In [1]:
```
import numpy as np
```

In [2]:
```
x=np.arange(1,10)
```

In [3]:
```
x.shape
```

Out[3]:
```
(9,)
```

In [4]:
```
y=x.reshape(3,3)
```

In [5]:
```
x
```

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

In [6]:
```
y
```

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

In [8]:
```
y[0,0]
```

Out[8]:
```
1
```

In [9]:
```
y[(1,0),(1,1)]
```

Out[9]:
```
array([5, 2])
```

In [8]:
```
y[(1,0)]
```

Out[8]:
```
4
```

In [30]:
```
y[(2,1),(2,2)]
```

Out[30]:
```
array([9, 6])
```

In [ ]:
```
```

In [10]:
```
x.shape=(3,3)
```

In [11]:
```
x
```

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

In [12]:
```
y[0:1,0:3]
```

Out[12]:
```
array([[1, 2, 3]])
```

In [13]:
```
y[0:1,0:2]
```

Out[13]:
```
array([[1, 2]])
```

In [14]:
```
y[0:2,0:3]
```

Out[14]:
```
array([[1, 2, 3],
       [4, 5, 6]])
```

In [15]:
```
y[0:3,0:3]
```

Out[15]:
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [17]:
```
y[0:1,1:2]
```

Out[17]:
```
array([[2]])
```

In [26]:
```
y[ 1:3]
```

Out[26]:
```
array([[4, 5, 6],
       [7, 8, 9]])
```

In [24]:
```
y
```

Out[24]:
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [29]:
```
y[ 1:3,1:3]
```

Out[29]:
```
array([[5, 6],
       [8, 9]])
```

In [23]:
```
y[ 1:3,1:3]
```

Out[23]:
```
array([[5, 6],
       [8, 9]])
```

In [30]:
```
y[0:1]
```

Out[30]:
```
array([[1, 2, 3]])
```

In [33]:
```
y[0:1,0]
```

Out[33]:
```
array([1])
```

In [34]:
```
y[0:1,1]
```

Out[34]:
```
array([2])
```

In [35]:
```
y[0:1,2]
```

Out[35]:
```
array([3])
```

In [36]:
```
y[0:1,0:1]
```

Out[36]:
```
array([[1]])
```

In [37]:
```
y[0:1,0:2]
```

Out[37]:
```
array([[1, 2]])
```

In [42]:
```
y[0:1,1:6]
```

Out[42]:
```
array([[2, 3]])
```

In [49]:
```
y[0:0]
```

Out[49]:
```
array([], shape=(0, 3), dtype=int32)
```

In [44]:
```
y[0:1]
```

Out[44]:
```
array([[1, 2, 3],
       [4, 5, 6]])
```

In [50]:
```
y[0:2]
```

Out[50]:
```
array([[1, 2, 3],
       [4, 5, 6]])
```

In [51]:
```
y[0:3]
```

Out[51]:
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [55]:
```
y[1:3]
```

Out[55]:
```
array([[4, 5, 6],
       [7, 8, 9]])
```

In [ ]:

In [ ]:

In [ ]:

In [15]:
```
y[1:,0:]
```

Out[15]:
```
array([[4, 5, 6],
       [7, 8, 9]])
```

In [16]:
```
y[1:,0:2]
```

Out[16]:
```
array([[4, 5],
       [7, 8]])
```

In [57]:
```
z=np.arange(1,21).reshape(5,4)
```

In [58]:
```
z
```

Out[58]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12],
       [13, 14, 15, 16],
       [17, 18, 19, 20]])
```

In [59]:
```
y=z[1:3,1:3]
y
#doubt
```

Out[59]:
```
array([[ 6,  7],
       [10, 11]])
```

In [32]:
```
y[0,0]=100
y
```

Out[32]:
```
array([[100,   7],
       [ 10,  11]])
```

In [33]:
```
z
```

Out[33]:
```
array([[  1,   2,   3,   4],
       [  5, 100,   7,   8],
       [  9,  10,  11,  12],
       [ 13,  14,  15,  16],
       [ 17,  18,  19,  20]])
```

In [34]:
```
#integer based indexing
```

In [113]:
```
a=z[[2,2,0],[2,3,0]]
a
#doubt cleared
```

Out[113]:
```
array([11, 12,  1])
```

In [114]:
```
a.ndim
```

Out[114]:
```
1
```

In [115]:
```
a
```

Out[115]:
```
array([11, 12,  1])
```

In [116]:
```
a[0]=1000
a
```

Out[116]:
```
array([1000,   12,    1])
```

In [117]:
```
a[1]=230
a
```

Out[117]:
```
array([1000,  230,    1])
```

In [60]:
```
a=z[[2,2,0,0],[2,3,0,3]]
a
```

Out[60]:
```
array([11, 12,  1,  4])
```

In [ ]:
```

```

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

Out[61]:
```
array([11, 12,  1,  4])
```

In [62]:
```
z
```

Out[62]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12],
       [13, 14, 15, 16],
       [17, 18, 19, 20]])
```

In [119]:
```
#Boolean based index
#type of index based on condition
#+- will bedone element wise
```

In [120]:
```
x=np.arange(1,21).reshape(5,4)
x
```

Out[120]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12],
       [13, 14, 15, 16],
       [17, 18, 19, 20]])
```

In [121]:
```
x-1
```

Out[121]:
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
       [ 8,  9, 10, 11],
       [12, 13, 14, 15],
       [16, 17, 18, 19]])
```

In [122]:
```
x+1
```

Out[122]:
```
array([[ 2,  3,  4,  5],
       [ 6,  7,  8,  9],
       [10, 11, 12, 13],
       [14, 15, 16, 17],
       [18, 19, 20, 21]])
```

In [123]:
```
x-3
```

Out[123]:
```
array([[-2, -1,  0,  1],
       [ 2,  3,  4,  5],
       [ 6,  7,  8,  9],
       [10, 11, 12, 13],
       [14, 15, 16, 17]])
```

In [124]:
```
x*2
```

Out[124]:
```
array([[ 2,  4,  6,  8],
       [10, 12, 14, 16],
       [18, 20, 22, 24],
       [26, 28, 30, 32],
       [34, 36, 38, 40]])
```

In [63]:
```
a=np.arange(1,9).reshape(4,2)
b=np.arange(1,9).reshape(4,2)
```

In [64]:
```
a
```

Out[64]:
```
array([[1, 2],
       [3, 4],
       [5, 6],
       [7, 8]])
```

In [65]:
```
b
```

Out[65]:
```
array([[1, 2],
       [3, 4],
       [5, 6],
       [7, 8]])
```

In [66]:
```
a+b
```

Out[66]:
```
array([[ 2,  4],
       [ 6,  8],
       [10, 12],
       [14, 16]])
```

In [67]:
```
np.add(a,b)
```

Out[67]:
```
array([[ 2,  4],
       [ 6,  8],
       [10, 12],
       [14, 16]])
```

In [68]:
```
np.subtract(a,b)
```

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

In [69]:
```
np.multiply(a,b)
```

Out[69]:
```
array([[ 1,  4],
       [ 9, 16],
       [25, 36],
       [49, 64]])
```

In [74]:
```
np.power(a,b)
```

Out[74]:
```
array([[       1,        4],
       [      27,      256],
       [    3125,    46656],
       [  823543, 16777216]], dtype=int32)
```

In [88]:
```
x=np.arange(1,16).reshape(3,5)
y=np.arange(1,16).reshape(3,5)
```

In [89]:
```
x
```

Out[89]:
```
array([[ 1,  2,  3,  4,  5],
       [ 6,  7,  8,  9, 10],
       [11, 12, 13, 14, 15]])
```

In [90]:
```
y
```

Out[90]:
```
array([[ 1,  2,  3,  4,  5],
       [ 6,  7,  8,  9, 10],
       [11, 12, 13, 14, 15]])
```

In [91]:
```
x+y
```

Out[91]:
```
array([[ 2,  4,  6,  8, 10],
       [12, 14, 16, 18, 20],
       [22, 24, 26, 28, 30]])
```

In [94]:
```
np.power(x,y)
```

Out[94]:
```
array([[          1,           4,          27,         256,        3125],
       [      46656,      823543,    16777216,   387420489,  1410065408],
       [ 1843829075,  -251658240, -1692154371, -1282129920,  1500973039]],
      dtype=int32)
```

In [95]:
```
x**y
```

Out[95]:
```
array([[          1,           4,          27,         256,        3125],
       [      46656,      823543,    16777216,   387420489,  1410065408],
       [ 1843829075,  -251658240, -1692154371, -1282129920,  1500973039]],
      dtype=int32)
```

In [96]:
```
#comparison operators
```

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

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

In [98]:
```
a>4
```

Out[98]:
```
array([[False, False],
       [False, False],
       [ True,  True],
       [ True,  True]])
```

In [141]:
```
a<4
```

Out[141]:
```
array([[ True,  True],
       [ True, False],
       [False, False],
       [False, False]])
```

In [103]:
```
x1=np.arange(1,10).reshape(3,3)
x1
```

Out[103]:
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [104]:
```
x2=np.full((3,8),10)
x2
```

Out[104]:
```
array([[10, 10, 10, 10, 10, 10, 10, 10],
       [10, 10, 10, 10, 10, 10, 10, 10],
       [10, 10, 10, 10, 10, 10, 10, 10]])
```

In [105]:
```
#boolean indexing masking
```

In [106]:
```
x1
```

Out[106]:
```
array([[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
```

In [107]:
```
x1%2==0
```

Out[107]:
```
array([[False,  True, False],
       [ True, False,  True],
       [False,  True, False]])
```

In [110]:
```
x1[x1%2==0]
```

Out[110]:
```
array([2, 4, 6, 8])
```

In [111]:
```
x=np.arange(1,101).reshape(10,10)
x
```

Out[111]:
```
array([[  1,   2,   3,   4,   5,   6,   7,   8,   9,  10],
       [ 11,  12,  13,  14,  15,  16,  17,  18,  19,  20],
       [ 21,  22,  23,  24,  25,  26,  27,  28,  29,  30],
       [ 31,  32,  33,  34,  35,  36,  37,  38,  39,  40],
       [ 41,  42,  43,  44,  45,  46,  47,  48,  49,  50],
       [ 51,  52,  53,  54,  55,  56,  57,  58,  59,  60],
       [ 61,  62,  63,  64,  65,  66,  67,  68,  69,  70],
       [ 71,  72,  73,  74,  75,  76,  77,  78,  79,  80],
       [ 81,  82,  83,  84,  85,  86,  87,  88,  89,  90],
       [ 91,  92,  93,  94,  95,  96,  97,  98,  99, 100]])
```

In [112]:
```
(x%5==0)|(x%7==0)  #| -- or,&--and
```

Out[112]:
```
array([[False, False, False, False,  True, False,  True, False, False,
         True],
       [False, False, False,  True,  True, False, False, False, False,
         True],
       [ True, False, False, False,  True, False, False,  True, False,
         True],
       [False, False, False, False,  True, False, False, False, False,
         True],
       [False,  True, False, False,  True, False, False, False,  True,
         True],
       [False, False, False, False,  True,  True, False, False, False,
         True],
       [False, False,  True, False,  True, False, False, False, False,
         True],
       [False, False, False, False,  True, False,  True, False, False,
         True],
       [False, False, False,  True,  True, False, False, False, False,
         True],
       [ True, False, False, False,  True, False, False,  True, False,
         True]])
```

In [113]:
```
x[(x%5==0) | (x%7==0)]
```

Out[113]:
```
array([  5,   7,  10,  14,  15,  20,  21,  25,  28,  30,  35,  40,  42,
        45,  49,  50,  55,  56,  60,  63,  65,  70,  75,  77,  80,  84,
        85,  90,  91,  95,  98, 100])
```

In [115]:
```
(x%5==0) & (x%7==0)  #| -- or,&--and
```

Out[115]:
```
array([[False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False,  True, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
         True],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False]])
```

In [116]:
```
x[(x%5==0)&(x%7==0)]
```

Out[116]:
```
array([35, 70])
```

In [125]:
```
a=np.zeros((5,5),dtype=int)
a
```

Out[125]:
```
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 [42]:
```
a=np.zeros((5,6,1),dtype=int) #first loops,second rows,third columns
a
```

Out[42]:
```
array([[[0],
        [0],
        [0],
        [0],
        [0],
        [0]],

       [[0],
        [0],
        [0],
        [0],
        [0],
        [0]],

       [[0],
        [0],
        [0],
        [0],
        [0],
        [0]],

       [[0],
        [0],
        [0],
        [0],
        [0],
        [0]],

       [[0],
        [0],
        [0],
        [0],
        [0],
        [0]]])
```

In [ ]: