1st MAY

In [21]:
```
b[1:3]
```

Out[21]:
```
array([[12, 12, 11, 15],
       [13, 16, 17, 11]])
```

In [22]:
```
b
```

Out[22]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [23]:
```
b[1,2]
```

Out[23]:
```
11
```

In [24]:
```
b
```

Out[24]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [25]:
```
b[1,3]
```

Out[25]:
```
15
```

In [26]:
```
b
```

Out[26]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [27]:
```
b[1,-1]
```

Out[27]:
```
15
```

In [29]:
```
b
```

Out[29]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [30]:
```
b[2:3]
```

Out[30]:
```
array([[13, 16, 17, 11]])
```

In [32]:
```
b
```

Out[32]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [33]:
```
b[0:-2]
```

Out[33]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11]])
```

In [34]:
```
b
```

Out[34]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [41]:
```
b[0,2]
```

Out[41]:
```
12
```

In [36]:
```
b
```

Out[36]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [38]:
```
b[-5,-3]
```

Out[38]:
```
13
```

In [39]:
```
b
```

Out[39]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [40]:
```
b[-4,-2]
```

Out[40]:
```
11
```

In [42]:
```
b
```

Out[42]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [43]:
```
b[-4,2]
```

Out[43]:
```
11
```

In [44]:
```
np.random.randint(10,20,(4,4))
```

Out[44]:
```
array([[18, 18, 19, 16],
       [18, 19, 18, 18],
       [13, 13, 15, 10],
       [14, 10, 13, 11]])
```

In [45]:
```
b
```

Out[45]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [46]:
```
b[-4,-2]
```

Out[46]:
```
11
```

In [47]:
```
b
```

Out[47]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

In [48]:
```
b[-4:2]
```

Out[48]:
```
array([[12, 12, 11, 15]])
```

In [49]:
```
b[:]
```

Out[49]:
```
array([[12, 13, 12, 18],
       [12, 12, 11, 15],
       [13, 16, 17, 11],
       [10, 18, 12, 11],
       [18, 12, 18, 18]])
```

operations

In [52]:
```
a = np.random.randint(10,20,10)
a
```

Out[52]:
```
array([10, 14, 18, 15, 16, 11, 17, 19, 16, 17])
```

In [54]:
```
id(a)
```

Out[54]:
```
2647901339344
```

In [55]:
```
__name__
```

Out[55]:
```
'__main__'
```

In [56]:
```
arr
```

Out[56]:
```
array([0, 1, 2, 3, 4, 5])
```

In [57]:
```
arr2 = np.random.randint(0,100,(10,10))
```

In [58]:
```
arr2
```

Out[58]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [59]:
```
arr
```

Out[59]:
```
array([0, 1, 2, 3, 4, 5])
```

In [60]:
```
arr[:]
```

Out[60]:
```
array([0, 1, 2, 3, 4, 5])
```

In [61]:
```
arr
```

Out[61]:
```
array([0, 1, 2, 3, 4, 5])
```

In [62]:
```
arr[:4]
```

Out[62]:
```
array([0, 1, 2, 3])
```

In [63]:
```
arr2[:]
```

Out[63]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [64]:
```
arr2[0:5]
```

Out[64]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77]])
```

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

Out[65]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [66]:
```
arr2[1,4]
```

Out[66]:
```
23
```

In [67]:
```
arr2
```

Out[67]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [68]:
```
arr2[-5,5]
```

Out[68]:
```
96
```

In [69]:
```
arr2[-5,-5]
```

Out[69]: 96

In [70]:
```
arr2
```

Out[70]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [71]:
```
arr2[-5,-5]
```

Out[71]: 96

In [72]:
```
arr2
```

Out[72]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [73]:
```
arr2[-1,-2]
```

Out[73]: 37

In [74]:
```
arr2
```

Out[74]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [75]:
```
arr2[::-1]
```

Out[75]:
```
array([[87, 94, 78, 66, 28, 96, 10,  2, 37,  8],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [77, 37,  2, 45, 56, 95, 52, 60, 11, 32]])
```

In [76]:
```
arr2
```

Out[76]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [77]:
```
arr2[::-2]
```

Out[77]:
```
array([[87, 94, 78, 66, 28, 96, 10,  2, 37,  8],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57]])
```

In [78]:
```
arr2
```

Out[78]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [80]:
```
arr2[::-3]
```

Out[80]:
```
array([[87, 94, 78, 66, 28, 96, 10,  2, 37,  8],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [77, 37,  2, 45, 56, 95, 52, 60, 11, 32]])
```

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

Out[81]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [82]:
```
arr2[:-3]
```

Out[82]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22]])
```

In [83]:
```
arr2
```

Out[83]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [23, 42,  4, 58, 23, 22, 72, 40, 56, 57],
       [93, 97, 52,  1, 75, 26, 56, 28, 60, 41],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [61, 70, 88,  3, 91, 89, 14, 14, 66, 77],
       [12, 50, 42,  2, 36, 96, 84, 99,  6, 56],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [80, 36, 64, 56, 97, 82, 99, 13, 68, 29],
       [55, 32, 15,  7, 18,  9, 47, 56, 48,  0],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

In [84]:
```
arr2[0:10:3]
```

Out[84]:
```
array([[77, 37,  2, 45, 56, 95, 52, 60, 11, 32],
       [ 8, 15, 75, 73, 70,  9, 54, 38, 84, 49],
       [78, 28,  5, 99, 90, 43, 68, 13, 37, 22],
       [87, 94, 78, 66, 28, 96, 10,  2, 37,  8]])
```

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

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

In [87]:
```
arr.max()
```

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

In [88]:
```
arr.min()
```

Out[88]:
```
0
```

In [89]:
```
arr
```

Out[89]:
```
array([0, 1, 2, 3, 4, 5])
```

In [90]:
```
arr.mean() # AVERAGE
```

Out[90]:
```
2.5
```

In [91]:
```
arr
```

Out[91]:
```
array([0, 1, 2, 3, 4, 5])
```

In [92]:
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[92], line 1
----> 1 arr.median()

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

In [93]:
```
# 257 inbuild memory numpy
```

In [94]:
```
from numpy import * # 256 function called internally
a = array([1,2,3,4,9])
median(a)
```

Out[94]:
```
3.0
```

Without work on import* can you please find the median, mode)

In [95]:
```
arr
```

Out[95]:
```
array([0, 1, 2, 3, 4, 5])
```

In [96]:
```
arr.reshape(3,2)
```

Out[96]:
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [97]:
```
arr.reshape(6,1) # six row one column
```

Out[97]:
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [98]:
```
arr.reshape(1,6)
```

Out[98]:
```
array([[0, 1, 2, 3, 4, 5]])
```

In [99]:
```
arr
```

Out[99]:
```
array([0, 1, 2, 3, 4, 5])
```

In [100…
```
arr.reshape(2,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[100], line 1
----> 1 arr.reshape(2,4)

ValueError: cannot reshape array of size 6 into shape (2,4)
```

In [101…
```
arr
```

Out[101…
```
array([0, 1, 2, 3, 4, 5])
```

In [102…
```
arr.reshape(3,2,order='C') # print element with fortran
```

Out[102…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [104…
```
arr.reshape(2,3,order='C') # A almost give you C type output
```

Out[104…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [105…
```
arr.reshape(2,3,order='F') # print element with fortran
```

Out[105…
```
array([[0, 2, 4],
       [1, 3, 5]])
```

In [106…
```
arr.reshape(2,3,order='A') # A almost give you c type output
```

Out[106…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [107…
```
# importing Numpy package
import numpy as np

# creating a Numpy array
num_array = np.arange(100).reshape(20, 5)
print(num_array)

# Display array in Fortran order

print("\n C type array:")
for num_array in np.nditer(num_array, order='C'):
    print(num_array,end=' ')
```

```
[[ 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]]

 C type 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 3
1 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 5
9 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 8
7 88 89 90 91 92 93 94 95 96 97 98 99
```

In [109…

```python
# importing Numpy package
import numpy as np

# creating a Numpy array
num_array = np.arange(100).reshape(20, 5)
print(num_array)

# Display array in Fortran order

print("\n C type array:")
for num_array in np.nditer(num_array, order="F"):
    print(num_array,end=' ')
```

```
[[ 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]]

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

In [110…
```
arr.
```

```
  Cell In[110], line 1
    arr.
        ^
SyntaxError: invalid syntax
```

In [111…
```
arr.reshape(2,3)
```

Out[111…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [112…
```
arr.reshape(1,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[112], line 1
----> 1 arr.reshape(1,4)

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

In [113…
```
arr.reshape(1,6)
```

Out[113…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [114…
```
arr.reshape(6,1)
```

Out[114…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [115…
```
arr.reshape(2,6)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[115], line 1
----> 1 arr.reshape(2,6)

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

In [116…
```
arr.reshape(3,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[116], line 1
----> 1 arr.reshape(3,3)

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

In [117…
```
arr
```

Out[117…
```
array([0, 1, 2, 3, 4, 5])
```

In [118…
```
arr.reshape(3,2)
```

Out[118…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

Indexing

In [119…
```
mat = np.arange(0,100).reshape(10,10)
```

In [120…
```
mat
```

Out[120…
```
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 [121…
```
row = 4
col = 5
```

In [122…
```
col
```

Out[122…
```
5
```

In [123…
```
row
```

Out[123…
```
4
```

In [124…
```
mat
```

Out[124…
```
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 [125…
```
mat[row,col]
```

Out[125…
```
45
```

In [126…
```
mat
```

Out[126…
```
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 [127…
```
mat[:]
```

Out[127…
```
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 [128…
```
col = 6
```

In [129…
```
mat
```

Out[129…
```
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 [130…
```
mat[6] # befault it represent to rows
```

Out[130…
```
array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [131…
```
mat
```

Out[131…
```
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 [132…
```
mat
```

Out[132…
```
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 [133…
```
# with slices
mat[:,col]
```

Out[133…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [134…
```
mat
```

Out[134…
```
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 [135…
```
mat[:, 5]
```

Out[135…
```
array([ 5, 15, 25, 35, 45, 55, 65, 75, 85, 95])
```

In [136…
```
mat
```

Out[136…
```
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 [137…
```
mat
```

Out[137…
```
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 [138…
```
mat[row,:]
```

Out[138…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [139…
```
mat
```

Out[139…
```
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 [140…
```
mat[:,8]
```

Out[140…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [141…
```
mat
```

Out[141…
```
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 [142…
```
mat[:col]
```

Out[142…
```
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 [143…
```
mat[:6]
```

Out[143…
```
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 [144…
```
row
```

Out[144…
```
4
```

In [145…
```
mat
```

Out[145…
```
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 [146…
```
mat[:row]
```

Out[146…
```
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 [147…
```
mat
```

Out[147…
```
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 [148…
```
mat[row:]
```

Out[148…
```
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 [149…
```
mat[:]
```

Out[149…
```
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 [150…
```
mat[:,8]
```

Out[150… array([8, 18, 28, 38, 48, 58, 68, 78, 88, 98])

In [151…
```
mat
```

Out[151…
```
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 [152…
```
mat[:,-1]
```

Out[152… array([9, 19, 29, 39, 49, 59, 69, 79, 89, 99])

In [153…
```
mat
```

Out[153…
```
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 [154…
```
row
```

Out[154… 4

In [155…
```
col
```

Out[155… 6

In [156…
```
mat[:,col]
```

Out[156… array([6, 16, 26, 36, 46, 56, 66, 76, 86, 96])

In [157…
```
mat[:,col]
```

Out[157… array([6, 16, 26, 36, 46, 56, 66, 76, 86, 96])

In [158…
```
mat
```

Out[158…
```
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 [159…
```
mat[1,4]
```

Out[159…
```
14
```

In [160…
```
mat
```

Out[160…
```
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 [161…
```
mat[1:4]
```

Out[161…
```
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 [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 [165…
```
mat[2:6,2:4] # 1:5 --> only row part /// 1:3 -- it indicates only column parts
```

Out[165…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [166…
```
mat
```

Out[166…
```
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 [167…
```
mat[1:2,2:4]
```

Out[167…
```
array([[12, 13]])
```

In [168…
```
mat
```

Out[168…
```
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 [169…
```
mat[2:4,3:5]
```

Out[169…
```
array([[23, 24],
       [33, 34]])
```

Masking

In [170…
```
mat # we also called as filter
```

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 [171…
```
id(mat)
```

Out[171…
```
2647902685968
```

In [172…
```
mat
```

Out[172…
```
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 [174…
```
mat>50
```

Out[174…
```
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 [173…
```
mat[mat>50] # greater than 50
```

Out[173…
```
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 [175…
```
mat[mat<50]
```

Out[175…
```
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 [176…
```
mat > 50
```

Out[176…
```
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 [177…
```
mat[mat==50]
```

Out[177…
```
array([50])
```

In [178…
```
mat == 50
```

Out[178…
```
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 [179…
```
mat
```

Out[179…
```
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…
```
a1 = mat[mat<50]
a1
```

Out[180…
```
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 [181…
```
mat
```

Out[181…
```
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 [182…
```
a2 = mat[mat>50]
a2
```

Out[182…
```
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 [184…
```
a3 = mat[mat<=50]
a3
```

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])
```

In [185…
```
a4 = mat[mat==50]
a4
```

Out[185…
```
array([50])
```

Python program to generate otp

In [188…
```
import random
```

```
def generate_otp(length=4):
    """Generate a numberic OTP of a specified length."""
    digits = '012345'
    otp = ''.join(random.choice(digits) for _ in range(length))
    return otp

# Example usage
otp_length = 4 # You can change this to any length you prefer
otp = generate_otp(otp_length)
print(f"Your OTP is: {otp}")
```

```
Your OTP is: 4512
```

In [ ]:

In [ ]: