Numpy Crash Course

In [280…
```
import numpy as np
```

In [281…
```
np.__version__
```

Out[281…
```
'2.1.3'
```

In [282…
```
import sys
sys.version
```

Out[282…
```
'3.13.5 | packaged by Anaconda, Inc. | (main, Jun 12 2025, 16:37:03) [MSC v.1929 6
4 bit (AMD64)]'
```

Creating Arrays

In [283…
```
my_list = [0,1,2,3,4,5]
my_list
```

Out[283…
```
[0, 1, 2, 3, 4, 5]
```

In [284…
```
type(my_list)
```

Out[284…
```
list
```

In [285…
```
arr = np.array(my_list)
```

In [286…
```
arr
```

Out[286…
```
array([0, 1, 2, 3, 4, 5])
```

In [287…
```
type(arr)
```

Out[287…
```
numpy.ndarray
```

In [288…
```
type(my_list)
```

Out[288…
```
list
```

In [289…
```
np. # we learn important function
```

```
  Cell In[289], line 1
    np. # we learn important function
        ^
SyntaxError: invalid syntax
```

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

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

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

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

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

In [ ]:
```
np.arange(20,10) # 1st arg < 2nd arg
```

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

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

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

In [ ]:
```
print (np.arange(30,20))  # 1st arg always be < then 2nd arg
```

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

In [ ]:
```
print (np.arange(10,10))
```

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

In [ ]:
```
np.arange(10,30,5)  # 10- starting from 30- end point 5 - step count
```

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

In [ ]:
```
np.arange(10,30,5,8) #fourth element (8) is not allowed
```

In [ ]:
```
np.zeros(3) # parameter  tunning
```

In [ ]:
```
np.zeros(5, dtype=int) # hyperparameter tunning
```

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

In [ ]:
```
zero = np.zeros([2,2])
print(zero)
print(type(zero))
```

In [ ]:
```
zero = np.zeros([2,2])
print(zero)

print('####')

print(type(zero))
```

In [ ]:
```
np.zeros((2,10))
```

In [ ]:
```
np.zeros((2,2))
```

In [ ]:
```
np.zeros((3,3))
```

In [ ]:
```
np.zeros((10,30))
```

In [ ]:
```
np.zeros((5,10)) # by defaul 1arge -- will give row & 2nd arg - columns
```

In [ ]:
```
n = (6,7)
n1 = (6,8)
print(np.zeros(n1)) # parameter tunnin g
```

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

In [ ]:
```
n
```

In [ ]:
```
n1
```

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

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

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

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

In [ ]:
```
n
```

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

In [ ]:
```
np.ones((5,4),dtype=int) # by default 5- rows & 4 - columns
```

In [ ]:
```
np.
```

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

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

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

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

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

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

NumPy doesn't have a built-in np.twos() like np.zeros() or np.ones(), but you can easily get the same effect with np.full().

In [ ]:
```
np.full((3, 4), 2)
```

In [ ]:
```
np.full((3, 4), 3)
```

In [ ]:
```
np.full((3, 4), 5)
```

In [ ]:
```
np.
```

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

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

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

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

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

In [ ]:
```
range(1,10)
```

In [ ]:
```
list(range(1,10))
```

In [ ]:
```
list(range(1,10,3))
```

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

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

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

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

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

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

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

np.random.randint(low, high=None, size=None, dtype=int)

low → inclusive lower bound (minimum possible value)

high → exclusive upper bound (maximum possible value not included)

size → shape of output (if you want more than one number)

dtype → data type (default is int)

In [ ]:
```
np.random.randint(2,20) # 2nd argument is exlusive
```

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

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

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

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

In [ ]:
```
print (np.random.randint(1)  )
```

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

In [ ]:
```
np.random.randint(-30,20,15) # 15 means fifteen items to print. If I change to 10,
```

