NumPy

- ## How to create a NumPy Array ?

- ## import numpy as np

In [31]:
```
1 import numpy as np
2
3 a = np.array(['a', 'He', 2,3])
4 print(a) # ['a' 'He' '2' '3']
5 print(type(a)) # <class 'numpy.ndarray'>
```

```
['a' 'He' '2' '3']
<class 'numpy.ndarray'>
```

- ## Combined types are not allowed.

In [5]:
```
1 import numpy as np
2
3 a = np.array(25)
4 print(a) # 25
```

```
25
```

In [7]:
```
1 import numpy as np
2 a = np.array([10,20,30,40,50])
3 print(a)
4 # [10 20 30 40 50]
```

```
[10 20 30 40 50]
```

In [12]:
```
1 import numpy as np
2 a = np.array([10,20,30,40,50])
3 print("Dimension is :", a.ndim) # 1
4 print(a) # [10 20 30 40 50]
5 print(a.shape) # (5,)
```

```
Dimension is : 1
[10 20 30 40 50]
(5,)
```

- # Dimenstions :- 0-D || 1-D || 2-D || 3-D

In [16]:
```
import numpy as np
a = np.array([[10,20,30],[40,50]])
print("Dimension is :", a.ndim) # 1
print(a) # [list([10, 20, 30]) list([40, 50])]
print(a.shape) # (2,)
```

```
Dimension is : 1
[list([10, 20, 30]) list([40, 50])]
(2,)

<ipython-input-16-6fd59125c966>:2: VisibleDeprecationWarning: Creating an
ndarray from ragged nested sequences (which is a list-or-tuple of lists-or
-tuples-or ndarrays with different lengths or shapes) is deprecated. If yo
u meant to do this, you must specify 'dtype=object' when creating the ndar
ray
  a = np.array([[10,20,30],[40,50]])
```

- # Each row must have same column

In [17]:
```
import numpy as np
a = np.array([[10,20,30],[40,50,60]])
print("Dimension is :", a.ndim) # 2
print(a)
# [[10 20 30]
# [40 50 60]]
print(a.shape) # (2, 3)
```

```
Dimension is : 2
[[10 20 30]
 [40 50 60]]
(2, 3)
```

In [18]:
```
import numpy as np
a = np.array([[[10,20,30],[40,50,60]],[[1,2,3],[4,5,6]]])
print("Dimension is :", a.ndim) # 3
print(a)
# [[[10 20 30]
#   [40 50 60]]

#  [[ 1  2  3]
#   [ 4  5  6]]]
print(a.shape) # (2, 2, 3)
```

```
Dimension is : 3
[[[10 20 30]
  [40 50 60]]

 [[ 1  2  3]
  [ 4  5  6]]]
(2, 2, 3)
```

- **In 3-D array 1-D && 0-D is Equal.**

In [19]:
```
import numpy as np
a = np.array([[[[1,2,3]]]])
print("Dimension is :", a.ndim) # 4
print(a) # [[[[1 2 3]]]]
print(a.shape) # (1, 1, 1, 3)
```

```
Dimension is : 4
[[[[1 2 3]]]]
(1, 1, 1, 3)
```

In [22]:
```
import numpy as np
a = np.array([1,2,3,4,5])

print(a[-4:]) # [2 3 4 5]
print(a[1:]) # [2 3 4 5]
```

```
[2 3 4 5]
[2 3 4 5]
```

In [24]:
```
import numpy as np
a = np.array([[1,2,3,4,5],[6,7,8,9,10]])
print(a[1:,1:4]) # [[7 8 9]]
print(a[:,1:4])
# [[2 3 4]
#  [7 8 9]]
```

```
[[7 8 9]]
[[2 3 4]
 [7 8 9]]
```

In [29]:
```
import numpy as np
a = np.array([[[1,2,3],[4,5,6,2,3],[7,8,9,2,3]],
              [[2,3,4,8,5],[4,2,3,5,6],[8,7,2,3,9]]])
print(a[:,1:,1:])

# [[[5 6]
#   [8 9]]

#  [[5 6]
#   [7 9]]]
```

```
[[[5 6]
  [8 9]]

 [[5 6]
  [7 9]]]
```

In [30]:
```
import numpy as np
a = np.array([[[1,2,9,8,3],[4,5,6,2,3],[7,8,9,2,3]],
              [[2,3,4,8,5],[4,2,3,5,6],[8,7,2,3,9]]])

print(a[:,::2,1::2])
# [[[2 8]
#   [8 2]]

#  [[3 8]
#   [7 3]]]
```

```
[[[2 8]
  [8 2]]

 [[3 8]
  [7 3]]]
```

In [32]:
```
import numpy as np
a = np.array([[[1,2,9,8,3],[4,5,6,2,3],[7,8,9,2,3]],
              [[2,3,4,8,5],[4,2,3,5,6],[8,7,2,3,9]]])
print(a[:,0,1]) # [2 3]
```

```
[2 3]
```

In [39]:
```
import numpy as np
a = np.array((1,2,3,4,5,6))
a = a.reshape(2,3)
print(a)
# [[1 2 3]
#  [4 5 6]]
```

```
[[1 2 3]
 [4 5 6]]
```

In [40]:
```
import numpy as np
a = np.array((1,2,3,4,5,6))
a = a.reshape(2,4)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call las
t)
<ipython-input-40-ad54128a8811> in <module>
      1 import numpy as np
      2 a = np.array((1,2,3,4,5,6))
----> 3 a = a.reshape(2,4)

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

In [44]:

```
import numpy as np
a = np.array((1,2,3,4,5,6))
a = a.reshape(1,3,2)
print(a)
# [[[1 2]
#   [3 4]
#   [5 6]]]
```

```
[[[1 2]
  [3 4]
  [5 6]]]
```

In [45]:

```
import numpy as np
a = np.array((1,2,3,4,5,6))
a = a.reshape(1,3,2,-1)
print(a)
# [[[[1]
#    [2]]

#   [[3]
#    [4]]

#   [[5]
#    [6]]]]
```

```
[[[[1]
   [2]]

  [[3]
   [4]]

  [[5]
   [6]]]]
```

In [48]:
```
import numpy as np
a = np.array(range(1,51)).reshape(2,5,5)
print(a)

# [[[ 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]]]
```

```
[[[ 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 [49]:
```
import numpy as np
a = np.array(([[1,2],[5,6],[8,9]]))
a = a.reshape(-1)
print(a) # [1 2 5 6 8 9]
```

```
[1 2 5 6 8 9]
```

In [50]:
```
import numpy as np
a = np.array(([[1,2],[5,6],[8,9]]))
a = a.reshape(1,-1)
print(a) # [[1 2 5 6 8 9]]
```

```
[[1 2 5 6 8 9]]
```

In [8]:

```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)
print(a)

for i in a:
    for j in i:
        for k in j:
            if k==12:
                print(k)
                break

# [[[ 1  2  3  4]
#   [ 5  6  7  8]]

#  [[ 9 10 11 12]
#   [13 14 15 16]]

#  [[17 18 19 20]
#   [21 22 23 24]]]
# 12

# If i want to access index

for i in range(len(a)):
    print(i)
    for j in range(i):
        for k in range(j):
            print(k)
            break
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]]

 [[ 9 10 11 12]
  [13 14 15 16]]

 [[17 18 19 20]
  [21 22 23 24]]]
12
0
1
2
0
```

In [67]:
```
import numpy as np
a = np.array(range(1,19)).reshape(2,3,3)
print(a)
sum = 0
x = a[:,:,1].reshape(-1)
print(x)

for i in x:
    sum += i
print(sum) # 57
```

```
[[[ 1  2  3]
  [ 4  5  6]
  [ 7  8  9]]

 [[10 11 12]
  [13 14 15]
  [16 17 18]]]
[ 2  5  8 11 14 17]
57
```

Concatenate

In [68]:
```
import numpy as np
a = np.array([1,2,3,4,5])
b = np.array([6,7,8,10])
print(a.shape) # (5,)

n = np.concatenate((a,b))
print(n) # [ 1  2  3  4  5  6  7  8 10]
print(n.shape) # (9,)
```

```
(5,)
[ 1  2  3  4  5  6  7  8 10]
(9,)
```

In [69]:
```
import numpy as np
a = np.array([[1,2,3],[4,5,6],[7,8,9]])
b = np.array([[1,2,3],[4,5,6],[7,8,9]])
n = np.concatenate((a,b))
print(n)
# [[1 2 3]
#  [4 5 6]
#  [7 8 9]
#  [1 2 3]
#  [4 5 6]
#  [7 8 9]]
print(n.shape) # (6, 3)
```

```
[[1 2 3]
 [4 5 6]
 [7 8 9]
 [1 2 3]
 [4 5 6]
 [7 8 9]]
(6, 3)
```

In [11]:

```
import numpy as np
a = np.array([[1,2,3],[4,5,6],[7,8,9]])
b = np.array([[1,2,3],[4,5,6],[7,8,9]])
n = np.concatenate((a,b),axis = 1)
print(n)
# [[1 2 3 1 2 3]
#  [4 5 6 4 5 6]
#  [7 8 9 7 8 9]]
print(n.shape) # (3, 6)
```

```
[[1 2 3 1 2 3]
 [4 5 6 4 5 6]
 [7 8 9 7 8 9]]
(3, 6)
```

NumPy

- **Dimension (0D, 1D, 2D, 3D)**
- **array**
- **ndim**
- **shape**
- **Indexing**
- **Slicing**
- **reshape**
- **Iteration (for, while)**
- **Concatenate**
- **array_split**
- **where**
- **sort**
- **operation**

In [20]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)
b = np.array(range(51,75)).reshape(3,2,4)

print(a)
print('------------------------------------------------------')
print(b)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]]

 [[ 9 10 11 12]
  [13 14 15 16]]

 [[17 18 19 20]
  [21 22 23 24]]]
------------------------------------------------------
[[[51 52 53 54]
  [55 56 57 58]]

 [[59 60 61 62]
  [63 64 65 66]]

 [[67 68 69 70]
  [71 72 73 74]]]
```

In [13]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)

b = np.array(range(51,75)).reshape(3,2,4)

x = np.concatenate((a,b))
print(x)
print(x.shape)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]]

 [[ 9 10 11 12]
  [13 14 15 16]]

 [[17 18 19 20]
  [21 22 23 24]]

 [[51 52 53 54]
  [55 56 57 58]]

 [[59 60 61 62]
  [63 64 65 66]]

 [[67 68 69 70]
  [71 72 73 74]]]
(6, 2, 4)
```

In [14]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)

b = np.array(range(51,75)).reshape(3,2,4)

x = np.concatenate((a,b), axis=0)
print(x)
print(x.shape)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]]

 [[ 9 10 11 12]
  [13 14 15 16]]

 [[17 18 19 20]
  [21 22 23 24]]

 [[51 52 53 54]
  [55 56 57 58]]

 [[59 60 61 62]
  [63 64 65 66]]

 [[67 68 69 70]
  [71 72 73 74]]]
(6, 2, 4)
```

In [16]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)

b = np.array(range(51,75)).reshape(3,2,4)

x = np.concatenate((a,b),axis=1)
print(x)
print(x.shape)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [51 52 53 54]
  [55 56 57 58]]

 [[ 9 10 11 12]
  [13 14 15 16]
  [59 60 61 62]
  [63 64 65 66]]

 [[17 18 19 20]
  [21 22 23 24]
  [67 68 69 70]
  [71 72 73 74]]]
(3, 4, 4)
```

In [17]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)

b = np.array(range(51,75)).reshape(3,2,4)

x = np.concatenate((a,b),axis=2)
print(x)
print(x.shape)
```

```
[[[ 1  2  3  4 51 52 53 54]
  [ 5  6  7  8 55 56 57 58]]

 [[ 9 10 11 12 59 60 61 62]
  [13 14 15 16 63 64 65 66]]

 [[17 18 19 20 67 68 69 70]
  [21 22 23 24 71 72 73 74]]]
(3, 2, 8)
```

In [26]:

```
import numpy as np
a = np.array([1,2,3,4,5,6])
x = np.array_split(a,2)
print(x)
print("---------------------------")

for i in x:
    print(i)

print("---------------------------")
print(x[1])

"""
[array([1, 2, 3]), array([4, 5, 6])]
---------------------------
[1 2 3]
[4 5 6]
---------------------------
[4 5 6] """
```

```
[array([1, 2, 3]), array([4, 5, 6])]
---------------------------
[1 2 3]
[4 5 6]
---------------------------
[4 5 6]
```

In [25]:

```
import numpy as np
a = np.array([1,2,3,4,5,6])
x = np.array_split(a,10)
print(x)
print("---------------------------")

for i in x:
    print(i)

print("---------------------------")
print(x[1])

"""
[array([1]), array([2]), array([3]), array([4]), array([5]), array([6])
dtype=int32), array([], dtype=int32), array([], dtype=int32), array([],
---------------------------
[1]
[2]
[3]
[4]
[5]
[6]
[]
[]
[]
[]
---------------------------
[2] """
```

```
[array([1]), array([2]), array([3]), array([4]), array([5]), array([6]), a
rray([], dtype=int32), array([], dtype=int32), array([], dtype=int32), arr
ay([], dtype=int32)]
---------------------------
[1]
[2]
[3]
[4]
[5]
[6]
[]
[]
[]
[]
---------------------------
[2]
```

In [29]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, axis=0)
print(x)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-29-125cfbb1f7a7> in <module>
      1 import numpy as np
      2 a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
----> 3 x = np.array_split(a, axis=0)
      4 print(x)

<__array_function__ internals> in array_split(*args, **kwargs)

TypeError: _array_split_dispatcher() missing 1 required positional argument: 'indices_or_sections'
```

In [30]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 2, axis=0)
print(x)

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

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

In [31]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 3, axis=0)
print(x)
```

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

In [32]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 4, axis=0)
print(x)
```

```
[array([[1, 2, 3, 4]]), array([[5, 6, 7, 8]]), array([[ 9, 10, 11, 12]]),
array([], shape=(0, 4), dtype=int32)]
```

In [33]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 5, axis=0)
print(x)
```

```
[array([[1, 2, 3, 4]]), array([[5, 6, 7, 8]]), array([[ 9, 10, 11, 12]]),
array([], shape=(0, 4), dtype=int32), array([], shape=(0, 4), dtype=int32)]
```

In [35]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 2, axis=1)
print(x)
```

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

In [38]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 3, axis=1)
print(x)
```

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

In [39]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 4, axis=1)
print(x)
```

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

In [42]:
```
import numpy as np
a = np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12]])
x = np.array_split(a, 4, axis=1)
print(x)

for i in x:
    print(i)
```

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

In [50]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)
print(a)
print("---------------------------------")
x = np.array_split(a, 2)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]]

 [[ 9 10 11 12]
  [13 14 15 16]]

 [[17 18 19 20]
  [21 22 23 24]]]
---------------------------------
[array([[[ 1,  2,  3,  4],
         [ 5,  6,  7,  8]],

        [[ 9, 10, 11, 12],
         [13, 14, 15, 16]]]), array([[[17, 18, 19, 20],
         [21, 22, 23, 24]]])]
```

In [48]:
```
import numpy as np
a = np.array(range(1,25)).reshape(3,2,4)
x = np.array_split(a, 2, axis=1)
print(x)
```

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

       [[ 9, 10, 11, 12]],

       [[17, 18, 19, 20]]]), array([[[ 5,  6,  7,  8]],

       [[13, 14, 15, 16]],

       [[21, 22, 23, 24]]])]
```

In [55]:
```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 2, axis=0)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1,  2,  3,  4],
        [ 5,  6,  7,  8],
        [ 9, 10, 11, 12]]]), array([[[13, 14, 15, 16],
        [17, 18, 19, 20],
        [21, 22, 23, 24]]])]
```

In [56]:
```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 2, axis=1)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1,  2,  3,  4],
        [ 5,  6,  7,  8]],

       [[13, 14, 15, 16],
        [17, 18, 19, 20]]]), array([[[ 9, 10, 11, 12]],

       [[21, 22, 23, 24]]])]
```

In [58]:

```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 2, axis=2)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1,  2],
         [ 5,  6],
         [ 9, 10]],

        [[13, 14],
         [17, 18],
         [21, 22]]]), array([[[ 3,  4],
         [ 7,  8],
         [11, 12]],

        [[15, 16],
         [19, 20],
         [23, 24]]])]
```

In [59]:

```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 3, axis=2)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1,  2],
         [ 5,  6],
         [ 9, 10]],

        [[13, 14],
         [17, 18],
         [21, 22]]]), array([[[ 3],
         [ 7],
         [11]],

        [[15],
         [19],
         [23]]]), array([[[ 4],
         [ 8],
         [12]],

        [[16],
         [20],
         [24]]])]
```

In [60]:

```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 4, axis=2)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1],
         [ 5],
         [ 9]],

        [[13],
         [17],
         [21]]]), array([[[ 2],
         [ 6],
         [10]],

        [[14],
         [18],
         [22]]]), array([[[ 3],
         [ 7],
         [11]],

        [[15],
         [19],
         [23]]]), array([[[ 4],
         [ 8],
         [12]],

        [[16],
         [20],
         [24]]])]
```

In [61]:
```
import numpy as np
a = np.array(range(1,25)).reshape(2,3,4)
print(a)
print('-'*25)
x = np.array_split(a, 5, axis=2)
print(x)
```

```
[[[ 1  2  3  4]
  [ 5  6  7  8]
  [ 9 10 11 12]]

 [[13 14 15 16]
  [17 18 19 20]
  [21 22 23 24]]]
-------------------------
[array([[[ 1],
         [ 5],
         [ 9]],

        [[13],
         [17],
         [21]]]), array([[[ 2],
         [ 6],
         [10]],

        [[14],
         [18],
         [22]]]), array([[[ 3],
         [ 7],
         [11]],

        [[15],
         [19],
         [23]]]), array([[[ 4],
         [ 8],
         [12]],

        [[16],
         [20],
         [24]]]), array([], shape=(2, 3, 0), dtype=int32)]
```

Where :

In [63]:
```
import numpy as np
a =  np.array([1,2,4,9,5,4,6,4])
print(a)

x = np.where(a == 4)
print(x)
```

```
[1 2 4 9 5 4 6 4]
(array([2, 5, 7], dtype=int64),)
```

In [79]:
```
import numpy as np
a =  np.array(range(1,7)).reshape(3,2)
print(a)

x = np.where(a%2==0)
print(x)
```

```
[[1 2]
 [3 4]
 [5 6]]
(array([0, 1, 2], dtype=int64), array([1, 1, 1], dtype=int64))
```

In [82]:
```
import numpy as np
a =  np.array([[2,3,5,7],[15,6,20,5],[30,10,2,4],[6,9,8,7]])
print(a)

x = np.where(a%5==0)
print(x)
```

```
[[ 2  3  5  7]
 [15  6 20  5]
 [30 10  2  4]
 [ 6  9  8  7]]
(array([0, 1, 1, 1, 2, 2], dtype=int64), array([2, 0, 2, 3, 0, 1], dtype=i
nt64))
```

In [84]:
```
import numpy as np
a =  np.array([[[2,3,9],[4,6,7]],[[1,3,5],[7,8,7]],[[16,3,4],[7,7,7]]])
print(a)

x = np.where(a%2==0)
print(x)
```

```
[[[ 2  3  9]
  [ 4  6  7]]

 [[ 1  3  5]
  [ 7  8  7]]

 [[16  3  4]
  [ 7  7  7]]]
(array([0, 0, 0, 1, 2, 2], dtype=int64), array([0, 1, 1, 1, 0, 0], dtype=i
nt64), array([0, 0, 1, 1, 0, 2], dtype=int64))
```

Sort :

In [86]:
```
import numpy as np
a =  np.array([1,9,8,5,3,4])
print(a)

np.sort(a)
```

```
[1 9 8 5 3 4]
```

Out[86]:
```
array([1, 3, 4, 5, 8, 9])
```

In [88]:
```
import numpy as np
a =  np.array([1,9,8,5,3,4])
print(a)

np.sort(a)[::-1]
```

```
[1 9 8 5 3 4]
```

Out[88]:
```
array([9, 8, 5, 4, 3, 1])
```

In [89]:
```
import numpy as np
a =  np.array([[9,1],[6,20],[34,2]])
print(a)

np.sort(a)
```

```
[[ 9  1]
 [ 6 20]
 [34  2]]
```

Out[89]:
```
array([[ 1,  9],
       [ 6, 20],
       [ 2, 34]])
```

In [90]:
```
import numpy as np
a =  np.array([[9,1],[6,20],[34,2]])
print(a)

np.sort(a)[::-1]
```

```
[[ 9  1]
 [ 6 20]
 [34  2]]
```

Out[90]:
```
array([[ 2, 34],
       [ 6, 20],
       [ 1,  9]])
```

- **axis = 1 is default in sort**

In [92]:
```
import numpy as np
a =  np.array([[9,1],[6,20],[34,2]])
print(a)

np.sort(a, axis=1)
```

```
[[ 9  1]
 [ 6 20]
 [34  2]]
```

Out[92]:
```
array([[ 1,  9],
       [ 6, 20],
       [ 2, 34]])
```

- **axis = 0 is sorting column wise**

In [96]:
```
import numpy as np
a =  np.array([[9,1],[6,20],[34,2]])
print(a)

np.sort(a, axis=0)
```

```
[[ 9  1]
 [ 6 20]
 [34  2]]
```

Out[96]:
```
array([[ 6,  1],
       [ 9,  2],
       [34, 20]])
```

- **axis = 2 default sort for 3D**

In [101]:
```
import numpy as np
a = np.array([[[5,8,91],[6,5,4]],[[45,84,2],[85,62,5]]])
print(a)

np.sort(a, axis=2)
```

```
[[[ 5  8 91]
  [ 6  5  4]]

 [[45 84  2]
  [85 62  5]]]
```

Out[101]:
```
array([[[ 5,  8, 91],
        [ 4,  5,  6]],

       [[ 2, 45, 84],
        [ 5, 62, 85]]])
```

- **column wise in particular array**

In [103]:
```
1 import numpy as np
2 a = np.array([[[5,8,91],[6,5,4]],[[45,84,2],[85,62,5]]])
3 print(a)
4
5 np.sort(a, axis=1)
```

```
[[[ 5  8 91]
  [ 6  5  4]]

 [[45 84  2]
  [85 62  5]]]
```

Out[103]:
```
array([[[ 5,  5,  4],
        [ 6,  8, 91]],

       [[45, 62,  2],
        [85, 84,  5]]])
```

- **Compairing row**

In [104]:
```
1 import numpy as np
2 a = np.array([[[5,8,91],[6,5,4]],[[45,84,2],[85,62,5]]])
3 print(a)
4
5 np.sort(a, axis=0)
```

```
[[[ 5  8 91]
  [ 6  5  4]]

 [[45 84  2]
  [85 62  5]]]
```

Out[104]:
```
array([[[ 5,  8,  2],
        [ 6,  5,  4]],

       [[45, 84, 91],
        [85, 62,  5]]])
```

In [114]:
```
import numpy as np
a = np.array([[[9,2,5],[6,1,7]],[[3,1,4],[5,20,5]],[[2,10,3],[4,15,3]]]
print(a)

print("------------ each index of array (000,111,.... -> sort) --------
np.sort(a, axis=0)
```

```
[[[ 9  2  5]
  [ 6  1  7]]

 [[ 3  1  4]
  [ 5 20  5]]

 [[ 2 10  3]
  [ 4 15  3]]]
------------ each index of array (000,111,.... -> sort) -----------
```

Out[114]:
```
array([[[ 2,  1,  3],
        [ 4,  1,  3]],

       [[ 3,  2,  4],
        [ 5, 15,  5]],

       [[ 9, 10,  5],
        [ 6, 20,  7]]])
```

In [115]:
```
import numpy as np
a = np.array([[[9,2,5],[6,1,7]],[[3,1,4],[5,20,5]],[[2,10,3],[4,15,3]]]
print(a)

print("------------------------ individual 2D column wise ------------
np.sort(a, axis=1)
```

```
[[[ 9  2  5]
  [ 6  1  7]]

 [[ 3  1  4]
  [ 5 20  5]]

 [[ 2 10  3]
  [ 4 15  3]]]
------------------------ individual 2D column wise ----------------------
```

Out[115]:
```
array([[[ 6,  1,  5],
        [ 9,  2,  7]],

       [[ 3,  1,  4],
        [ 5, 20,  5]],

       [[ 2, 10,  3],
        [ 4, 15,  3]]])
```

In [113]:
```
import numpy as np
a = np.array([[[9,2,5],[6,1,7]],[[3,1,4],[5,20,5]],[[2,10,3],[4,15,3]]]
print(a)

print("------------------------ sort individual row -------------------
np.sort(a, axis=2)
```

```
[[[ 9  2  5]
  [ 6  1  7]]

 [[ 3  1  4]
  [ 5 20  5]]

 [[ 2 10  3]
  [ 4 15  3]]]
------------------------ sort individual row ----------------------
```

Out[113]:
```
array([[[ 2,  5,  9],
        [ 1,  6,  7]],

       [[ 1,  3,  4],
        [ 5,  5, 20]],

       [[ 2,  3, 10],
        [ 3,  4, 15]]])
```

Operations :

In [ ]:
```
1
```