In [1]:

```
#Importing packages
import pandas as pd
import numpy as np
```

In [2]:

```
# #TO create a DF
# 1.Determine the columns
# 2.Using for loop  and numpy generate some fake values
# 3.Create a empty Dataframe
```

In [3]:

```
df=pd.DataFrame(columns=['COlumn1','COlumn2'])
```

In [4]:

```
df
```

Out[4]:

COlumn1	COlumn2

In [5]:

```
df['COlumn1']=np.random.choice([1,0],99)
```

In [6]:

```
type(df)
```

Out[6]:

```
pandas.core.frame.DataFrame
```

In [7]:

```
1 df
```

Out[7]:

	COlumn1	COlumn2
0	0	NaN
1	0	NaN
2	0	NaN
3	0	NaN
4	0	NaN
...	...	...
94	0	NaN
95	0	NaN
96	0	NaN
97	1	NaN

In [8]:

```
1 df.iloc[1,1]=58
```

In [9]:

```
1 df
```

Out[9]:

	COlumn1	COlumn2
0	0	NaN
1	0	58
2	0	NaN
3	0	NaN
4	0	NaN
...	...	...
94	0	NaN
95	0	NaN
96	0	NaN
97	1	NaN
98	1	NaN

99 rows × 2 columns

In [10]:

```
df.iloc[0,1]=58
```

In [11]:

```
df
```

Out[11]:

	COlumn1	COlumn2
0	0	58
1	0	58
2	0	NaN
3	0	NaN
4	0	NaN
...	...	...
94	0	NaN
95	0	NaN
96	0	NaN
97	1	NaN
98	1	NaN

99 rows × 2 columns

In [12]:

```
dic={'COlumn1':47,'COlumn2':57}
```

In [13]:

```
new_df=pd.DataFrame(dic,index=[99])
```

In [14]:

```
df=pd.concat([df,new_df])
```

In [15]:

```
1 df
```

Out[15]:

	COlumn1	COlumn2
0	0	58
1	0	58
2	0	NaN
3	0	NaN
4	0	NaN
...	...	...
95	0	NaN
96	0	NaN
97	1	NaN
98	1	NaN
99	47	57

100 rows × 2 columns

In [16]:

```
1 df['COlumn3']=np.arange(1,101,1)
```

In [17]:

```
1 df
```

Out[17]:

	COlumn1	COlumn2	COlumn3
0	0	58	1
1	0	58	2
2	0	NaN	3
3	0	NaN	4
4	0	NaN	5
...	...	...	...
95	0	NaN	96
96	0	NaN	97
97	1	NaN	98
98	1	NaN	99
99	47	57	100

100 rows × 3 columns

In [18]:

```
df['COlumn2'].fillna(df['COlumn2'].mean())
```

Out[18]:

```
0     58.000000
1     58.000000
2     57.666667
3     57.666667
4     57.666667
        ...
95    57.666667
96    57.666667
97    57.666667
98    57.666667
99    57.000000
Name: COlumn2, Length: 100, dtype: float64
```

In [19]:

```
df['COlumn2']=df['COlumn2'].fillna(df['COlumn2'].mean())
```

In [20]:

```
df
```

Out[20]:

	COlumn1	COlumn2	COlumn3
0	0	58.000000	1
1	0	58.000000	2
2	0	57.666667	3
3	0	57.666667	4
4	0	57.666667	5
...	...	...	...
95	0	57.666667	96
96	0	57.666667	97
97	1	57.666667	98
98	1	57.666667	99
99	47	57.000000	100

100 rows × 3 columns

In [21]:

```
1 df.isnull()
```

Out[21]:

	COlumn1	COlumn2	COlumn3
0	False	False	False
1	False	False	False
2	False	False	False
3	False	False	False
4	False	False	False
...	...	...	...
95	False	False	False
96	False	False	False
97	False	False	False
98	False	False	False
99	False	False	False

100 rows × 3 columns

In [22]:

```
1 import math
2 math.floor(df['COlumn2'].mean())
```

Out[22]:

57

In [23]:

```
1 df.describe()
```

Out[23]:

	COlumn1	COlumn2	COlumn3
count	100.000000	100.000000	100.000000
mean	0.940000	57.666667	50.500000
std	4.679247	0.082061	29.011492
min	0.000000	57.000000	1.000000
25%	0.000000	57.666667	25.750000
50%	0.000000	57.666667	50.500000
75%	1.000000	57.666667	75.250000
max	47.000000	58.000000	100.000000

In [24]:

```
1 df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 100 entries, 0 to 99
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   COlumn1  100 non-null    int64
 1   COlumn2  100 non-null    float64
 2   COlumn3  100 non-null    int32
dtypes: float64(1), int32(1), int64(1)
memory usage: 2.7 KB
```

In [25]:

```
1 for x in df.index:
2     print(x)
```

```
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
```

In [26]:

```
1 df.columns
```

Out[26]:

```
Index(['COlumn1', 'COlumn2', 'COlumn3'], dtype='object')
```

In [27]:

```
df.index
```

Out[27]:

```
Int64Index([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 1
5, 16,
            17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 3
2, 33,
            34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 4
9, 50,
            51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 6
6, 67,
            68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 8
3, 84,
            85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99],
           dtype='int64')
```

In [28]:

```
df['COlumn4']=np.random.choice(['AI&ML','AI&DA','CYS'],100)
```

In [29]:

```
a=np.random.choice(['AI&ML','AI&DA','CYS'],100)
```

In [30]:

```
a
```

Out[30]:

```
array(['CYS', 'AI&ML', 'AI&DA', 'AI&ML', 'CYS', 'AI&DA', 'AI&ML', 'AI&DA',
       'CYS', 'AI&ML', 'AI&ML', 'AI&DA', 'AI&DA', 'AI&DA', 'AI&ML',
       'AI&ML', 'AI&DA', 'AI&ML', 'AI&DA', 'CYS', 'AI&DA', 'AI&DA', 'CYS',
       'AI&DA', 'CYS', 'AI&ML', 'CYS', 'AI&DA', 'AI&ML', 'AI&ML', 'AI&ML',
       'AI&DA', 'AI&DA', 'AI&DA', 'AI&ML', 'AI&ML', 'AI&ML', 'CYS',
       'AI&DA', 'AI&ML', 'AI&DA', 'AI&ML', 'AI&DA', 'AI&ML', 'CYS',
       'AI&ML', 'AI&ML', 'CYS', 'AI&ML', 'AI&DA', 'AI&DA', 'AI&ML', 'CYS',
       'AI&DA', 'AI&ML', 'CYS', 'AI&ML', 'AI&DA', 'CYS', 'CYS', 'CYS',
       'AI&ML', 'AI&DA', 'AI&DA', 'CYS', 'AI&DA', 'AI&DA', 'AI&DA', 'CYS',
       'CYS', 'AI&ML', 'AI&DA', 'CYS', 'CYS', 'CYS', 'CYS', 'AI&DA',
       'AI&DA', 'CYS', 'AI&DA', 'AI&DA', 'AI&DA', 'AI&DA', 'AI&DA',
       'AI&DA', 'AI&ML', 'AI&DA', 'AI&ML', 'AI&ML', 'AI&ML', 'AI&ML',
       'CYS', 'AI&DA', 'CYS', 'AI&DA', 'CYS', 'AI&ML', 'AI&ML', 'AI&ML',
       'AI&DA'], dtype='<U5')
```

In [31]:

```
df['Column4']=a
```

In [32]:

```
1 df
```

Out[32]:

	COlumn1	COlumn2	COlumn3	COlumn4	Column4
0	0	58.000000	1	AI&ML	CYS
1	0	58.000000	2	CYS	AI&ML
2	0	57.666667	3	CYS	AI&DA
3	0	57.666667	4	CYS	AI&ML
4	0	57.666667	5	CYS	CYS
...	...	...	...	...	...
95	0	57.666667	96	CYS	CYS
96	0	57.666667	97	CYS	AI&ML
97	1	57.666667	98	CYS	AI&ML
98	1	57.666667	99	AI&DA	AI&ML
99	47	57.000000	100	AI&ML	AI&DA

100 rows × 5 columns

In [33]:

```
1 df.loc[0,'Column4']="DA"
```

In [34]:

```
1 df
```

Out[34]:

	COlumn1	COlumn2	COlumn3	COlumn4	Column4
0	0	58.000000	1	AI&ML	DA
1	0	58.000000	2	CYS	AI&ML
2	0	57.666667	3	CYS	AI&DA
3	0	57.666667	4	CYS	AI&ML
4	0	57.666667	5	CYS	CYS
...	...	...	...	...	...
95	0	57.666667	96	CYS	CYS
96	0	57.666667	97	CYS	AI&ML
97	1	57.666667	98	CYS	AI&ML
98	1	57.666667	99	AI&DA	AI&ML
99	47	57.000000	100	AI&ML	AI&DA

100 rows × 5 columns

In [35]:

```
set(df['Column4'])
```

Out[35]:

```
{'AI&DA', 'AI&ML', 'CYS', 'DA'}
```

In [36]:

```
dic={'AI&DA':'Artificial Intelligence & Data Analytics','DA':'Artificial Intelligenc
```

In [37]:

```
df['Column4']=df['Column4'].map(dic)
```

In [38]:

```
df
```

Out[38]:

	COlumn1	COlumn2	COlumn3	COlumn4	Column4
0	0	58.000000	1	AI&ML	Artificial Intelligence & Data Analytics
1	0	58.000000	2	CYS	Artificial Intelligence & Machine Learning
2	0	57.666667	3	CYS	Artificial Intelligence & Data Analytics
3	0	57.666667	4	CYS	Artificial Intelligence & Machine Learning
4	0	57.666667	5	CYS	CYber Security
...	...	...	...	...	...
95	0	57.666667	96	CYS	CYber Security
96	0	57.666667	97	CYS	Artificial Intelligence & Machine Learning
97	1	57.666667	98	CYS	Artificial Intelligence & Machine Learning
98	1	57.666667	99	AI&DA	Artificial Intelligence & Machine Learning
99	47	57.000000	100	AI&ML	Artificial Intelligence & Data Analytics

100 rows × 5 columns

In [39]:

```
del df['COlumn4']
```

In [40]:

```
1 df
```

Out[40]:

	COlumn1	COlumn2	COlumn3	Column4
0	0	58.000000	1	Artificial Intelligence & Data Analytics
1	0	58.000000	2	Artificial Intelligence & Machine Learning
2	0	57.666667	3	Artificial Intelligence & Data Analytics
3	0	57.666667	4	Artificial Intelligence & Machine Learning
4	0	57.666667	5	CYber Security
...	...	...	...	...
95	0	57.666667	96	CYber Security
96	0	57.666667	97	Artificial Intelligence & Machine Learning
97	1	57.666667	98	Artificial Intelligence & Machine Learning
98	1	57.666667	99	Artificial Intelligence & Machine Learning
99	47	57.000000	100	Artificial Intelligence & Data Analytics

100 rows × 4 columns

In [41]:

```
1 dic={'Artificial Intelligence & Machine Learning':'E01','CYber Security':'E02','Arti
```

In [42]:

```
1 df['Column5']=df['Column4'].map(dic)
```

In [43]:

```
1 df['Column4']
```

Out[43]:

```
0       Artificial Intelligence & Data Analytics
1     Artificial Intelligence & Machine Learning
2       Artificial Intelligence & Data Analytics
3     Artificial Intelligence & Machine Learning
4                                CYber Security
                         ...
95                               CYber Security
96    Artificial Intelligence & Machine Learning
97    Artificial Intelligence & Machine Learning
98    Artificial Intelligence & Machine Learning
99      Artificial Intelligence & Data Analytics
Name: Column4, Length: 100, dtype: object
```

In [44]:

```
1 df
```

Out[44]:

	COlumn1	COlumn2	COlumn3	Column4	Column5
0	0	58.000000	1	Artificial Intelligence & Data Analytics	E03
1	0	58.000000	2	Artificial Intelligence & Machine Learning	E01
2	0	57.666667	3	Artificial Intelligence & Data Analytics	E03
3	0	57.666667	4	Artificial Intelligence & Machine Learning	E01
4	0	57.666667	5	CYber Security	E02
...	...	...	...	...	...
95	0	57.666667	96	CYber Security	E02
96	0	57.666667	97	Artificial Intelligence & Machine Learning	E01
97	1	57.666667	98	Artificial Intelligence & Machine Learning	E01
98	1	57.666667	99	Artificial Intelligence & Machine Learning	E01
99	47	57.000000	100	Artificial Intelligence & Data Analytics	E03

100 rows × 5 columns

In [45]:

```
1 df=pd.read_clipboard()
```

In [46]:

```
1 df
```

Out[46]:

	1	67	1000
0	2	17	1547
1	5	96	2587
2	6	74	4586
3	3	38	3578
4	4	87	1486
5	8	54	5713
6	3	43	9841
7	4	23	2684
8	2	32	7513
9	4	23	9855
10	5	23	4521
11	3	12	1564

In [47]:

```
df['new1']=df['1']/max(df['1'])
```

In [48]:

```
df
```

Out[48]:

	1	67	1000	new1
0	2	17	1547	0.250
1	5	96	2587	0.625
2	6	74	4586	0.750
3	3	38	3578	0.375
4	4	87	1486	0.500
5	8	54	5713	1.000
6	3	43	9841	0.375
7	4	23	2684	0.500
8	2	32	7513	0.250
9	4	23	9855	0.500
10	5	23	4521	0.625
11	3	12	1564	0.375

In [55]:

```
df['new2']=(df['67']-min(df['67']))/(max(df['67'])-min(df['67']))
```

In [56]:

```
1 df
```

Out[56]:

	1	67	1000	new1	new2	new3
0	2	17	1547	0.250	0.059524	-1.011055
1	5	96	2587	0.625	1.000000	-0.669207
2	6	74	4586	0.750	0.738095	-0.012135
3	3	38	3578	0.375	0.309524	-0.343465
4	4	87	1486	0.500	0.892857	-1.031106
5	8	54	5713	1.000	0.500000	0.358311
6	3	43	9841	0.375	0.369048	1.715186
7	4	23	2684	0.500	0.130952	-0.637323
8	2	32	7513	0.250	0.238095	0.949972
9	4	23	9855	0.500	0.130952	1.719788
10	5	23	4521	0.625	0.130952	-0.033500
11	3	12	1564	0.375	0.000000	-1.005467

In [57]:

```
1 df['new3']=(df['1000']-(df['1000'].mean()))/((df['1000']).std())
```

In [58]:

```
1 df
```

Out[58]:

	1	67	1000	new1	new2	new3
0	2	17	1547	0.250	0.059524	-1.011055
1	5	96	2587	0.625	1.000000	-0.669207
2	6	74	4586	0.750	0.738095	-0.012135
3	3	38	3578	0.375	0.309524	-0.343465
4	4	87	1486	0.500	0.892857	-1.031106
5	8	54	5713	1.000	0.500000	0.358311
6	3	43	9841	0.375	0.369048	1.715186
7	4	23	2684	0.500	0.130952	-0.637323
8	2	32	7513	0.250	0.238095	0.949972
9	4	23	9855	0.500	0.130952	1.719788
10	5	23	4521	0.625	0.130952	-0.033500
11	3	12	1564	0.375	0.000000	-1.005467

In [59]:

```
lst=[1,2,3,4,5,6]
arr=np.array(lst)
```

In [60]:

```
arr
```

Out[60]:

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

In [61]:

```
arr=np.array([1,2,3,4,5,6,7])
```

In [62]:

```
arr
```

Out[62]:

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

In [63]:

```
lst[2]
```

Out[63]:

```
3
```

In [65]:

```

```

```
<>:2: SyntaxWarning: list indices must be integers or slices, not tuple; p
erhaps you missed a comma?
<>:5: SyntaxWarning: list indices must be integers or slices, not tuple; p
erhaps you missed a comma?
<>:2: SyntaxWarning: list indices must be integers or slices, not tuple; p
erhaps you missed a comma?
<>:5: SyntaxWarning: list indices must be integers or slices, not tuple; p
erhaps you missed a comma?
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:2: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:5: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:2: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:5: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:2: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:5: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:2: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:5: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:2: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
C:\Users\klmar\AppData\Local\Temp\ipykernel_28268\3096359092.py:5: SyntaxW
arning: list indices must be integers or slices, not tuple; perhaps you mi
ssed a comma?
  [[1,2,4],[4,5,6,]]
```

```
---------------------------------------------------------------------------
-
TypeError                                 Traceback (most recent call las
t)
Input In [65], in <cell line: 2>()
      1 arr=[[
----> 2     [[1,2,4],[4,5,6,]]
      3     [[4,2,3],[1,7,8]] ]
      4     [
      5     [[1,2,4],[4,5,6,]]
      6     [[4,2,3],[1,7,8]] ]]

TypeError: list indices must be integers or slices, not tuple
```

In [68]:

```
arr.shape
```

Out[68]:

```
(2, 5, 2, 5)
```

In [66]:

```
arr=np.arange(0,100).reshape(2,5,2,5)
```

In [67]:

```
arr
```

Out[67]:

```
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 [ ]:

```
2,5,2,5
```

In [69]:

```
arr[0]
```

Out[69]:

```
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 [70]:

```
arr.shape
```

Out[70]:

```
(2, 5, 2, 5)
```

In [74]:

```
1 arr
```

Out[74]:

```
array([[[[495, 339, 476],
         [371, 409, 334],
         [232, 324, 484],
         [397, 325, 231]],

        [[251, 496, 264],
         [377, 301, 443],
         [388, 434, 271],
         [228, 394, 295]]],


       [[[431, 405, 244],
         [221, 454, 201],
         [241, 311, 464],
         [242, 346, 310]],

        [[254, 247, 466],
         [491, 218, 295],
         [200, 263, 411],
         [377, 310, 417]]],


       [[[376, 213, 352],
         [342, 210, 231],
         [258, 208, 420],
         [463, 304, 259]],

        [[294, 343, 226],
         [441, 464, 437],
         [238, 229, 375],
         [230, 376, 200]]],


       [[[336, 316, 466],
         [464, 464, 432],
         [418, 368, 335],
         [294, 254, 234]],

        [[370, 459, 282],
         [257, 330, 425],
         [268, 416, 202],
         [378, 499, 400]]],


       [[[257, 318, 481],
         [463, 285, 211],
         [290, 458, 490],
         [408, 488, 498]],

        [[235, 355, 254],
         [473, 205, 247],
         [252, 206, 334],
         [383, 332, 259]]]])
```

In [ ]:

```
5,2,4,3
```

In [77]:

```
arr.shape
```

Out[77]:

```
(5, 2, 4, 3)
```

In [79]:

```
1 arr
```

Out[79]:

```
array([[[[141, 157],
         [141, 568],
         [141, 568],
         [157, 157]],

        [[141, 568],
         [141, 157],
         [141, 141],
         [568, 568]],

        [[157, 141],
         [157, 157],
         [141, 568],
         [141, 568]]],


       [[[568, 568],
         [568, 568],
         [141, 157],
         [157, 141]],
```

In [80]:

```
1 arr.shape
```

```
        [[157, 157],
         [141, 141],
Out[80]: [157, 568],
         [157, 141]],
(5, 3, 4, 2)
        [[568, 157],
         [568, 568],
In [81]: [157, 568],
         [157, 568]],
```

```
1 arr=arr.flatten()
```

```
In [82]:
        [[[141, 141],
```

```
1 arr
```

```
         [568, 157],
         [568, 568],
Out[82]: [568, 568]],

array([[[[141, 157, 141, 568, 141, 568, 157, 157, 141, 568, 141, 157, 141,
          141, 568, 157, 141, 157, 157, 141, 568, 141, 568, 568, 568,
          568, 141, 157, 157, 157, 141, 157, 157, 141, 141, 157, 568, 157,
          141, 141, 568, 157, 568, 568, 157, 568, 157, 568, 141, 141, 568, 157,
          568, 568, 568, 568, 141, 141, 141, 157, 141, 157, 141, 568, 141,
          141, 141, 157, 141, 141, 157, 568, 157, 568, 157, 141, 568, 157, 157,
          141, 157, 141, 141, 141, 568, 568, 141, 568, 157, 568, 568, 157,
          568, 157, 568, 157, 568, 157, 568, 568, 157, 568, 141, 141, 141,
          568, 568, 141, 157, 157, 568, 141, 141, 568, 141, 157, 568, 157, 157, 141,
          141, 568, 157])
```

In [83]:

```
1 arr.shape
```

```
        [[568, 157],
         [141, 568],
         [157, 157],
         [141, 141]],
Out[83]:
        [[141, 141],
(120,)   [141, 568],
         [568, 141],
         [568, 157]],

        [[568, 568],
         [157, 568],
         [157, 568],
```

```
       [157, 568]]],
```

In [88]:

```
arr=np.arange(1,1001).reshape(2,50,10)
```

```
array([[[157, 568],
        [568, 157],
        [568, 141],
        [141, 141]],

       [[568, 141],
        [157, 568],
        [141, 141],
        [568, 141]],

       [[157, 568],
        [157, 157],
        [141, 141],
        [568, 157]]])
```

In [89]:

```
1 arr
```

Out[89]:

```
array([[[   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,  100],
        [ 101,  102,  103,  104,  105,  106,  107,  108,  109,  110],
        [ 111,  112,  113,  114,  115,  116,  117,  118,  119,  120],
        [ 121,  122,  123,  124,  125,  126,  127,  128,  129,  130],
        [ 131,  132,  133,  134,  135,  136,  137,  138,  139,  140],
        [ 141,  142,  143,  144,  145,  146,  147,  148,  149,  150],
        [ 151,  152,  153,  154,  155,  156,  157,  158,  159,  160],
        [ 161,  162,  163,  164,  165,  166,  167,  168,  169,  170],
        [ 171,  172,  173,  174,  175,  176,  177,  178,  179,  180],
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        [ 191,  192,  193,  194,  195,  196,  197,  198,  199,  200],
        [ 201,  202,  203,  204,  205,  206,  207,  208,  209,  210],
        [ 211,  212,  213,  214,  215,  216,  217,  218,  219,  220],
        [ 221,  222,  223,  224,  225,  226,  227,  228,  229,  230],
        [ 231,  232,  233,  234,  235,  236,  237,  238,  239,  240],
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        [ 261,  262,  263,  264,  265,  266,  267,  268,  269,  270],
        [ 271,  272,  273,  274,  275,  276,  277,  278,  279,  280],
        [ 281,  282,  283,  284,  285,  286,  287,  288,  289,  290],
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        [ 321,  322,  323,  324,  325,  326,  327,  328,  329,  330],
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        [ 481,  482,  483,  484,  485,  486,  487,  488,  489,  490],
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       [[ 501,  502,  503,  504,  505,  506,  507,  508,  509,  510],
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        [ 581,  582,  583,  584,  585,  586,  587,  588,  589,  590],
        [ 591,  592,  593,  594,  595,  596,  597,  598,  599,  600],
```

In [90]:
```
arr.ravel()
```

```
array([[[  1,   2,   3,   4,   5,   6,   7,   8,   9,  10],
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        [ 81,  82,  83,  84,  85,  86,  87,  88,  89,  90],
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        [111, 112, 113, 114, 115, 116, 117, 118, 119, 120],
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        [641, 642, 643, 644, 645, 646, 647, 648, 649, 650],
        [651, 652, 653, 654, 655, 656, 657, 658, 659, 660],
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        [671, 672, 673, 674, 675, 676, 677, 678, 679, 680],
        [681, 682, 683, 684, 685, 686, 687, 688, 689, 690],
        [691, 692, 693, 694, 695, 696, 697, 698, 699, 700],
        [701, 702, 703, 704, 705, 706, 707, 708, 709, 710],
        [711, 712, 713, 714, 715, 716, 717, 718, 719, 720],
        [721, 722, 723, 724, 725, 726, 727, 728, 729, 730],
        [731, 732, 733, 734, 735, 736, 737, 738, 739, 740],
        [741, 742, 743, 744, 745, 746, 747, 748, 749, 750],
        [751, 752, 753, 754, 755, 756, 757, 758, 759, 760],
        [761, 762, 763, 764, 765, 766, 767, 768, 769, 770],
        [771, 772, 773, 774, 775, 776, 777, 778, 779, 780],
        [781, 782, 783, 784, 785, 786, 787, 788, 789, 790],
        [791, 792, 793, 794, 795, 796, 797, 798, 799, 800],
        [801, 802, 803, 804, 805, 806, 807, 808, 809, 810],
        [811, 812, 813, 814, 815, 816, 817, 818, 819, 820],
        [821, 822, 823, 824, 825, 826, 827, 828, 829, 830],
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        [841, 842, 843, 844, 845, 846, 847, 848, 849, 850],
        [851, 852, 853, 854, 855, 856, 857, 858, 859, 860],
        [861, 862, 863, 864, 865, 866, 867, 868, 869, 870],
        [871, 872, 873, 874, 875, 876, 877, 878, 879, 880],
        [881, 882, 883, 884, 885, 886, 887, 888, 889, 890],
        [891, 892, 893, 894, 895, 896, 897, 898, 899, 900],
        [901, 902, 903, 904, 905, 906, 907, 908, 909, 910],
        [911, 912, 913, 914, 915, 916, 917, 918, 919, 920],
        [921, 922, 923, 924, 925, 926, 927, 928, 929, 930],
        [931, 932, 933, 934, 935, 936, 937, 938, 939, 940],
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        [951, 952, 953, 954, 955, 956, 957, 958, 959, 960],
        [961, 962, 963, 964, 965, 966, 967, 968, 969, 970],
        [971, 972, 973, 974, 975, 976, 977, 978, 979, 980],
        [981, 982, 983, 984, 985, 986, 987, 988, 989, 990],
        [991, 992, 993, 994, 995, 996, 997, 998, 999, 1000]]])
```

Out[90]:

```
array([   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,
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         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,
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        507,  508,  509,  510,  511,  512,  513,  514,  515,  516,  517,
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```

In [91]:

```
arr
```

```
array([  1,   2,   3,   4,   5,   6,   7,   8,   9,  10,  11,
        12,  13,  14,  15,  16,  17,  18,  19,  20,  21,  22,  23,
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In [92]:

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Out[93]:

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In [94]:

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```

Out[94]:

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```

In [142]:

```
arr
```

Out[142]:

```
array([ 21, -47,  50,  61])
```

In [114]:

```
arr=np.arange(1,7)
```

In [115]:

```
arr
```

Out[115]:

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

In [116]:

```
arr1=arr
```

In [117]:
```
arr1
```

Out[117]:
```
array([1738, 3734, 5740])
```

In [118]:
```
arr
```

Out[118]:
```
array([1, 2, 3, 4, 5, 6])
```

In [122]:
```
arr1
```

Out[122]:
```
array([1, 2, 3, 4, 5, 6])
```

In [121]:
```
arr
```

Out[121]:
```
array([2, 3, 4, 5, 6, 7])
```

In [123]:
```
np.random.randint(1,10,100)
```

Out[123]:
```
array([7, 4, 7, 9, 4, 6, 8, 4, 9, 2, 8, 8, 1, 9, 6, 2, 2, 1, 9, 6, 9, 7,
       8, 9, 1, 6, 1, 5, 6, 8, 5, 4, 8, 7, 2, 1, 3, 6, 5, 5, 2, 8, 6, 1,
       2, 1, 4, 5, 2, 3, 1, 5, 7, 8, 5, 5, 8, 2, 7, 6, 6, 1, 8, 7, 7, 2,
       7, 1, 8, 4, 9, 1, 5, 4, 4, 1, 2, 9, 6, 6, 3, 4, 5, 3, 4, 6, 7, 3,
       7, 6, 5, 8, 9, 2, 6, 4, 6, 1, 8, 4])
```

In [124]:
```
arr=np.array([1,2,3])
```

In [125]:
```
np.random.choice(arr,10)
```

Out[125]:
```
array([2, 1, 3, 1, 2, 1, 2, 3, 1, 1])
```

In [127]:

```
1 np.linspace(1,2,10)
```

Out[127]:

```
array([1.        , 1.11111111, 1.22222222, 1.33333333, 1.44444444,
       1.55555556, 1.66666667, 1.77777778, 1.88888889, 2.        ])
```

In [128]:

```
1 arr=np.array([77,82,69,1,7])
```

In [129]:

```
1 arr
```

Out[129]:

```
array([77, 82, 69,  1,  7])
```

In [130]:

```
1 np.argsort(arr)
```

Out[130]:

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

In [131]:

```
1 np.sort(arr)
```

Out[131]:

```
array([ 1,  7, 69, 77, 82])
```

In [132]:

```
1 arr=np.array([21,-47,50,-61])
```

In [133]:

```
1 arr
```

Out[133]:

```
array([ 21, -47,  50, -61])
```

In [134]:

```
1 np.argsort(arr)
```

Out[134]:

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

In [136]:

```
a=np.array([3,8,5,4,1])
b=np.array([9,1,7,0,5])
```

In [137]:

```
a.max()
```

Out[137]:

```
8
```

In [138]:

```
a.min()
```

Out[138]:

```
1
```

In [139]:

```
np.maximum(a,b)
```

Out[139]:

```
array([9, 8, 7, 4, 5])
```

In [140]:

```
np.minimum(a,b)
```

Out[140]:

```
array([3, 1, 5, 0, 1])
```

In [141]:

```
np.ndim(arr)
```

Out[141]:

```
1
```

In [173]:

```
arr=np.arange(1,10).reshape(3,3)
```

In [174]:

```
arr
```

Out[174]:

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

In [175]:

```
mat=np.matrix(arr)
```

In [176]:

```
mat
```

Out[176]:

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

In [181]:

```
np.invert(arr)
```

Out[181]:

```
array([[ -2,  -3,  -4],
       [ -5,  -6,  -7],
       [ -8,  -9, -10]], dtype=int32)
```

In [182]:

```
np.linalg.inv(arr)
```

Out[182]:

```
array([[-4.50359963e+15,  9.00719925e+15, -4.50359963e+15],
       [ 9.00719925e+15, -1.80143985e+16,  9.00719925e+15],
       [-4.50359963e+15,  9.00719925e+15, -4.50359963e+15]])
```

In [183]:

```
np.linalg.det(arr)
```

Out[183]:

```
6.66133814775094e-16
```

In [184]:

```
np.linalg.eig(arr)
```

Out[184]:

```
(array([ 1.61168440e+01, -1.11684397e+00, -4.22209278e-16]),
 array([[-0.23197069, -0.78583024,  0.40824829],
        [-0.52532209, -0.08675134, -0.81649658],
        [-0.8186735 ,  0.61232756,  0.40824829]]))
```

In [185]:

```
np.sum(a)
```

Out[185]:

```
21
```

In [186]:

```
1 a.sum()
```

Out[186]:

```
21
```

In [188]:

```
1 arr
```

Out[188]:

In [189]:

```
arr.shape
```

Out[189]:

```
(2, 5, 5, 7)
```

In [ ]:

```

```

```
array([[[[235, 392, 461, 616, 463, 270, 398],
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         [929, 583, 981,  81, 483,  51, 507],
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         [647, 271, 508, 615, 999, 792, 539]]],


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         [461, 283, 720, 609, 225, 111, 479],
         [572, 760, 693, 163, 942, 426, 210]],

        [[442, 877, 446, 252, 996, 203, 814],
         [788, 698, 190, 216,  47, 151, 960],
```