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

In [ ]:
```
print (np.random.randint(5,9))  #GET THE VALUE >=5 & <9
```

In [ ]:
```
print (np.random.randint(10,21,3))
```

In [ ]:
```
print (np.random.randint(1,12,10))
```

In [ ]:
```
print(np.random.randint(10, 40, (10, 10)))  # generate 10x10 matrix with values fro
```

In [ ]:
```
print (np.random.randint(1,100,(12,12))) #generre 12x12 matrix with value from 1 to
```

In [ ]:
```
np.arange(1,13).reshape(3,4)
```

In [ ]:
```
np.arange(1,13).reshape(12, 1)
```

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

In [ ]:
```
type(b)
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[:] )
```

In [ ]:
```
print (b[1:3])
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[1,2])
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[1,3])
```

In [ ]:
```
print (b[1,-1])
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[2:3])
```

In [ ]:
```
print (b)
```

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

In [ ]:
```
print (b)
```

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

below codes are used to see how np works in a real world.

In [ ]:
```
import numpy as np

sales = np.random.randint(100, 200, size=365)
window_size = 7
moving_avg = np.convolve(sales, np.ones(window_size)/window_size, mode='valid')
```

In [ ]:
```
print(sales)
```

In [ ]:
```
print(moving_avg)
```

In [ ]:
```
import pandas as pd

df = pd.DataFrame({
    'sales': sales,
    'moving_avg': np.append([np.nan]*(window_size-1), moving_avg)  # align lengths
})
df.head(15)   # show first 15 rows nicely formatted
```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[-5,-3] )
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[-4,2] )
```

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

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[-4,-2])
```

In [ ]:
```
print (b)
```

In [ ]:
```
print (b[-4:2])
```

In [ ]:
```
print (b[:])
```

Operations

In [290…
```
a = np.random.randint(10,20,10)
print (a)
```

```
[14 10 17 10 10 18 16 12 17 15]
```

In [291…
```
print (id(a))
```

```
2658243579504
```

In [292…
```
arr
```

Out[292…
```
 array([0, 1, 2, 3, 4, 5])
```

In [293…
```
arr2 = np.random.randint(0,100,(10,10))
```

In [294…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [295…
```
arr
```

Out[295…
```
 array([0, 1, 2, 3, 4, 5])
```

In [296…
```
arr[:]
```

Out[296…
```
 array([0, 1, 2, 3, 4, 5])
```

In [297…
```
arr
```

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

In [298…
```
arr[:4]
```

Out[298…
```
 array([0, 1, 2, 3])
```

In [299…
```
print (arr2[:])
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [300…
```
print (arr2[0:5] )
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]]
```

In [301…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [302…
```
print (arr2[1,4] )
```

```
34
```

In [303…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [304…
```
print (arr2[-5,5] )
```

```
37
```

In [305…
```
print (arr2[-5,-5] )
```

```
37
```

In [306…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [307…
```
print (arr2[-10,-5])
```

```
7
```

In [308…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [309…
```
print (arr2[-1,-2])
```

```
98
```

In [310…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [311…
```
print (arr2[::-1]) # Revers order
```

```
[[ 5 69 69 68 58 50 41 41 98 27]
 [43 88 34 20 39 98  2 34 72 22]
 [79 52 22 91 29 29 33 82 57 53]
 [31 37 11 67 86 51 83 59 76 49]
 [60 82 96 13 74 37 77 10 92 32]
 [63 91 89 63 39 55  8 77 62 89]
 [82 44 85 20 69  4 54 34 61  4]
 [41 81 10 45 44 35 54 26 26 36]
 [97  7 26 80 34 60 90 29 28 38]
 [90 53 39 62 84  7 64 62  9 21]]
```

In [312…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [313…
```
print (arr2[::-2] ) # revers order - starts from bottom and skip every other row
```

```
[[ 5 69 69 68 58 50 41 41 98 27]
 [79 52 22 91 29 29 33 82 57 53]
 [60 82 96 13 74 37 77 10 92 32]
 [82 44 85 20 69  4 54 34 61  4]
 [97  7 26 80 34 60 90 29 28 38]]
```

In [314…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [315…
```
print (arr2[::-3])
```

```
[[ 5 69 69 68 58 50 41 41 98 27]
 [31 37 11 67 86 51 83 59 76 49]
 [82 44 85 20 69  4 54 34 61  4]
 [90 53 39 62 84  7 64 62  9 21]]
```

In [316…
```
print (arr2)
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]
 [79 52 22 91 29 29 33 82 57 53]
 [43 88 34 20 39 98  2 34 72 22]
 [ 5 69 69 68 58 50 41 41 98 27]]
```

In [317…
```
print (arr2[:-3] )
```

```
[[90 53 39 62 84  7 64 62  9 21]
 [97  7 26 80 34 60 90 29 28 38]
 [41 81 10 45 44 35 54 26 26 36]
 [82 44 85 20 69  4 54 34 61  4]
 [63 91 89 63 39 55  8 77 62 89]
 [60 82 96 13 74 37 77 10 92 32]
 [31 37 11 67 86 51 83 59 76 49]]
```

In [318…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [319…
```
print (arr.max() )
```

```
5
```

In [320…
```
print (arr.min())
```

```
0
```

In [321…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [322…
```
print (arr.mean())
```

```
2.5
```

In [323…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [324…
```
print (arr.median())
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[324], line 1
----> 1 print (arr.median())

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

In [325…
```
from numpy import *
a = array([1,2,3,4,9])
print (median(a))
```

```
3.0
```

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

In [326…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [327…
```
print (arr.reshape(3,2)  )
```

```
[[0 1]
 [2 3]
 [4 5]]
```

In [328…
```
print (arr.reshape(6,1)  )
```

```
[[0]
 [1]
 [2]
 [3]
 [4]
 [5]]
```

In [329…
```
print (arr.reshape(1,6) )
```

```
[[0 1 2 3 4 5]]
```

In [330…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [331…
```
print (arr.reshape(2,3))
```

```
[[0 1 2]
 [3 4 5]]
```

In [332…
```
print (arr)
```

```
[0 1 2 3 4 5]
```

In [333…
```
print (arr.reshape(2,3,order='C') )
```

```
[[0 1 2]
 [3 4 5]]
```

In [334…
```
print (arr.reshape(2,3,order='F')) # print element with fortran
```

```
[[0 2 4]
 [1 3 5]]
```

In [335…
```
print (arr.reshape(2,3,order='A')) # A almost give you c type output
```

```
[[0 1 2]
 [3 4 5]]
```

In [336…
```
arr
```

Out[336…
```
array([0, 1, 2, 3, 4, 5])
```

In [337…
```
arr.reshape(2,3)
```

Out[337…
```
array([[0, 1, 2],
       [3, 4, 5]])
```

In [338…
```
arr.reshape(1,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[338], line 1
----> 1 arr.reshape(1,4)

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

In [339…
```
arr.reshape(1,6)
```

Out[339…
```
array([[0, 1, 2, 3, 4, 5]])
```

In [340…
```
arr.reshape(6,1)
```

Out[340…
```
array([[0],
       [1],
       [2],
       [3],
       [4],
       [5]])
```

In [341…
```
arr.reshape(2,6)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[341], line 1
----> 1 arr.reshape(2,6)

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

In [342…
```
arr.reshape(3,3)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[342], line 1
----> 1 arr.reshape(3,3)

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

In [343…
```
arr
```

Out[343…
```
array([0, 1, 2, 3, 4, 5])
```

In [344…
```
arr.reshape(3,2)
```

Out[344…
```
array([[0, 1],
       [2, 3],
       [4, 5]])
```

Indexing

In [345…
```
mat = np.arange(0,100).reshape(10,10)
```

In [346…
```
mat
```

Out[346…
```
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 [347…
```
row = 4
col = 5
```

In [348…
```
col
```

Out[348… 5

In [349…
```
row
```

Out[349… 4

In [350…
```
mat
```

Out[350…
```
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 [352…
```
print (mat[row,col] )
```

45

In [353…
```
print (mat[4,5] )
```

45

In [354…
```
mat
```

Out[354…
```
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 [355…
```
mat[:]
```

Out[355…
```
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 [356…
```
col = 6
```

In [357…
```
mat
```

Out[357…
```
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 [358…
```
mat[6] # default it represent to rows
```

Out[358…
```
array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [359…
```
mat
```

Out[359…
```
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]])
```

mat[row_indices, column_indices]

A slice is specified by : (colon), meaning "all elements along this axis."

What does mat[:, col] mean?

: in the row position means select all rows.

col in the column position means select a specific column (an integer index or an array of indices).

In [360…
```
# With Slices
mat[:,col]
```

Out[360…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [361…
```
mat
```

Out[361…
```
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 [362…
```
mat[row,:]
```

Out[362…
```
array([40, 41, 42, 43, 44, 45, 46, 47, 48, 49])
```

In [363…
```
mat
```

Out[363…
```
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 [364…
```
mat[:,8]
```

Out[364…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [365…
```
mat
```

Out[365…
```
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 [366…
```
mat[:col]
```

Out[366…
```
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 [367…
```
mat[:6]
```

Out[367…
```
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 [368…
```
row
```

Out[368…
```
4
```

In [ ]:
```
mat
```

In [369…
```
mat[:row]
```

Out[369…
```
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 [370…
```
mat
```

Out[370…
```
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 [371…
```
mat[row:]
```

Out[371…
```
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 [372…
```
mat[:]
```

Out[372…
```
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 [373…
```
mat[:,8]
```

Out[373…
```
array([ 8, 18, 28, 38, 48, 58, 68, 78, 88, 98])
```

In [374…
```
mat
```

Out[374…
```
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 [375…
```
mat[:,-1]
```

Out[375…
```
array([ 9, 19, 29, 39, 49, 59, 69, 79, 89, 99])
```

In [376…
```
mat
```

Out[376…
```
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 [377…
```
row
```

Out[377…
```
4
```

In [378…
```
col
```

Out[378…
```
6
```

In [379…
```
mat[:,col]
```

Out[379…
```
array([ 6, 16, 26, 36, 46, 56, 66, 76, 86, 96])
```

In [380…
```
mat
```

Out[380…
```
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 [382…
```
print (mat[1,4])
```

```
14
```

In [383…
```
mat
```

Out[383…
```
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 [384…
```
mat[1:4]
```

Out[384…
```
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 [385…
```
mat
```

Out[385…
```
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 [386…
```
mat[3:-3]
```

Out[386…
```
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 [ ]:
```
mat
```

In [387…
```
mat[0]
```

Out[387…
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [388…
```
mat[6]
```

Out[388…
```
array([60, 61, 62, 63, 64, 65, 66, 67, 68, 69])
```

In [389…
```
mat
```

Out[389…
```
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 [390…
```
mat[6:]
```

Out[390…
```
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 [391…
```
mat[:6]
```

Out[391…
```
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 [392…
```
mat
```

Out[392…
```
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 [393…
```
mat[5:7]
```

Out[393…
```
array([[50, 51, 52, 53, 54, 55, 56, 57, 58, 59],
       [60, 61, 62, 63, 64, 65, 66, 67, 68, 69]])
```

In [394…
```
mat
```

Out[394…
```
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 [395…
```
mat[0:10]
```

Out[395…
```
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 [396…
```
mat
```

Out[396…
```
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 [397…
```
mat[0:10:3]
```

Out[397…
```
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 [398…
```
mat[0:10]
```

Out[398…
```
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 [399…
```
mat[0:10:3]
```

Out[399…
```
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 [400…
```
mat
```

Out[400…
```
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 [401…
```
mat[4:]
```

Out[401…
```
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 [402…
```
mat
```

Out[402…
```
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 [403…
```
mat[:4]
```

Out[403…
```
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 [404…
```
mat
```

Out[404…
```
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 [405…
```
mat[::-1]
```

Out[405…
```
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 [406…
```
mat
```

Out[406…
```
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 [407…
```
mat[::-3]
```

Out[407…
```
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 [408…
```
mat
```

Out[408…
```
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 [409…
```
mat[::-3]
```

Out[409…
```
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 [410…
```
mat
```

Out[410…
```
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 [411…
```
mat[::-5]
```

Out[411…
```
array([[90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

In [412…
```
mat
```

Out[412…
```
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 [413…
```
mat[2:6]
```

Out[413…
```
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 [414…
```
mat
```

Out[414…
```
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 [415…
```
mat[2:6,2:4] # 1:5 --> only row part /// 1:3 -- it indicates only column parts
```

Out[415…
```
array([[22, 23],
       [32, 33],
       [42, 43],
       [52, 53]])
```

In [416…
```
mat
```

Out[416…
```
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 [417…
```
mat[0,1]
```

Out[417… np.int64(1)

In [419…
```
mat[1,6]
```

Out[419… np.int64(16)

In [420…
```
mat
```

Out[420…
```
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 [421…
```
mat[1:6]
```

Out[421…
```
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 [422…
```
mat[1:]
```

Out[422…
```
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 [423…
```
mat
```

Out[423…
```
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 [424…
```
mat[:6]
```

Out[424…
```
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 [425…
```
mat[0:1]
```

Out[425…
```
array([[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]])
```

In [426…
```
mat
```

Out[426…
```
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 [427…
```
mat[3:5]
```

Out[427…
```
array([[30, 31, 32, 33, 34, 35, 36, 37, 38, 39],
       [40, 41, 42, 43, 44, 45, 46, 47, 48, 49]])
```

In [428…
```
mat[3,5]
```

Out[428…
```
np.int64(35)
```

In [429…
```
mat
```

Out[429…
```
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 [430…
```
mat[1:2,2:4]
```

Out[430…
```
array([[12, 13]])
```

In [431…
```
mat
```

Out[431…
```
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 [432…
```
mat[2:3,2:3]
```

Out[432…
```
array([[22]])
```

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 [434…
```
mat[2:4,3:5]
```

Out[434…
```
array([[23, 24],
       [33, 34]])
```

In [436…
```
mat[3:5,2:4]
```

Out[436…
```
array([[32, 33],
       [42, 43]])
```

In [437…
```
mat
```

Out[437…
```
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 [438…
```
mat[2:3,4:5]
```

Out[438…
```
array([[24]])
```

Masking

In [439…
```
mat # we also called as filter
```

Out[439…
```
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 [440…
```
id(mat)
```

Out[440…
```
2658248274928
```

In [ ]:
```
mat
```

In [441…
```
mat[mat<50]
```

Out[441…
```
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 [442…
```
mat[mat<=50]
```

Out[442…
```
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 [443…
```
mat > 50
```

Out[443…
```
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 [444…
```
mat[mat==50]
```

Out[444…
```
array([50])
```

In [445…
```
mat
```

Out[445…
```
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 == 50
```

Out[446…
```
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 [447…
```
mat
```

Out[447…
```
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 [448…
```
a1 = mat[mat<50]
a1
```

Out[448…
```
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 [449…
```
mat
```

Out[449…
```
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 [450…
```
a2 = mat[mat>50]
a2
```

Out[450…
```
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 [451…
```
a3 = mat[mat<=50]
a3
```

Out[451…
```
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 [452…
```
a4 = mat[mat==50]
a4
```

Out[452…
```
array([50])
```

python program to generat otp

In [455…
```
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

# 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: 5324
```

In [454…
```
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 [456…
```
def wish():
    print('good even')
wish()

wish()
```

```
wish()
```

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

In [457…

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

```
<built-in method pop of list object at 0x0000026AEBCD8680>
```

In [458…

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

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

In [ ]: