NUMPY DAY 2

slicing[:](value after : apply n-1); fetching particular element[,] ; getting particular part of metrix

In [13]:
```
import numpy as np
```

Slicing in matrix

In [15]:
```
b = np.random.randint(10,20,(5,4))
b
```

Out[15]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14],
       [19, 10, 16, 14],
       [13, 17, 13, 15],
       [10, 18, 19, 15]])
```

In slicing for list index value = slicing of matrix rows

In [16]:
```
b[:]   # gives whole array
```

Out[16]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14],
       [19, 10, 16, 14],
       [13, 17, 13, 15],
       [10, 18, 19, 15]])
```

In [17]:
```
b[0:2]               # gives row 0 to 1 (n-1 applied for high value)
```

Out[17]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14]])
```

In [18]:
```
b
```

Out[18]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14],
       [19, 10, 16, 14],
       [13, 17, 13, 15],
       [10, 18, 19, 15]])
```

In [19]:
```
b[0:-1]   # gives rows from 0 to (n-1)for second value
```

Out[19]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14],
       [19, 10, 16, 14],
       [13, 17, 13, 15]])
```

In [20]:
```
b
```

Out[20]:
```
array([[18, 18, 13, 16],
       [12, 19, 18, 14],
       [19, 10, 16, 14],
       [13, 17, 13, 15],
       [10, 18, 19, 15]])
```

In [22]:
```
b[0,2]    # row= 0 and col= 2 and that particular index value
```

Out[22]:
```
13
```

In [23]:
```
np.random.randint(10,20,(4,4))
#creating 4 row 4 col matrix of random values between 10 to 20 (excluding 20)
```

Out[23]:
```
array([[16, 19, 14, 11],
       [14, 12, 19, 15],
       [16, 17, 18, 17],
       [15, 11, 13, 11]])
```

In [24]:
```
a = np.random.randint(10,20,5)
a                # array of 5 any random values bet 10 to 19(caz n-1)
```

Out[24]:
```
array([10, 17, 11, 11, 18])
```

In [44]:
```
arr = np.arange(0,6)   # array of 0 to 5 value (n-1 = 6-1 = 5)
arr
```

Out[44]:
```
array([0, 1, 2, 3, 4, 5])
```

In [46]:
```
arr2 = np.random.randint(0,100,(10,10))
arr2         # matrix of 10 row and 10 col of random numbers from 0 to 99
```

Out[46]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [48]:
```
arr[:]
```

Out[48]:
```
array([0, 1, 2, 3, 4, 5])
```

In [52]:
```
arr[:4]    # value of index 0 to 3   (n-1 applied)
```

Out[52]:
```
array([0, 1, 2, 3])
```

In [56]:
```
arr2[:]     # whole matrix
```

Out[56]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [58]:
```
arr2[0:5]    # row 0 to row 4   (n-1 applied)
```

Out[58]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2]])
```

In [61]:
```
arr2
```

Out[61]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [63]:
```
arr2[1:5]  # row 1 to 4  (value after : apply n-1)
```

Out[63]:
```
array([[86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2]])
```

In [65]:
```
arr2
```

Out[65]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [67]:
```
arr2[-5,5]    # getting element which is in row=-5 and col=5
```

Out[67]:
```
65
```

In [69]:
```
arr2[-5,-5]              # element in row=-5 and col=-5
```

Out[69]:
```
65
```

In [71]:
```
arr2
```

Out[71]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [73]:
```
arr2[-1,-2]  # element which is in -1 row and -2 col
```

Out[73]:
```
82
```

In [75]:
```
arr2
```

Out[75]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [81]:
```
arr2[::]
```

Out[81]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [77]:
```
arr2[::-1]   # whole matrix in reverse order
```

Out[77]:
```
array([[79, 94,  0, 76, 10, 67, 24, 17, 82, 55],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [38, 69, 94, 74, 86, 84, 16, 36, 44, 41]])
```

In [79]:
```
arr2
```

Out[79]:
```
array([[38, 69, 94, 74, 86, 84, 16, 36, 44, 41],
       [86, 32, 82, 56, 43, 60, 88, 53, 26, 88],
       [63, 84, 76, 51, 52, 24, 49, 67, 17, 11],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [81, 93, 10, 10, 62, 10, 62, 95, 53,  2],
       [85, 38,  0, 47, 29, 65, 48, 61,  3, 45],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [ 0,  4, 98, 18, 27, 19, 13, 75, 17, 18],
       [28,  7, 38, 95, 25, 65, 84, 77, 98, 65],
       [79, 94,  0, 76, 10, 67, 24, 17, 82, 55]])
```

In [83]:
```
arr2[::-3]  # matrix in reverse order with gap of -3(rows -1,-4,-7,-10)
```

Out[83]:
```
array([[79, 94,  0, 76, 10, 67, 24, 17, 82, 55],
       [43, 64, 60, 46, 93, 26, 82, 36, 61, 91],
       [16, 17, 41, 14, 84, 85, 64, 21,  2, 32],
       [38, 69, 94, 74, 86, 84, 16, 36, 44, 41]])
```

In [85]:
```
arr
```

Out[85]:
```
array([0, 1, 2, 3, 4, 5])
```

In [87]:
```
arr.max()                          # max. element from array
```

Out[87]:
```
5
```

In [91]:
```
arr.min()                    # min from array
```

Out[91]:
```
0
```

In [93]:
```
arr.mean()            # to get mean of the element of the given array
```

Out[93]:
```
2.5
```

In [95]:
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[95], line 1
----> 1 arr.median()

AttributeError: 'numpy.ndarray' object has no attribute 'median'
```

In [105…
```
from numpy import*            # to call all function from numpy module
a = array([1,2,3,4,9])
median(a)
```

Out[105…
```
3.0
```

In [107…
```
arr
```

Out[107…
```
array([0, 1, 2, 3, 4, 5])
```

In [109…
```
arr.reshape(2,3)        # make a matrix row= 2, col=3
```

Out[109…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [115…
```
arr.reshape(6,1)             # 1st value=row ; 2nd value=col
```

Out[115…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [121…
```
arr.reshape(1,6)      # no. of element = row*col
```

Out[121…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [123…
```
arr.reshape(1,5)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[123], line 1
----> 1 arr.reshape(1,5)

ValueError: cannot reshape array of size 6 into shape (1,5)
```

In [127…
```
arr.reshape(3,2,order='C')       # make matrix in shape of c
                              # while writing numbers in matrix go horizontally
```

Out[127…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [129…
```
arr.reshape(3,2,order='F')      # matrix with F shape
                                # while writing numbers in matrix go vertically
```

Out[129…
```
array([[0, 3],
       [1, 4],
       [2, 5]])
```

In [131…
```
arr.reshape(3,2,order='A')       # make matrix in shape of A
                                 # while writing numbers in matrix go horizontally
```

Out[131…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [133…
```
arr.reshape(3,2,order='K')
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[133], line 1
----> 1 arr.reshape(3,2,order='K')

ValueError: order 'K' is not permitted for reshaping
```

In [135…
```
arr
```

Out[135…
```
array([0, 1, 2, 3, 4, 5])
```

In [137…
```
arr.reshape(2,3)
```

Out[137…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [139…
```
arr.reshape(1,4)   # no. of element should fit in given size of metrix
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[139], line 1
----> 1 arr.reshape(1,4)

ValueError: cannot reshape array of size 6 into shape (1,4)
```

In [141…
```
arr.reshape(1,6)
```

Out[141…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [143…
```
arr.reshape(2,6)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[143], line 1
----> 1 arr.reshape(2,6)

ValueError: cannot reshape array of size 6 into shape (2,6)
```

In [145…
```
arr.reshape(3,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[145], line 1
----> 1 arr.reshape(3,3)

ValueError: cannot reshape array of size 6 into shape (3,3)
```

In [147…
```
arr.reshape(3,2)
```

Out[147…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [153…
```
mat = arange(0,100).reshape(10,10)  # 10by10 matrix of no from 0 to (100-1)
```

In [155…
```
mat
```

Out[155…
```
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, 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]])
```

In [158…
```
row = 4
row
```

Out[158…
```
4
```

In [160…
```
col = 5
col
```

Out[160…
```
5
```

In [162…
```
mat
```

Out[162…
```
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, 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]])
```

In [166…
```
mat[row,col]     # fectching particular element
```

Out[166…
```
45
```

In [168…
```
mat[4,5]
```

Out[168…
```
45
```

In [174…
```
mat
```

Out[174…
```
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, 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]])
```

In [170…
```
mat[:]  # whole matrix
```

Out[170…
```
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, 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]])
```

In [172…
```
col= 6
```

In [176…
```
# with slices
mat[:,col]        # to get particular col
```

Out[176…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [178…
```
mat
```

Out[178…
```
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, 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]])
```

In [180…
```
mat[row,:]
```

Out[180…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [182…
```
mat
```

Out[182…
```
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, 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]])
```

In [184…
```
mat[:col]  # slicing
```

Out[184…
```
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, 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]])
```

In [186…
```
mat[:row]  # slicing
```

Out[186…
```
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, 24, 25, 26, 27, 28, 29],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39]])
```

In [188…
```
mat
```

Out[188…
```
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, 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]])
```

In [190…
```
mat[row:] # slicing
```

Out[190…
```
array([[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]])
```

In [192…
```
mat[:]
```

Out[192…
```
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, 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]])
```

In [194…
```
mat[:,8]
```

Out[194…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [196…
```
mat[:,-1]
```

Out[196…
```
array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

In [198…
```
mat
```

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, 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]])
```

In [200…
```
row
```

Out[200…
```
4
```

In [202…
```
col
```

Out[202…
```
6
```

In [204…
```
mat[:,col]
```

Out[204…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [206…
```
mat
```

Out[206…
```
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, 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]])
```

In [208…
```
mat[1:4]  # slicing
```

Out[208…
```
array([[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]])
```

In [211…
```
mat[1,4]   # particular element
```

Out[211…
```
14
```

In [214…
```
mat[3:-3]
```

Out[214…
```
array([[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]])
```

In [216…
```
mat
```

Out[216…
```
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, 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]])
```

In [218…
```
mat[0]       # In list 0 index value in matrix 0th row of matrix
```

Out[218…
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [221…
```
mat[row]      # get speific row
```

Out[221…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [223…
```
mat[row,:]        # get specific row
```

Out[223…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [227…
```
mat[6]
```

Out[227… array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])

In [230…
```
mat
```

Out[230…
```
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, 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]])
```

In [232…
```
mat[6:]
```

Out[232…
```
array([[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]])
```

In [234…
```
mat[:6]
```

Out[234…
```
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, 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]])
```

In [236…
```
mat
```

Out[236…
```
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, 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]])
```

In [238…
```
mat[0:10]
```

Out[238…
```
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, 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]])
```

In [240…
```
mat[0:10:3]     # get rows from 0 to (10-1 with gap of 3
```

Out[240…
```
array([[ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
       [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

In [244…
```
mat
```

Out[244…
```
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, 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]])
```

In [246…
```
mat[4:]
```

Out[246…
```
array([[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]])
```

In [248…
```
mat[:4]
```

Out[248…
```
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, 24, 25, 26, 27, 28, 29],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39]])
```

In [250…
```
mat[::-1]
```

Out[250…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
       [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
       [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
       [10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
       [ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9]])
```

In [258…
```
mat
```

Out[258…
```
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, 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]])
```

In [262…
```
mat[::-2]      # row in reverse direction with gap of -2
```

Out[262…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
       [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [10, 11, 12, 13, 14, 15, 16, 17, 18, 19]])
```

In [264…
```
mat
```

Out[264…
```
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, 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]])
```

In [260…
```
mat[::-3]
```

Out[260…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
       [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9]])
```

In [266…
```
mat
```

Out[266…
```
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, 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]])
```

In [268…
```
mat[::-5]        # matrix in reverse order with gap of -5
```

Out[268…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

In [270…
```
mat
```

Out[270…
```
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, 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]])
```

In [272…
```
mat[2:6]
```

Out[272…
```
array([[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]])
```

In [274…
```
mat
```

Out[274…
```
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, 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]])
```

In [276…
```
mat[2:6,2:4]   # to get specific part of matrix
# rows 2 to (6-1) ; column 2 to (4-1) ; the part of matrix which fall in to this
```

Out[276…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [278…
```
mat
```

Out[278…
```
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, 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]])
```

In [280…
```
mat[0,1]
```

Out[280…
```
1
```

In [282…
```
mat[1,6]
```

Out[282…
```
16
```

In [284…
```
mat
```

Out[284…
```
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, 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]])
```

In [286…
```
mat[1:6]
```

Out[286…
```
array([[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]])
```

In [290…
```
mat[1:]
```

Out[290…
```
array([[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]])
```

In [292…
```
mat
```

Out[292…
```
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, 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]])
```

In [294…
```
mat[:6]
```

Out[294…
```
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, 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]])
```

In [297…
```
mat[0:1]
```

Out[297…
```
array([[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]])
```

In [299…
```
mat[3:5]
```

Out[299…
```
array([[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

In [301…
```
mat[3,5]
```

Out[301…
```
35
```

In [303…
```
mat
```

Out[303…
```
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, 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]])
```

In [305…
```
mat[1:2,2:4] # row 1 to (2-1); col 2 to (4-1) ;the part of matrix that come in this
```

Out[305…
```
array([[12, 13]])
```

In [307…
```
mat[2:3,2:3]
```

Out[307…
```
array([[22]])
```

In [309…
```
mat
```

Out[309…
```
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, 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]])
```

In [311…
```
mat[3:5,2:4]
```

Out[311…
```
array([[32, 33],
       [42, 43]])
```

In [313…
```
mat[2:3,4:5]
```

Out[313…
```
array([[24]])
```

In [315…
```
id(mat)
```

Out[315…
```
1823277081840
```

In [317…
```
mat
```

Out[317…
```
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, 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]])
```

In [319…
```
mat<50
```

Out[319…
```
array([[ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         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, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False]])
```

In [321…
```
mat>50
```

Out[321…
```
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, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True]])
```

In [323…
```
mat == 50
```

Out[323…
```
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, 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, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False]])
```

In [325…
```
mat[mat==50]
```

Out[325…
```
array([50])
```

In [333…
```
a1 = mat[mat < 50]
a1
```

Out[333…
```
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, 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])
```

In [335…
```
a2 = mat[mat > 50]
a2
```

Out[335…
```
array([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])
```

In [337…
```
a3 = mat[mat>=50]
a3
```

Out[337…
```
array([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])
```

In [341…
```
a4 = mat[mat ==50]
a4
```

Out[341…
```
array([50])
```

In [343…
```
mat>50
```

Out[343…
```
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, False, False, False, False, False,
        False],
       [False, False, False, False, False, False, False, False, False,
        False],
       [False,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True],
       [ True,  True,  True,  True,  True,  True,  True,  True,  True,
         True]])
```

In [345…
```
a1
```

Out[345…
```
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, 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])
```

In [347…
```
a2
```

Out[347…
```
array([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])
```