In [1]:
```
n=(6,7)
n1=(6,8)
print(np.zeros(n1))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[1], line 3
      1 n=(6,7)
      2 n1=(6,8)
----> 3 print(np.zeros(n1))

NameError: name 'np' is not defined
```

In [2]:
```
import numpy as np
```

In [3]:
```
n=(6,7)
n1=(6,8)
print(np.zeros(n1))
```

```
[[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. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]]
```

In [4]:
```
print(np.zeros(n, dtype=int))
```

```
[[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 0 0 0 0 0]
 [0 0 0 0 0 0 0]]
```

In [5]:
```
n
```

Out[5]: (6, 7)

In [6]:
```
n1
```

Out[6]: (6, 8)

In [7]:
```
print(np.zeros(n1))
```

```
[[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. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]]
```

In [8]:
```
np.ones(3)
```

Out[8]: array([1., 1., 1.])

In [9]:
```
np.ones(4,dtype=int)
```

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

In [10]:
```
np.ones(4)
```

Out[10]:
```
array([1., 1., 1., 1.])
```

In [11]:
```
n
```

Out[11]:
```
(6, 7)
```

In [12]:
```
np.ones(n)
```

Out[12]:
```
array([[1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.]])
```

In [13]:
```
np.ones((5,4),dtype=int)
```

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

In [14]:
```
np.twos((2,3))
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[14], line 1
----> 1 np.twos((2,3))

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'twos'
```

In [15]:
```
np.threes(2,3)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[15], line 1
----> 1 np.threes(2,3)

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'threes'
```

In [16]:
```
np.ones(2)
```

Out[16]:
```
array([1., 1.])
```

In [17]:
```
np.ones((2,4))
```

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

In [18]:
```
range(5)
```

Out[18]:
```
range(0, 5)
```

In [19]:
```
range(0,5)
```

Out[19]:
```
range(0, 5)
```

In [20]:
```
list(range(0,5))
```

Out[20]:
```
[0, 1, 2, 3, 4]
```

In [21]:
```
r=range(5)
r
```

Out[21]:
```
range(0, 5)
```

In [22]:
```
for i in r:
    print(i)
```

```
0
1
2
3
4
```

In [23]:
```
y=list(range(12))
y
```

Out[23]:
```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]
```

In [24]:
```
rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[24], line 1
----> 1 rand(3,2)

NameError: name 'rand' is not defined
```

In [25]:
```
np.ran(3,2)
random.rand(3,2)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[25], line 1
----> 1 np.ran(3,2)
      2 random.rand(3,2)

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'ran'
```

In [26]:
```
np.random.rand(5)
```

Out[26]:
```
array([0.49196321, 0.17022831, 0.95245376, 0.83784837, 0.77647004])
```

In [27]:
```
np.random.rand(5, dtype=int)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[27], line 1
----> 1 np.random.rand(5, dtype=int)

TypeError: rand() got an unexpected keyword argument 'dtype'
```

In [28]:
```
np.rand(4)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[28], line 1
----> 1 np.rand(4)

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'rand'
```

In [29]:
```
np.randint(4)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[29], line 1
----> 1 np.randint(4)

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'randint'
```

In [35]:
```
np.random.randint(4)
```

Out[35]:
```
0
```

In [36]:
```
np.random.rand(2,4)
```

Out[36]:
```
array([[0.60199774, 0.71955087, 0.91291692, 0.06582771],
       [0.37174463, 0.82075818, 0.20735045, 0.11686198]])
```

In [41]:
```
np.random.randint(2,4)
```

Out[41]:
```
2
```

In [46]:
```
np.random.randint(2,20)
```

Out[46]:
```
12
```

In [49]:
```
np.random.randint(0,1)
```

Out[49]:
```
0
```

In [60]:
```
np.random.randint(10,20,5)
```

Out[60]:
```
array([16, 18, 11, 14, 17])
```

In [65]:
```
np.random.randint(1,6,4)
```

Out[65]:
```
array([1, 5, 3, 1])
```

In [66]:
```
np.random.rand(3)
```

Out[66]:
```
array([0.9049959 , 0.55249397, 0.76250847])
```

In [67]:
```
np.random.randint(30,20,10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[67], line 1
----> 1 np.random.randint(30,20,10)

File numpy\\random\\mtrand.pyx:780, in numpy.random.mtrand.RandomState.randint()

File numpy\\random\\_bounded_integers.pyx:1425, in numpy.random._bounded_integer
s._rand_int32()

ValueError: low >= high
```

In [71]:
```
np.random.randint(-30,20,10)
```

Out[71]:
```
array([  3, -13,  -6, -19,  -1,  -2,  19,  14, -14, -11])
```

In [76]:
```
np.random.randint(20,30,10)
```

Out[76]:
```
array([29, 25, 22, 28, 25, 26, 27, 20, 23, 20])
```

In [78]:
```
np.random.randint(5,9)
```

Out[78]:
```
6
```

In [79]:
```
np.rand(2)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[79], line 1
----> 1 np.rand(2)

File ~\anaconda3\Lib\site-packages\numpy\__init__.py:333, in __getattr__(attr)
    330     "Removed in NumPy 1.25.0"
    331     raise RuntimeError("Tester was removed in NumPy 1.25.")
--> 333 raise AttributeError("module {!r} has no attribute "
    334                      "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'rand'
```

In [80]:
```
np.random.rand(2)
```

Out[80]:
```
array([0.07371706, 0.31909034])
```

In [97]:
```
np.random.randint(3)
```

Out[97]:
```
2
```

In [105…
```
np.random.randint(2,5)
```

Out[105…
```
3
```

In [108…
```
np.random.randint(2,5,4)
```

Out[108…
```
array([3, 3, 4, 2])
```

In [109…
```
np.random.randint(1,12,10)
```

Out[109…
```
array([10,  2, 11,  4, 11,  6,  2,  7,  1,  1])
```

In [110…
```
np.random.randint(10,40,(10,10))
```

Out[110…
```
array([[31, 22, 19, 11, 33, 20, 29, 30, 36, 36],
       [35, 18, 24, 33, 33, 20, 34, 19, 25, 37],
       [29, 37, 34, 13, 20, 12, 29, 26, 14, 11],
       [21, 16, 36, 35, 31, 30, 13, 32, 39, 12],
       [26, 37, 14, 25, 31, 33, 19, 34, 17, 17],
       [24, 28, 21, 28, 38, 19, 19, 15, 32, 35],
       [23, 20, 17, 24, 29, 15, 25, 29, 20, 26],
       [33, 17, 38, 22, 32, 10, 35, 22, 28, 32],
       [35, 10, 32, 25, 23, 29, 22, 36, 38, 23],
       [15, 37, 30, 32, 24, 14, 10, 24, 25, 29]])
```

In [111…
```
np.random.randint(1,100,(12,12))
```

Out[111…
```
array([[86, 92, 22, 43, 94, 67, 73, 58,  4, 87, 10, 98],
       [53, 61,  2,  8, 70, 25,  1, 32, 93, 40, 21, 75],
       [62, 92, 27, 81,  3, 54, 82, 98, 34, 89, 85, 84],
       [48, 54, 21, 43, 35, 94, 53, 54, 50, 55, 49, 26],
       [54, 68, 42, 42, 32, 80,  3,  2, 85, 13, 51, 24],
       [72, 82, 86, 63, 58, 61, 93, 55, 99, 55,  8, 79],
       [73, 37, 56,  9, 67, 28, 25, 13, 51, 41, 79, 92],
       [34, 25, 79, 94, 72, 49, 38, 27, 22, 91,  9, 60],
       [85, 73, 13, 80, 55, 34, 57, 80, 77, 36, 92, 15],
       [59, 82,  6, 93, 91, 29, 12, 58, 88, 44, 85, 92],
       [38, 75, 17, 26, 14, 30, 55, 42, 91,  6, 50, 68],
       [58, 35, 21, 90, 79, 25, 31, 51, 36,  8, 41, 97]])
```

In [112…
```
np.arange(1,13).reshape(3,4)
```

Out[112…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [115…
```
np.arange(1,13).reshape(12,1)
```

Out[115…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [116…
```
np.arange(1,13)
```

Out[116…
```
array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

In [117…
```
np.arange(0,13)
```

Out[117…
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])
```

In [118…
```
list(range(0,13))
```

Out[118…
```
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]
```

In [119…
```
np.arange(1,13).reshape(12,1)
```

Out[119…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [120…
```
np.arange(1,13).reshape(3,4)
```

Out[120…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [121…
```
b=np.random.randint(10,20,(5,4))
b
```

Out[121…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [122…
```
np.random.randint(10,25)
```

Out[122…
```
23
```

In [123…
```
type(b)
```

Out[123…
```
numpy.ndarray
```

In [124…
```
b
```

Out[124…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [125…
```
b[:]
```

Out[125…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [126…
```
b[1:3]
```

Out[126…
```
array([[14, 10, 14, 12],
       [16, 16, 17, 10]])
```

In [127…
```
b
```

Out[127…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [128…
```
b(1,2)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[128], line 1
----> 1 b(1,2)

TypeError: 'numpy.ndarray' object is not callable
```

In [129…
```
b[1,2]
```

Out[129…
```
14
```

In [130…
```
b
```

Out[130…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [131…
```
b[1,3]
```

Out[131…
```
12
```

In [132…
```
b[1,-1]
```

Out[132…
```
12
```

In [133…
```
b
```

Out[133…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [134…
```
b[2:3]
```

Out[134…
```
array([[16, 16, 17, 10]])
```

In [135…
```
b
```

Out[135…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [136…
```
b[0:-2]
```

Out[136…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10]])
```

In [137…
```
b
```

Out[137…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [138…
```
b[0,2]
```

Out[138…
```
10
```

In [139…
```
b
```

Out[139…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [140…
```
b[-5,-3]
```

Out[140…
```
12
```

In [141…
```
b
```

Out[141…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [142…
```
b[-4,2]
```

Out[142…
```
14
```

In [143…
```
b
```

Out[143…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [144…
```
np.random.randint(10,20,(4,4))
```

Out[144…
```
array([[17, 13, 10, 11],
       [13, 16, 18, 10],
       [13, 14, 15, 17],
       [11, 14, 18, 12]])
```

In [145…
```
b
```

Out[145…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [146…
```
b[-4,-2]
```

Out[146…
```
14
```

In [147…
```
b
```

Out[147…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [148…
```
b[-4,2]
```

Out[148…
```
14
```

In [149…
```
a=np.random.randint(10,20,10)
a
```

Out[149…
```
array([14, 13, 16, 15, 14, 14, 17, 18, 18, 11])
```

In [150…
```
id(a)
```

Out[150…
```
2487289816400
```

In [152…
```
arr=np.arange(0,6)
```

In [153…
```
arr
```

Out[153…
```
array([0, 1, 2, 3, 4, 5])
```

In [155…
```
np.arange((0,6),dtype=int)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[155], line 1
----> 1 np.arange((0,6),dtype=int)

TypeError: arange: scalar arguments expected instead of a tuple.
```

In [156…
```
np.zeros((2,2))
```

Out[156…
```
array([[0., 0.],
       [0., 0.]])
```

In [166…
```
np.arange(1,13).reshape(12,1)
```

Out[166…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

Operations

In [167…
```
arr2=np.random.randint(0,100,(10,10))
```

In [168…
```
arr2
```

Out[168…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [169…
```
arr
```

Out[169…
```
array([0, 1, 2, 3, 4, 5])
```

In [170…
```
arr[:]
```

Out[170…
```
array([0, 1, 2, 3, 4, 5])
```

In [171…
```
arr
```

Out[171…
```
array([0, 1, 2, 3, 4, 5])
```

In [172…
```
arr[:4]
```

Out[172…
```
array([0, 1, 2, 3])
```

In [173…
```
arr2[:]
```

Out[173…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [174…
```
arr2[0:5]
```

Out[174…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50]])
```

In [175…
```
arr2
```

Out[175…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [176…
```
arr2[1,4]
```

Out[176…
```
64
```

In [177…
```
arr2
```

Out[177…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [178…
```
arr2[-5,5]
```

Out[178…
```
42
```

In [179…
```
arr2
```

Out[179…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [180…
```
arr2[-5,-5]
```

Out[180…
```
42
```

In [181…
```
arr2
```

Out[181…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [182…
```
arr2[-1,-2]
```

Out[182…
```
78
```

In [183…
```
arr2
```

Out[183…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [184…
```
arr2[::-1]
```

Out[184…
```
array([[44, 54, 74, 54, 79, 13, 95,  9, 78, 84],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74]])
```

In [185…
```
b[::-1]
```

Out[185…
```
array([[10, 19, 13, 17],
       [14, 10, 16, 17],
       [16, 16, 17, 10],
       [14, 10, 14, 12],
       [17, 12, 10, 12]])
```

In [186…
```
arr2
```

Out[186…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [187…
```
arr2[::-2]
```

Out[187…
```
array([[44, 54, 74, 54, 79, 13, 95,  9, 78, 84],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50]])
```

In [188…
```
b[::-2]
```

Out[188…
```
array([[10, 19, 13, 17],
       [16, 16, 17, 10],
       [17, 12, 10, 12]])
```

In [189…
```
b[:]
```

Out[189…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [190…
```
arr2
```

Out[190…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [191…
```
arr2[::-3]
```

Out[191…
```
array([[44, 54, 74, 54, 79, 13, 95,  9, 78, 84],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74]])
```

In [192…
```
arr2
```

Out[192…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28],
       [19, 16, 35, 20, 31, 87, 20, 67, 64, 16],
       [10, 86, 29, 39, 61, 60, 62,  6,  8, 71],
       [44, 54, 74, 54, 79, 13, 95,  9, 78, 84]])
```

In [193…
```
arr2[:-3]
```

Out[193…
```
array([[ 0, 63, 89, 91, 21, 71, 41,  1, 17, 74],
       [13, 10, 52, 44, 64, 83, 76, 82, 18, 50],
       [78, 86, 40, 57, 20, 92, 85, 49, 52, 13],
       [10, 76, 26, 39, 85, 61, 49, 95, 36, 43],
       [52, 88, 49, 12,  5, 18, 82, 27, 42, 50],
       [77,  9, 74, 82, 89, 42, 56, 65, 79, 32],
       [57, 24, 48, 47, 42, 89, 16, 92, 30, 28]])
```

In [194…
```
b[:-3]
```

Out[194…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12]])
```

In [195…
```
b
```

Out[195…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [196…
```
arr
```

Out[196…
```
array([0, 1, 2, 3, 4, 5])
```

In [197…
```
arr.max()
```

Out[197…
```
5
```

In [198…
```
arr.min()
```

Out[198…
```
0
```

In [199…
```
arr.mean()
```

Out[199…
```
2.5
```

In [200…
```
arr
```

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

In [201…
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[201], line 1
----> 1 arr.median()

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

In [202…
```
from numpy import *
a=array([1,2,3,4,9])
median(a)
```

Out[202…
```
3.0
```

In [203…
```
median(a)
```

Out[203…
```
3.0
```

In [204…
```
median(a,dtype=int)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[204], line 1
----> 1 median(a,dtype=int)

TypeError: median() got an unexpected keyword argument 'dtype'
```

In [205…
```
median(a)
```

Out[205…
```
3.0
```

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

In [206…
```
arr
```

Out[206…
```
array([0, 1, 2, 3, 4, 5])
```

In [207…
```
arr.reshape(3,2)
```

Out[207…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

In [208…
```
arr.reshape(6,1)
```

Out[208…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [209…
```
arr.reshape(1,6)
```

Out[209…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [210…
```
arr.reshape(2,3)
```

Out[210…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [211…
```
arr
```

Out[211…
```
array([0, 1, 2, 3, 4, 5])
```

In [212…
```
arr.reshape(2,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[212], line 1
----> 1 arr.reshape(2,4)

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

In [213…
```
arr.reshape(2,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[213], line 1
----> 1 arr.reshape(2,4)

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

In [214…
```
arr
```

Out[214…
```
array([0, 1, 2, 3, 4, 5])
```

In [215…
```
arr.reshape(2,3,order='C')
```

Out[215…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [216…
```
arr.reshape(2,3,order='F')
```

Out[216…
```
array([[0, 2, 4],
       [1, 3, 5]])
```

In [217…
```
arr.reshape(2,3,order='A')
```

Out[217…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [218…
```
b.reshape(4,5,order='A')
```

Out[218…
```
array([[17, 12, 10, 12, 14],
       [10, 14, 12, 16, 16],
       [17, 10, 14, 10, 16],
       [17, 10, 19, 13, 17]])
```

In [219…
```
b
```

Out[219…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [220…
```
b.reshape(5,4,order='A')
```

Out[220…
```
array([[17, 12, 10, 12],
       [14, 10, 14, 12],
       [16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [223…
```
bc=np.random.randint(10,20,(5,4))
bc
```

Out[223…
```
array([[12, 10, 18, 16],
       [15, 18, 19, 12],
       [19, 12, 17, 16],
       [11, 19, 19, 16],
       [18, 11, 11, 10]])
```

In [224…
```
bc.reshape(5,4,order='F')
```

Out[224…
```
array([[12, 10, 18, 16],
       [15, 18, 19, 12],
       [19, 12, 17, 16],
       [11, 19, 19, 16],
       [18, 11, 11, 10]])
```

In [225…
```
bc.reshape(5,4,order='A')
```

Out[225…
```
array([[12, 10, 18, 16],
       [15, 18, 19, 12],
       [19, 12, 17, 16],
       [11, 19, 19, 16],
       [18, 11, 11, 10]])
```

In [227…
```
bc=np.arange(10,20)
```

In [228…
```
bc
```

Out[228…
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [229…
```
bc.reshape(5,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[229], line 1
----> 1 bc.reshape(5,4)

ValueError: cannot reshape array of size 10 into shape (5,4)
```

In [230…
```
bc.reshape(4,5)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[230], line 1
----> 1 bc.reshape(4,5)

ValueError: cannot reshape array of size 10 into shape (4,5)
```

In [231…
```
bc.reshape(2,2)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[231], line 1
----> 1 bc.reshape(2,2)

ValueError: cannot reshape array of size 10 into shape (2,2)
```

In [232…
```
bc.reshape(12,1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[232], line 1
----> 1 bc.reshape(12,1)

ValueError: cannot reshape array of size 10 into shape (12,1)
```

In [233…
```
bc.reshape(2,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[233], line 1
----> 1 bc.reshape(2,3)

ValueError: cannot reshape array of size 10 into shape (2,3)
```

In [234…
```
arr
```

Out[234…
```
array([0, 1, 2, 3, 4, 5])
```

In [235…
```
arr.reshape(2,3)
```

Out[235…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [236…
```
arr.reshape(1,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[236], line 1
----> 1 arr.reshape(1,4)

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

In [237…
```
arr.reshape(1,6)
```

Out[237…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [238…
```
arr.reshape(6,1)
```

Out[238…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [239…
```
arr.reshape(2,6)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[239], line 1
----> 1 arr.reshape(2,6)

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

In [240…
```
arr.reshape(3,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[240], line 1
----> 1 arr.reshape(3,3)

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

In [241…
```
arr
```

Out[241…
```
array([0, 1, 2, 3, 4, 5])
```

In [242…
```
arr.reshape(3,2)
```

Out[242…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

indexing

In [243…
```
mat=np.arange(0,100).reshape(10,10)
mat
```

Out[243…
```
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 [244…
```
row=4
col=5
```

In [245…
```
col
```

Out[245…
```
5
```

In [246…
```
row
```

Out[246…
```
4
```

In [247…
```
mat
```

Out[247…
```
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 [248…
```
mat[row,col]
```

Out[248…
```
45
```

In [249…
```
mat[4,5]
```

Out[249…
```
45
```

In [250…
```
mat[:]
```

Out[250…
```
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 [251…
```
col=6
```

In [252…
```
mat
```

Out[252…
```
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 [253…
```
mat[6]
```

Out[253…
```
array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [254…
```
b[2]
```

Out[254… array([16, 16, 17, 10])

In [255…
```
mat
```

Out[255…
```
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 [256…
```
mat[:,col]
```

Out[256… array([6, 16, 26, 36, 46, 56, 66, 76, 86, 96])

In [257…
```
b[:,2]
```

Out[257… array([10, 14, 17, 16, 13])

In [258…
```
mat[row,:]
```

Out[258… array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])

In [259…
```
b[2,:]
```

Out[259… array([16, 16, 17, 10])

In [260…
```
mat
```

Out[260…
```
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 [261…
```
mat[:,8]
```

Out[261… array([8, 18, 28, 38, 48, 58, 68, 78, 88, 98])

In [262…
```
mat[8:,]
```

Out[262…
```
array([[80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
       [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])
```

In [263…
```
b[2:,]
```

Out[263…
```
array([[16, 16, 17, 10],
       [14, 10, 16, 17],
       [10, 19, 13, 17]])
```

In [264…
```
b[:,2]
```

Out[264…
```
array([10, 14, 17, 16, 13])
```

In [265…
```
mat[:col]
```

Out[265…
```
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 [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 [267…
```
mat[:6]
```

Out[267…
```
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 [268…
```
row
```

Out[268…
```
4
```

In [269…
```
mat[:row]
```

Out[269…
```
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 [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 [271…
```
mat[row:]
```

Out[271…
```
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 [272…
```
mat[:]
```

Out[272…
```
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 [273…
```
mat[:,8]
```

Out[273…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

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 [275…
```
mat[:,-1]
```

Out[275…
```
array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

In [276…
```
mat
```

Out[276…
```
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 [277…
```
row
```

Out[277… 4

In [278…
```
col
```

Out[278… 6

In [279…
```
mat[:,col]
```

Out[279… array([6, 16, 26, 36, 46, 56, 66, 76, 86, 96])

In [280…
```
mat[row,:]
```

Out[280… array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])

In [281…
```
mat
```

Out[281…
```
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 [282…
```
mat[1,4]
```

Out[282… 14

In [283…
```
b[1,4]
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
Cell In[283], line 1
----> 1 b[1,4]

IndexError: index 4 is out of bounds for axis 1 with size 4
```

In [284…
```
b[1,3]
```

Out[284… 12

In [285…
```
mat[1:4]
```

Out[285…
```
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 [286…
```
b[1:3]
```

Out[286…
```
array([[14, 10, 14, 12],
       [16, 16, 17, 10]])
```

In [287…
```
mat
```

Out[287…
```
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 [288…
```
mat[3:-3]
```

Out[288…
```
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 [289…
```
mat
```

Out[289…
```
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 [290…
```
mat[0]
```

Out[290…
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [291…
```
b[0]
```

Out[291…
```
array([17, 12, 10, 12])
```

In [292…
```
mat[6]
```

Out[292…
```
array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [293…
```
mat
```

Out[293…
```
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([[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 [295…
```
mat[:6]
```

Out[295…
```
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 [296…
```
mat
```

Out[296…
```
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 [297…
```
mat[5:7]
```

Out[297…
```
array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]])
```

In [298…
```
mat
```

Out[298…
```
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 [299…
```
mat[0:10]
```

Out[299…
```
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 [300…
```
mat[0:10:3]
```

Out[300…
```
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 [301…
```
mat
```

Out[301…
```
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 [302…
```
mat[4:]
```

Out[302…
```
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 [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 [304…
```
mat[:4]
```

Out[304…
```
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 [305…
```
mat
```

Out[305…
```
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 [306…
```
mat[::-3]
```

Out[306…
```
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 [307…
```
mat
```

Out[307…
```
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 [308…
```
mat[::-5]
```

Out[308…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

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 [310…
```
mat[2:6]
```

Out[310…
```
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 [311…
```
mat
```

Out[311…
```
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 [312…
```
mat[2:6,2:4]
```

Out[312…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [313…
```
mat[0,1]
```

Out[313…
```
1
```

In [314…
```
mat
```

Out[314…
```
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 [315…
```
mat[1:2,2:4]
```

Out[315…
```
array([[12, 13]])
```

In [316…
```
mat[2:3,2:3]
```

Out[316…
```
array([[22]])
```

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 [318…
```
mat[2:4,3:5]
```

Out[318…
```
array([[23, 24],
       [33, 34]])
```

In [319…
```
mat[3:5,2:4]
```

Out[319…
```
array([[32, 33],
       [42, 43]])
```

Masking

In [320…
```
mat
```

Out[320…
```
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 [321…
```
id(mat)
```

Out[321…
```
2487291667504
```

In [322…
```
mat
```

Out[322…
```
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 [323…
```
mat[mat<=50]
```

Out[323…
```
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 [324…
```
mat<=50
```

Out[324…
```
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],
       [ 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>50
```

Out[325…
```
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 [326…
```
mat[mat<=50]
```

Out[326…
```
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 [327…
```
mat[mat==50]
```

Out[327…
```
array([50])
```

In [328…
```
mat
```

Out[328…
```
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 [329…
```
mat==50
```

Out[329…
```
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 [330…
```
a1=mat[mat<50]
a1
```

Out[330…
```
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 [331…
```
mat
```

Out[331…
```
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 [332…
```
a2=mat[mat>50]
a2
```

Out[332…
```
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 [333…
```
a3=mat[mat<=50]
a3
```

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, 50])
```

In [334…
```
a4=mat[mat==50]
a4
```

Out[334…
```
array([50])
```

python program to generate otp

In [340…
```
import random
def generate_otp(length=4):
    """Generate a numeric OTP of a specified length."""
    digits='0123456789'
    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: 6404
```

In [341…
```
def wish():
    print('good even')
wish()

def wish():
    print('good even')

wish()

def wish():
    print('good even')

wish()
```

```
good even
good even
good even
```

In [342…
```
def wish():
    print('good even')

wish()
wish()
wish()
```

```
good even
good even
good even
```

In [343…
```
list1=['a','b','g',1,5]
print(list1.pop)
```

```
<built-in method pop of list object at 0x000002431E066480>
```

In [344…
```
x=[1,2,3]
y=x.copy()
x.append(4)
print(x)
```

```
[1, 2, 3, 4]
```

In [345…
```
y
```

Out[345… [1, 2, 3]

In [ ]: