.92886175, 0.20969095, 0.77321561,
                 0.44424516, 0.37858545, 0.63309592, 0.19253616, 0.47241695,
                 0.55872057, 0.42975697, 0.83557823, 0.02431363, 0.16464272])
```

```
In [248]: a = np.random.random((2,3))
          b = np.random.random((2,3))
```

```
In [249]: a
```

```
Out[249]: array([[0.24319094, 0.47352424, 0.7079608 ],
                 [0.66072608, 0.04687239, 0.41528602]])
```

```
In [250]: b

Out[250]: array([[0.32675051, 0.21966194, 0.08322717],
                 [0.61117881, 0.53913685, 0.19991502]])
```

```
In [253]: np.hstack((a,b))

Out[253]: array([[0.24319094, 0.47352424, 0.7079608 , 0.32675051, 0.21966194,
                  0.08322717],
                 [0.66072608, 0.04687239, 0.41528602, 0.61117881, 0.53913685,
                  0.19991502]])
```

```
In [254]: np.vstack((a,b))

Out[254]: array([[0.24319094, 0.47352424, 0.7079608 ],
                 [0.66072608, 0.04687239, 0.41528602],
                 [0.32675051, 0.21966194, 0.08322717],
                 [0.61117881, 0.53913685, 0.19991502]])
```

```
In [255]: np.vstack((a,b,b,a))

Out[255]: array([[0.24319094, 0.47352424, 0.7079608 ],
                 [0.66072608, 0.04687239, 0.41528602],
                 [0.32675051, 0.21966194, 0.08322717],
                 [0.61117881, 0.53913685, 0.19991502],
                 [0.32675051, 0.21966194, 0.08322717],
                 [0.61117881, 0.53913685, 0.19991502],
                 [0.24319094, 0.47352424, 0.7079608 ],
                 [0.66072608, 0.04687239, 0.41528602]])
```

```
In [257]: np.block([[a,b], [b,a]])

Out[257]: array([[0.24319094, 0.47352424, 0.7079608 , 0.32675051, 0.21966194,
                  0.08322717],
                 [0.66072608, 0.04687239, 0.41528602, 0.61117881, 0.53913685,
                  0.19991502],
                 [0.32675051, 0.21966194, 0.08322717, 0.24319094, 0.47352424,
                  0.7079608 ],
                 [0.61117881, 0.53913685, 0.19991502, 0.66072608, 0.04687239,
                  0.41528602]])
```

```
In [259]: a

Out[259]: array([[0.24319094, 0.47352424, 0.7079608 ],
                 [0.66072608, 0.04687239, 0.41528602]])
```

```
In [261]: b

Out[261]: array([[0.32675051, 0.21966194, 0.08322717],
                 [0.61117881, 0.53913685, 0.19991502]])
```

```
In [ ]:
```

```
a b
b a
```

```
In [269]: a = np.random.randint(1,10, (4,5))
In [270]: a

Out[270]: array([[5, 1, 4, 6, 2],
                 [4, 1, 8, 6, 9],
                 [6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])
```

```
In [275]: np.vsplit(a,2)

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

```
In [273]: a

Out[273]: array([[5, 1, 4, 6, 2],
                 [4, 1, 8, 6, 9],
                 [6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])
```

```
In [274]: a[1:3, 1:3]

Out[274]: array([[1, 8],
                 [9, 6]])
```

```
In [279]: np.vsplit(a,2)

Out[279]: [array([[5, 1, 4, 6, 2],
                  [4, 1, 8, 6, 9]]), array([[6, 9, 6, 8, 2],
                  [7, 5, 3, 4, 2]])]
```

```
In [281]: a1, a2 = np.vsplit(a,2)
```

```
In [282]: a1

Out[282]: array([[5, 1, 4, 6, 2],
                 [4, 1, 8, 6, 9]])
```

```
In [284]: a2

Out[284]: array([[6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])
```

```
In [285]: r = np.vsplit(a,2)[1]
```

```
In [286]: r

Out[286]: array([[6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])
```

```
In [288]: [list(x) for x in r]

Out[288]: [[6, 9, 6, 8, 2], [7, 5, 3, 4, 2]]
```

```
In [289]: a

Out[289]: array([[5, 1, 4, 6, 2],
                 [4, 1, 8, 6, 9],
                 [6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])
```

```
In [292]: f = np.zeros((5,5))
In [294]: f

Out[294]: 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 [298]: f[:4,:] = a
```

```
In [300]: f[-1,:] = np.array([3,4,5,6,7])
```

```
In [301]: f

Out[301]: array([[5., 1., 4., 6., 2.],
                 [4., 1., 8., 6., 9.],
                 [6., 9., 6., 8., 2.],
                 [7., 5., 3., 4., 2.],
                 [3., 4., 5., 6., 7.]])
```

```
In [302]: f

Out[302]: array([[5., 1., 4., 6., 2.],
                 [4., 1., 8., 6., 9.],
                 [6., 9., 6., 8., 2.],
                 [7., 5., 3., 4., 2.],
                 [3., 4., 5., 6., 7.]])
```

```
In [304]: f[1,3] = 'mitsos'

          ---------------------------------------------------------------------------
          ValueError                                Traceback (most recent call last)
          <ipython-input-304-b9a4a9fa6b85> in <module>()
          ----> 1 f[1,3] = 'mitsos'

          ValueError: could not convert string to float: 'mitsos'
```

```
In [307]: np.array(['a', 'b'])

Out[307]: array(['a', 'b'], dtype='<U1')
```

```
In [306]: np.array([3,4], dtype=np.int64)

Out[306]: array([3, 4])
```

```
In [313]: a.dtype

Out[313]: dtype('int64')
```

```
In [315]: b = a>5
```

```
In [316]: b.dtype

Out[316]: dtype('bool')
```

```
In [322]: a[~(a>5)]

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

```
In [323]: a

Out[323]: array([[5, 1, 4, 6, 2],
                 [4, 1, 8, 6, 9],
                 [6, 9, 6, 8, 2],
                 [7, 5, 3, 4, 2]])

In [327]: a[np.bitwise_or(a<3, a>6)]

Out[327]: array([1, 2, 1, 8, 9, 9, 8, 2, 7, 2])

In [329]: (a<3) | (a>6)

Out[329]: array([[False,  True, False, False,  True],
                 [False,  True,  True, False,  True],
                 [False,  True, False,  True,  True],
                 [ True, False, False, False,  True]])

In [330]: (a<3) & (a>6)

Out[330]: array([[False, False, False, False, False],
                 [False, False, False, False, False],
                 [False, False, False, False, False],
                 [False, False, False, False, False]])

In [333]: (a<3) ^ (a>6)

Out[333]: array([[False,  True, False, False,  True],
                 [False,  True,  True, False,  True],
                 [False,  True, False,  True,  True],
                 [ True, False, False, False,  True]])

In [334]: def xor(a,b):
              if a == True and b == True:
                  return False
              if a == True and b == False:
                  return True
              if a == False and b == True:
                  return True
              if a == False and b == False:
                  return False

          def my_or(a,b):
              return a or b

In [335]: xor(True, True)

Out[335]: False

In [336]: my_or(True, True)

Out[336]: True

In [337]: xor(False, True)

Out[337]: True

In [338]: my_or(False, True)

Out[338]: True
```

```
In [340]: ~((a<3) & (a>6))
```

```
Out[340]: array([[ True,  True,  True,  True,  True],
                 [ True,  True,  True,  True,  True],
                 [ True,  True,  True,  True,  True],
                 [ True,  True,  True,  True,  True]])
```

```
In [341]: np.inf
```

```
Out[341]: inf
```

```
In [342]: -np.inf
```

```
Out[342]: -inf
```

```
In [343]: np.nan
```

```
Out[343]: nan
```

```
In [344]: np.log(0)
```

```
/Users/alexandroskanterakis/anaconda3/lib/python3.7/site-packages/ipykernel_la
uncher.py:1: RuntimeWarning: divide by zero encountered in log
  """Entry point for launching an IPython kernel.
```

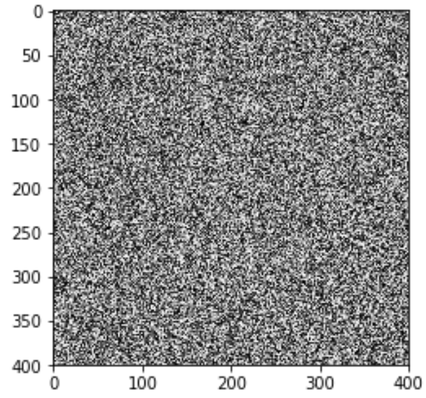
```
Out[344]: -inf
```

```
In [345]: np.log(np.e)
```

```
Out[345]: 1.0
```

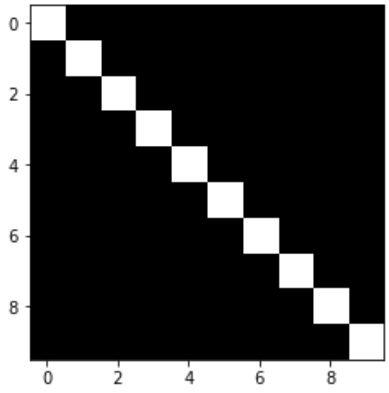
```
In [346]: import matplotlib.pyplot as plt
```

```
In [367]: plt.imshow(np.random.random((400,400)), cmap='gray')
          plt.show()
```



```
In [356]: plt.imshow(np.eye(10), cmap='gray')

Out[356]: <matplotlib.image.AxesImage at 0x1203a9be0>
```


0
2
4
6
8
0
2
4
6
8