```python
In [5]:  import numpy as np
```

```python
In [9]:  import sys
         sys.version
```

```
Out[9]:  '3.12.7 | packaged by Anaconda, Inc. | (main, Oct  4 2024, 13:17:27) [MSC v.192
         9 64 bit (AMD64)]'
```

```python
In [13]: my_list=[0,1,2,3,4,5]
         my_list
```

```
Out[13]: [0, 1, 2, 3, 4, 5]
```

```python
In [15]: type(my_list)
```

```
Out[15]: list
```

```python
In [45]: arr=np.array(my_list)
```

```python
In [47]: arr
```

```
Out[47]: array([0, 1, 2, 3, 4, 5])
```

```python
In [49]: type(arr)
```

```
Out[49]: numpy.ndarray
```

```python
In [51]: type(my_list)
```

```
Out[51]: list
```

```python
In [55]: np.
```

```
  Cell In[55], line 1
    np.
       ^
SyntaxError: invalid syntax
```

```python
In [63]: np.arange(15)
```

```
Out[63]: array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14])
```

```python
In [65]: np.arange(3.0)
```

```
Out[65]: array([0., 1., 2.])
```

```python
In [67]: np.arange(10)
```

```
Out[67]: array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```python
In [69]: np.arange(0,5)
```

```
Out[69]: array([0, 1, 2, 3, 4])
```

```python
In [71]: np.arange(20,10)
```

```
Out[71]:  array([], dtype=int32)

In [73]:  np.arange(-20,10)

Out[73]:  array([-20, -19, -18, -17, -16, -15, -14, -13, -12, -11, -10,  -9,  -8,
                  -7,  -6,  -5,  -4,  -3,  -2,  -1,   0,   1,   2,   3,   4,   5,
                   6,   7,   8,   9])

In [75]:  np.arange(-16,10)

Out[75]:  array([-16, -15, -14, -13, -12, -11, -10,  -9,  -8,  -7,  -6,  -5,  -4,
                  -3,  -2,  -1,   0,   1,   2,   3,   4,   5,   6,   7,   8,   9])

In [77]:  np.arange(-20,-10)

Out[77]:  array([-20, -19, -18, -17, -16, -15, -14, -13, -12, -11])

In [79]:  np.arange(30,20)

Out[79]:  array([], dtype=int32)

In [83]:  ar=np.arange(-30,20)
          ar

Out[83]:  array([-30, -29, -28, -27, -26, -25, -24, -23, -22, -21, -20, -19, -18,
                 -17, -16, -15, -14, -13, -12, -11, -10,  -9,  -8,  -7,  -6,  -5,
                  -4,  -3,  -2,  -1,   0,   1,   2,   3,   4,   5,   6,   7,   8,
                   9,  10,  11,  12,  13,  14,  15,  16,  17,  18,  19])

In [85]:  np.arange(10,10)

Out[85]:  array([], dtype=int32)

In [87]:  np.arange()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[87], line 1
----> 1 np.arange()

TypeError: arange() requires stop to be specified.
```

```
In [89]:  np.arange(10,30,5)

Out[89]:  array([10, 15, 20, 25])

In [91]:  np.arange(0,10,3)

Out[91]:  array([0, 3, 6, 9])

In [93]:  np.arange(10,30,5,8)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[93], line 1
----> 1 np.arange(10,30,5,8)

TypeError: Cannot interpret '8' as a data type
```

```python
In [95]: np.zeros(3)
```

```
Out[95]: array([0., 0., 0.])
```

```python
In [97]: np.zeros(5,dtype=int)
```

```
Out[97]: array([0, 0, 0, 0, 0])
```

```python
In [99]: np.zeros((2,2),dtype=int)
```

```
Out[99]: array([[0, 0],
                [0, 0]])
```

```python
In [101… zero=np.zeros([2,2])
         print(zero)
         print(type(zero))
```

```
[[0. 0.]
 [0. 0.]]
<class 'numpy.ndarray'>
```

```python
In [103… zero=np.zeros([2,2])
         print(zero)
         print('####')
         print(type(zero))
```

```
[[0. 0.]
 [0. 0.]]
####
<class 'numpy.ndarray'>
```

```python
In [105… np.zeros((2,10))
```

```
Out[105… array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

```python
In [107… np.zeros((2,2))
```

```
Out[107… array([[0., 0.],
                [0., 0.]])
```

```python
In [109… np.zeros((3,3))
```

```
Out[109… array([[0., 0., 0.],
                [0., 0., 0.],
                [0., 0., 0.]])
```

```python
In [111… np.zeros((10,30))
```

```
Out[111...   array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
                    0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                   [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., 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., 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., 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., 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.],
                   [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.]])
```

```python
In [113...   np.zeros((5,10))
```

```
Out[113...   array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                   [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                   [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                   [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
                   [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

```python
In [115...   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.]]
```

```python
In [117...   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]]
```

```python
In [119...   n
```

```
Out[119...   (6, 7)
```

```python
In [121...   n1
```

```
Out[121...   (6, 8)
```

```python
In [123...   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 [125...   `np.ones(3)`

Out[125...   `array([1., 1., 1.])`

In [127...   `np.ones(4,dtype=int)`

Out[127...   `array([1, 1, 1, 1])`

In [131...   `np.ones(4)`

Out[131...   `array([1., 1., 1., 1.])`

In [133...   `n`

Out[133...   `(6, 7)`

In [135...   `np.ones(n)`

Out[135...
```
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 [137...   `np.ones((5,4),dtype=int)`

Out[137...
```
array([[1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1],
       [1, 1, 1, 1]])
```

In [139...   `np.`

```
  Cell In[139], line 1
    np.
       ^
SyntaxError: invalid syntax
```

In [141...   `np.twos((2,3))`

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[141], 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 [143... `np.three(2,3)`

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[143], line 1
----> 1 np.three(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 'three'
```

In [145... `np.ones(2)`

Out[145... `array([1., 1.])`

In [147... `np.ones((2,4))`

Out[147... `array([[1., 1., 1., 1.],
       [1., 1., 1., 1.]])`

In [149... `np.ones((6,10),dtype=int)`

Out[149... `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, 1, 1, 1, 1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]])`

In [151... `np.twos((2,4))`
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[151], line 1
----> 1 np.twos((2,4))

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 'twos'
```

In [153... `np.`

```
  Cell In[153], line 1
    np.
       ^
SyntaxError: invalid syntax
```

In [155... `np.three((2,4))`

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[155], line 1
----> 1 np.three((2,4))

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 'three'
```

In [157... `range(5)`

Out[157... `range(0, 5)`

In [159...
```
r=range(5)
r
```

Out[159... `range(0, 5)`

In [161...
```
for i in r:
    print(i)
```

```
0
1
2
3
4
```

In [163... `list(range(5))`

Out[163... `[0, 1, 2, 3, 4]`

In [165... `range(1,10)`

```
Out[165...   range(1, 10)

In [169...   list(range(1,10,3))

Out[169...   [1, 4, 7]

In [171...   y=list(range(12))
             y

Out[171...   [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]

In [173...   rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[173], line 1
----> 1 rand(3,2)

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

```
In [175...   rand(3,2)
             random.rand(3,2)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
Cell In[175], line 1
----> 1 rand(3,2)
      2 random.rand(3,2)

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

```
In [215...   np.random.rand(5)

Out[215...   array([0.54452658, 0.33996169, 0.15257854, 0.52507332, 0.44827006])

In [217...   np.rand(4)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[217], 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 [219...   np.random.rand(2,4)

Out[219...   array([[0.89400835, 0.73323566, 0.37072323, 0.42598688],
                    [0.03010568, 0.63315608, 0.64460374, 0.92911187]])

In [221...   np.random.randint(2,4)

Out[221...   3
```

```
In [231... np.random.randint(2,20)
```

```
Out[231... 14
```

```
In [233... np.random.randint(0,1)
```

```
Out[233... 0
```

np.random.randint(10,20,5)

```
In [235... np.random.randint(1,6,4)
```

```
Out[235... array([2, 1, 1, 1])
```

```
In [237... np.random.rand(3)
```

```
Out[237... array([0.5576677 , 0.25139596, 0.03180715])
```

```
In [239... np.random.randint(1)
```

```
Out[239... 0
```

```
In [241... np.random.randint(30,20,10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[241], 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 [243... np.random.randint(-30,20,10)
```

```
Out[243... array([ 13, -14, -18, -24,  -6,   7, -29,  16,  18, -23])
```

```
In [245... np.random.randint(20,30,10)
```

```
Out[245... array([25, 23, 27, 20, 23, 20, 24, 25, 20, 22])
```

```
In [247... np.random.randint(5,9)
```

```
Out[247... 5
```

```
In [249... np.random.randint(10,21,3)
```

```
Out[249... array([12, 12, 10])
```

```
In [251... np.random.randint(1,12,10)
```

```
Out[251... array([10,  6,  6,  5,  7,  6,  6,  1,  6,  8])
```

```
In [253... np.random.randint(10,40,(10,10))
```

```
Out[253…    array([[12, 16, 15, 33, 12, 14, 33, 27, 25, 32],
                   [27, 38, 38, 24, 32, 30, 18, 22, 26, 38],
                   [17, 34, 10, 28, 18, 35, 21, 20, 24, 17],
                   [38, 36, 38, 25, 17, 29, 20, 20, 12, 12],
                   [11, 30, 33, 32, 18, 32, 15, 18, 21, 22],
                   [30, 27, 29, 34, 29, 20, 12, 25, 28, 38],
                   [11, 26, 25, 33, 37, 30, 37, 16, 32, 33],
                   [28, 21, 38, 22, 13, 39, 21, 23, 22, 17],
                   [18, 12, 34, 14, 21, 16, 36, 38, 30, 26],
                   [26, 28, 25, 20, 17, 19, 20, 35, 27, 19]])
```

In [255…
```
np.random.randint(1,100,(12,12))
```

Out[255…
```
array([[67, 74, 46, 92, 35, 55, 68, 50, 72, 11, 88, 79],
       [25, 54, 96, 20, 29, 98, 56, 29, 36, 87, 19, 91],
       [ 6, 50, 10, 59, 76, 31, 48, 76, 83, 20,  6, 11],
       [57, 10, 68, 75, 49, 56, 90, 37, 33, 76, 83,  6],
       [79, 26, 46, 45, 23, 19,  7, 28, 67, 80, 81, 34],
       [22, 20,  9,  7, 52, 25, 45, 70, 57, 11, 93,  8],
       [44, 47, 16, 63,  4, 74,  9,  4,  3, 16, 29, 12],
       [35, 24, 27, 64, 19, 30, 96, 97, 13,  1, 77, 42],
       [82, 89,  3, 55, 65, 55, 26, 53, 57, 30, 81, 73],
       [23, 93, 19, 96, 38, 77, 54, 11,  8,  9, 96,  4],
       [93, 50, 28, 46, 85, 62, 81, 20,  2, 52, 95, 39],
       [57, 74, 52, 96, 12,  3, 28, 93, 29, 56, 51, 46]])
```

In [257…
```
np.arange(1,13).reshape(3,4)
```

Out[257…
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [259…
```
np.arange(1,13).reshape(12,1)
```

Out[259…
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [265…
```
b=np.random.randint(10,20,(5,4))
b
```

Out[265…
```
array([[15, 16, 12, 18],
       [10, 18, 14, 13],
       [18, 15, 18, 15],
       [13, 16, 16, 17],
       [12, 15, 11, 10]])
```

In [267…
```
type(b)
```

Out[267…
```
numpy.ndarray
```

```
In [269...  b
```

```
Out[269...  array([[15, 16, 12, 18],
                   [10, 18, 14, 13],
                   [18, 15, 18, 15],
                   [13, 16, 16, 17],
                   [12, 15, 11, 10]])
```

```
In [271...  b[:]
```

```
Out[271...  array([[15, 16, 12, 18],
                   [10, 18, 14, 13],
                   [18, 15, 18, 15],
                   [13, 16, 16, 17],
                   [12, 15, 11, 10]])
```

```
In [273...  b[1:3]
```

```
Out[273...  array([[10, 18, 14, 13],
                   [18, 15, 18, 15]])
```

```
In [275...  b
```

```
Out[275...  array([[15, 16, 12, 18],
                   [10, 18, 14, 13],
                   [18, 15, 18, 15],
                   [13, 16, 16, 17],
                   [12, 15, 11, 10]])
```

```
In [279...  b[1,3]
```

```
Out[279...  13
```

```
In [281...  b[1,-1]
```

```
Out[281...  13
```

```
In [283...  b
```

```
Out[283...  array([[15, 16, 12, 18],
                   [10, 18, 14, 13],
                   [18, 15, 18, 15],
                   [13, 16, 16, 17],
                   [12, 15, 11, 10]])
```

```
In [285...  b[2:3]
```

```
Out[285...  array([[18, 15, 18, 15]])
```

```
In [287...  b
```

```
Out[287...  array([[15, 16, 12, 18],
                   [10, 18, 14, 13],
                   [18, 15, 18, 15],
                   [13, 16, 16, 17],
                   [12, 15, 11, 10]])
```

```
In [289...  b[0:-2]
```

```
Out[289…   array([[15, 16, 12, 18],
                  [10, 18, 14, 13],
                  [18, 15, 18, 15]])

In [291…   b

Out[291…   array([[15, 16, 12, 18],
                  [10, 18, 14, 13],
                  [18, 15, 18, 15],
                  [13, 16, 16, 17],
                  [12, 15, 11, 10]])

In [293…   b[0,2]

Out[293…   12

In [295…   b

Out[295…   array([[15, 16, 12, 18],
                  [10, 18, 14, 13],
                  [18, 15, 18, 15],
                  [13, 16, 16, 17],
                  [12, 15, 11, 10]])

In [297…   b[-5,-3]

Out[297…   16

In [299…   b

Out[299…   array([[15, 16, 12, 18],
                  [10, 18, 14, 13],
                  [18, 15, 18, 15],
                  [13, 16, 16, 17],
                  [12, 15, 11, 10]])

In [301…   b[-4,2]

Out[301…   14

In [303…   np.random.randint(10,20,(4,4))

Out[303…   array([[16, 16, 10, 12],
                  [17, 16, 16, 19],
                  [10, 19, 18, 15],
                  [10, 14, 17, 11]])

In [305…   b

Out[305…   array([[15, 16, 12, 18],
                  [10, 18, 14, 13],
                  [18, 15, 18, 15],
                  [13, 16, 16, 17],
                  [12, 15, 11, 10]])

In [307…   b[-4,-2]

Out[307…   14
```

```
In [309... b
```

```
Out[309... array([[15, 16, 12, 18],
                [10, 18, 14, 13],
                [18, 15, 18, 15],
                [13, 16, 16, 17],
                [12, 15, 11, 10]])
```

```
In [311... b[-4:2]
```

```
Out[311... array([[10, 18, 14, 13]])
```

```
In [313... b[:]
```

```
Out[313... array([[15, 16, 12, 18],
                [10, 18, 14, 13],
                [18, 15, 18, 15],
                [13, 16, 16, 17],
                [12, 15, 11, 10]])
```

```
In [315... a=np.random.randint(10,20,10)
         a
```

```
Out[315... array([11, 11, 10, 11, 13, 14, 10, 14, 12, 14])
```

```
In [317... id(a)
```

```
Out[317... 2073778616624
```

```
In [319... arr
```

```
Out[319... array([0, 1, 2, 3, 4, 5])
```

```
In [323... arr2=np.random.randint(0,100,(10,10))
```

```
In [325... arr2
```

```
Out[325... array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

```
In [327... arr
```

```
Out[327... array([0, 1, 2, 3, 4, 5])
```

```
In [329... arr[:]
```

```
Out[329... array([0, 1, 2, 3, 4, 5])
```

```
In [331... arr
```

```
Out[331…   array([0, 1, 2, 3, 4, 5])

In [333…    arr[:4]

Out[333…   array([0, 1, 2, 3])

In [335…    arr2[:]

Out[335…   array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                  [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                  [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                  [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                  [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                  [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                  [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                  [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                  [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                  [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])

In [337…    arr2[0:5]

Out[337…   array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                  [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                  [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                  [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                  [55,  2, 59, 70,  4, 48, 50, 76, 94, 81]])

In [339…    arr2

Out[339…   array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                  [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                  [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                  [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                  [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                  [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                  [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                  [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                  [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                  [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])

In [341…    arr2[1,4]

Out[341…   2

In [343…    arr2

Out[343…   array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                  [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                  [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                  [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                  [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                  [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                  [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                  [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                  [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                  [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])

In [345…    arr2[-5,5]
```

```
Out[345…    52
```

```
In [347…    arr2[-5,-5]
```

```
Out[347…    52
```

```
In [349…    arr2
```

```
Out[349…    array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                   [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                   [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                   [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                   [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                   [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                   [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                   [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                   [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                   [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

```
In [351…    arr2[-1,-2]
```

```
Out[351…    68
```

```
In [355…    arr2
```

```
Out[355…    array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                   [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                   [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                   [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                   [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                   [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                   [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                   [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                   [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                   [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

```
In [359…    arr2[::-1]
```

```
Out[359…    array([[60, 61, 97, 32, 59, 14, 11, 91, 68, 73],
                   [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
                   [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
                   [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
                   [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                   [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                   [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                   [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                   [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                   [23, 55,  8, 56, 70, 97, 15, 83, 65, 52]])
```

```
In [361…    arr2
```

```
Out[361...  array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
               [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
               [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
               [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
               [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
               [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
               [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
               [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
               [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
               [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

In [363...   `arr2[::-2]`

```
Out[363...  array([[60, 61, 97, 32, 59, 14, 11, 91, 68, 73],
               [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
               [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
               [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
               [73, 50, 64, 63,  2, 98, 31, 29, 49, 25]])
```

In [365...   `arr2`

```
Out[365...  array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
               [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
               [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
               [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
               [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
               [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
               [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
               [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
               [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
               [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

In [367...   `arr2[::-3]`

```
Out[367...  array([[60, 61, 97, 32, 59, 14, 11, 91, 68, 73],
               [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
               [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
               [23, 55,  8, 56, 70, 97, 15, 83, 65, 52]])
```

In [369...   `arr2`

```
Out[369...  array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
               [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
               [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
               [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
               [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
               [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
               [88, 72, 10, 39, 85, 69,  3, 34, 73, 33],
               [51, 30, 53, 64, 95, 13, 88,  3, 78, 17],
               [ 8, 94, 10, 67, 63, 84, 75, 12,  4, 55],
               [60, 61, 97, 32, 59, 14, 11, 91, 68, 73]])
```

In [371...   `arr2[:-3]`

```
Out[371...  array([[23, 55,  8, 56, 70, 97, 15, 83, 65, 52],
                   [73, 50, 64, 63,  2, 98, 31, 29, 49, 25],
                   [40, 69, 32,  6, 71, 57, 81, 17, 46, 24],
                   [88, 99, 59,  4, 93, 34, 30, 23, 20, 77],
                   [55,  2, 59, 70,  4, 48, 50, 76, 94, 81],
                   [ 0, 22, 61, 70, 16, 52, 85, 80, 98, 76],
                   [88, 72, 10, 39, 85, 69,  3, 34, 73, 33]])
```

In [373...
```
arr
```

Out[373...
```
array([0, 1, 2, 3, 4, 5])
```

In [375...
```
arr.max()
```

Out[375...
```
5
```

In [377...
```
arr.min()
```

Out[377...
```
0
```

In [379...
```
arr
```

Out[379...
```
array([0, 1, 2, 3, 4, 5])
```

In [381...
```
arr.mean()
```

Out[381...
```
2.5
```

In [383...
```
arr
```

Out[383...
```
array([0, 1, 2, 3, 4, 5])
```

In [385...
```
arr.median()
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[385], line 1
----> 1 arr.median()

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

In [387...
```
from numpy import*
a=array([1,2,3,4,9])
median(a)
```

Out[387...
```
3.0
```

In [389...
```
arr
```

Out[389...
```
array([0, 1, 2, 3, 4, 5])
```

In [391...
```
arr.reshape(3,2)
```

Out[391...
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

```
In [393...   arr.reshape(3,2)
```

```
Out[393...   array([[0, 1],
                    [2, 3],
                    [4, 5]])
```

```
In [395...   arr.reshape(6,1)
```

```
Out[395...   array([[0],
                    [1],
                    [2],
                    [3],
                    [4],
                    [5]])
```

```
In [397...   arr.reshape(1,6)
```

```
Out[397...   array([[0, 1, 2, 3, 4, 5]])
```

```
In [399...   arr
```

```
Out[399...   array([0, 1, 2, 3, 4, 5])
```

```
In [401...   arr.reshape(2,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[401], line 1
----> 1 arr.reshape(2,4)

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

```
In [403...   arr
```

```
Out[403...   array([0, 1, 2, 3, 4, 5])
```

```
In [407...   arr.reshape(2,3,order='c')
```

```
Out[407...   array([[0, 1, 2],
                    [3, 4, 5]])
```

```
In [409...   arr.reshape(2,3,order='f')
```

```
Out[409...   array([[0, 2, 4],
                    [1, 3, 5]])
```

```
In [411...   arr.reshape(2,3,order='a')
```

```
Out[411...   array([[0, 1, 2],
                    [3, 4, 5]])
```

```
In [413...   arr
```

```
Out[413...   array([0, 1, 2, 3, 4, 5])
```

```
In [415...   arr.reshape(2,3)
```

```
Out[415…   array([[0, 1, 2],
                  [3, 4, 5]])
```

```
In [417…   arr.reshape(1,4)
```

```
---------------------------------------------------------------------
ValueError                              Traceback (most recent call last)
Cell In[417], line 1
----> 1 arr.reshape(1,4)

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

```
In [419…   arr.reshape(1,6)
```

```
Out[419…   array([[0, 1, 2, 3, 4, 5]])
```

```
In [421…   arr.reshape(6,1)
```

```
Out[421…   array([[0],
                  [1],
                  [2],
                  [3],
                  [4],
                  [5]])
```

```
In [423…   arr.reshape(2,6)
```

```
---------------------------------------------------------------------
ValueError                              Traceback (most recent call last)
Cell In[423], line 1
----> 1 arr.reshape(2,6)

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

```
In [425…   arr.reshape(3,3)
```

```
---------------------------------------------------------------------
ValueError                              Traceback (most recent call last)
Cell In[425], line 1
----> 1 arr.reshape(3,3)

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

```
In [427…   arr
```

```
Out[427…   array([0, 1, 2, 3, 4, 5])
```

```
In [429…   arr.reshape(3,2)
```

```
Out[429…   array([[0, 1],
                  [2, 3],
                  [4, 5]])
```

```
In [431…   mat=np.arange(0,100).reshape(10,10)
```

```
In [433…   mat
```

```
Out[433... 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 [435... row=4
         col=5
```

```
In [439... row
```

```
Out[439... 4
```

```
In [442... col
```

```
Out[442... 5
```

```
In [444... mat
```

```
Out[444... 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 [446... mat[row,col]
```

```
Out[446... 45
```

```
In [448... mat[4,5]
```

```
Out[448... 45
```

```
In [450... mat
```

```
Out[450... 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 [452... mat[:]
```

```
Out[452...   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 [454...
```
col=6
```

In [456...
```
mat
```

```
Out[456...   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 [458...
```
mat[6]
```

```
Out[458...   array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [460...
```
mat
```

```
Out[460...   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 [462...
```
#with slices
mat[:,col]
```

```
Out[462...   array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [464...
```
mat
```

```
Out[464...   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 [466... `mat[row,:]`

```
Out[466...   array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [468... `mat`

```
Out[468...   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 [470... `mat[:,8]`

```
Out[470...   array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [472... `mat`

```
Out[472...   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 [474... `mat[:col]`

```
Out[474...   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 [476... `mat`
```

```
Out[476…   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 [478…
```
mat[:6]
```

```
Out[478…   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 [480…
```
row
```

```
Out[480…   4
```

In [482…
```
mat
```

```
Out[482…   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 [486…
```
mat[:row]
```

```
Out[486…   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 [488…
```
mat
```

```
Out[488…   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 [490…
```
mat[row:]
```

```
Out[490…   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 [492…
```
mat[:]
```

```
Out[492…   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 [494…
```
mat[:,8]
```

```
Out[494…   array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [496…
```
mat
```

```
Out[496…   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 [498…
```
mat[:,-1]
```

```
Out[498…   array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

In [500…
```
mat
```

```
Out[500…   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 [502…
```
row
```

```
Out[502…   4
```

In [504…
```
col
```

```
Out[504…    6

In [506…    mat[:,col]

Out[506…    array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])

In [508…    mat

Out[508…    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 [510…    mat[1,4]

Out[510…    14

In [512…    mat

Out[512…    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 [514…    mat[1:4]

Out[514…    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 [516…    mat

Out[516…    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 [518…    mat[3:3]

Out[518…    array([], shape=(0, 10), dtype=int32)
```

```
In [520...  mat
```

```
Out[520...  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 [522...  mat[0]
```

```
Out[522...  array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

```
In [524...  mat
```

```
Out[524...  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 [526...  mat[6]
```

```
Out[526...  array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

```
In [528...  mat
```

```
Out[528...  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 [530...  mat[6:]
```

```
Out[530...  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 [532...  mat[:6]
```

```
Out[532...   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 [534...   `mat`

```
Out[534...   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 [536...   `mat[5:7]`

```
Out[536...   array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
                    [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]])
```

In [538...   `mat`

```
Out[538...   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 [540...   `mat[0:10]`

```
Out[540...   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 [542...   `mat`

```
Out[542...  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 [544... `mat[0:10:3]`

```
Out[544...  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 [546... `mat`

```
Out[546...  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 [548... `mat[4:]`

```
Out[548...  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 [550... `mat`

```
Out[550...  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 [552... `mat[:4]`

```
Out[552...  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 [554…    mat
```

```
Out[554…   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 [556…    mat[::-1]
```

```
Out[556…   array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
                  [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
                  [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
                  [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
                  [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
                  [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
                  [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
                  [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
                  [10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
                  [ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9]])
```

```
In [558…    mat
```

```
Out[558…   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 [560…    mat[::-3]
```

```
Out[560…   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 [562…    mat
```

```
Out[562…   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 [564...  mat[::-5]

Out[564...  array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
                   [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])

In [566...  mat

Out[566...  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 [568...  mat[2:6]

Out[568...  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 [570...  mat

Out[570...  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 [572...  mat[2:6,2:4]

Out[572...  array([[22, 23],
                   [32, 33],
                   [42, 43],
                   [52, 53]])

In [574...  mat

Out[574...  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 [576...  mat[0,1]
```

```
Out[576... 1

In [578... mat

Out[578... 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 [580... mat[1,6]

Out[580... 16

In [582... mat

Out[582... 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 [584... mat[1:6]

Out[584... array([[10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
              [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
              [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
              [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
              [50, 51, 52, 53, 54, 55, 56, 57, 58, 59]])

In [586... mat[1:]

Out[586... array([[10, 11, 12, 13, 14, 15, 16, 17, 18, 19],
              [20, 21, 22, 23, 24, 25, 26, 27, 28, 29],
              [30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
              [40, 41, 42, 43, 44, 45, 46, 47, 48, 49],
              [50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
              [60, 61, 62, 63, 64, 65, 66, 67, 68, 69],
              [70, 71, 72, 73, 74, 75, 76, 77, 78, 79],
              [80, 81, 82, 83, 84, 85, 86, 87, 88, 89],
              [90, 91, 92, 93, 94, 95, 96, 97, 98, 99]])

In [588... mat
```

```
Out[588…    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 [592…   `mat[:6]`

```
Out[592…    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 [594…   `mat`

```
Out[594…    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 [596…   `mat[0:1]`

```
Out[596…    array([[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]])
```

In [598…   `mat`

```
Out[598…    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 [600…   `mat[3,5]`

Out[600…   35

In [602…   `mat[3:5]`

```
Out[602…    array([[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
                   [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

```
In [604...    mat
```

```
Out[604...   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 [606...    mat[1:2,2:4]
```

```
Out[606...   array([[12, 13]])
```

```
In [608...    mat
```

```
Out[608...   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 [610...    mat[2:3,2:3]
```

```
Out[610...   array([[22]])
```

```
In [612...    mat
```

```
Out[612...   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 [614...    mat[2:4,3:5]
```

```
Out[614...   array([[23, 24],
                    [33, 34]])
```

```
In [616...    mat[3:5,2:4]
```

```
Out[616...   array([[32, 33],
                    [42, 43]])
```

```
In [618...    mat
```

```
Out[618...   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 [620...   mat[2:3,4:5]
```

```
Out[620...   array([[24]])
```

```
In [622...   mat
```

```
Out[622...   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 [624...   id(mat)
```

```
Out[624...   2073778735024
```

```
In [626...   mat
```

```
Out[626...   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 [628...   mat[mat<50]
```

```
Out[628...   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 [630...   mat[mat<=50]
```

```
Out[630...   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 [632...   mat>50
```

```
Out[632...  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 [634... `mat[mat==50]`

Out[634... `array([50])`

In [636... `mat`

```
Out[636...  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 [638... `mat==50`
```

```
Out[638...   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 [644...   `mat`

```
Out[644...   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 [646...
```
a1=mat[mat<50]
a1
```

```
Out[646...   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 [648...   `mat`

```
Out[648...   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 [650...
```
a2=mat[mat<50]
a2
```

```
Out[650...   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 [652... a3=mat[mat<=50]
          a3

Out[652... 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 [654... a4=mat[mat==50]
          a4

Out[654... array([50])

In [682... import random
          def generate_otp(length=4):
              """generate a numeric otp of a specified length."""
              digits='012345'
              otp =''.join(random.choice(digits)for_in range(length))
              return otp
               otp_length=4
              otp=generate_otp(otp_length)
              print(f"your otp is:{otp}")
```

```
  Cell In[682], line 5
    otp =''.join(random.choice(digits)for_in range(length))
                    ^
SyntaxError: invalid syntax. Perhaps you forgot a comma?
```

```
In [666... def wish():
              print('good even')
              wish()

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

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

```
In [668... def wish():
              print('good even')
          wish()

          wish()

          wish()
```

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

```
In [672... list1=['a','b','g',1,5]
          print(list1.pop)
```

```
<built-in method pop of list object at 0x000001E2D6D9F540>
```

```
In [674... x=[1,2,3]
          y=x.copy()
```

```
x.append(4)
print(x)
```

[1, 2, 3, 4]

In [ ]: