In [2]:

```
pip install numpy
```

```
Defaulting to user installation because normal site-packages is not writea
ble
Requirement already satisfied: numpy in c:\programdata\anaconda3\lib\site-
packages (1.24.3)
Note: you may need to restart the kernel to use updated packages.
```

In [2]:

```
import numpy as np
```

In [3]:

```
A= np.array([[1,3],[4,5]])
A
```

Out[3]:

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

In [4]:

```
B= np.array([[1,2,8],[4,5,9],[10,11,12]])
B
```

Out[4]:

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

In [15]:

```
C= np.array([[1,2,3,4],[15,16,17,14],[20,25,30,1],[5,14,3,21]])
C
```

Out[15]:

```
array([[ 1,  2,  3,  4],
       [15, 16, 17, 14],
       [20, 25, 30,  1],
       [ 5, 14,  3, 21]])
```

In [23]:

```
D= np.array([[1,2,3,4,5],[13,4,5,16,7],[9,10,1,2,3],[12,11,15,16,1],[6,7,8,9,10]])
D
```

Out[23]:

```
array([[ 1,  2,  3,  4,  5],
       [13,  4,  5, 16,  7],
       [ 9, 10,  1,  2,  3],
       [12, 11, 15, 16,  1],
       [ 6,  7,  8,  9, 10]])
```

In [7]:

```
E=np.array([[11,13],[14,15]])
E
```

Out[7]:

```
array([[11, 13],
       [14, 15]])
```

In [11]:

```
from numpy import linalg as la
```

In [12]:

```
print(la.det(A))
```

```
-6.999999999999999
```

In [13]:

```
print(la.det(B))
```

```
-2.999999999999982
```

In [16]:

```
print(la.det(C))
```

```
8320.00000000001
```

In [24]:

```
print(la.det(D))
```

```
-14000.0
```

In [18]:

```
print(la.det(E))
```

```
-17.00000000000001
```

In [19]:

```
print(la.inv(A))
```

```
[[-0.71428571  0.42857143]
 [ 0.57142857 -0.14285714]]
```

In [20]:

```
print(la.inv(B))
```

```
[[ 13.         -21.33333333   7.33333333]
 [-14.          22.66666667  -7.66666667]
 [  2.          -3.           1.        ]]
```

In [21]:

```
print(la.inv(C))
```

```
[[-0.41887019  0.19939904 -0.06610577 -0.05      ]
 [-0.13100962 -0.11754808  0.06971154  0.1       ]
 [ 0.38401442 -0.03617788  0.02043269 -0.05      ]
 [ 0.13221154  0.03605769 -0.03365385  0.        ]]
```

In [25]:

```
print(la.inv(D))
```

```
[[-9.38571429e-01  5.71428571e-02 -7.85714286e-02 -7.14285714e-02
   4.60000000e-01]
 [ 7.98571429e-01 -5.71428571e-02  1.78571429e-01  7.14285714e-02
  -4.20000000e-01]
 [-7.60000000e-01 -5.00000000e-02 -1.50000000e-01  5.22997623e-17
   4.60000000e-01]
 [ 8.78571429e-01  4.28571429e-02  7.85714286e-02  7.14285714e-02
  -5.00000000e-01]
 [-1.78571429e-01  7.14285714e-03 -2.85714286e-02 -7.14285714e-02
   2.00000000e-01]]
```

In [26]:

```
print(la.inv(E))
```

```
[[-0.88235294  0.76470588]
 [ 0.82352941 -0.64705882]]
```

In [27]:

```
print(la.matrix_rank(A))
print(np.diag(A))
print(np.trace(A))
```

```
2
[1 5]
6
```

In [28]:

```
print(la.matrix_rank(B))
print(np.diag(B))
print(np.trace(B))
```

```
3
[ 1  5 12]
18
```

In [29]:

```
print(la.matrix_rank(C))
print(np.diag(C))
print(np.trace(C))
```

```
4
[ 1 16 30 21]
68
```

In [30]:

```
print(la.matrix_rank(D))
print(np.diag(D))
print(np.trace(D))
```

```
5
[ 1  4  1 16 10]
32
```

In [31]:

```
print(la.matrix_rank(E))
print(np.diag(E))
print(np.trace(E))
```

```
2
[11 15]
26
```

In [32]:

```
x,y=la.eig(A)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [-1.  7.]
Vectors: [[-0.83205029 -0.4472136 ]
 [ 0.5547002  -0.89442719]]
```

In [33]:

```
x,y=la.eig(B)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [22.81551702 -4.84266929  0.02715227]
Vectors: [[-0.34007748 -0.74971029  0.6804496 ]
 [-0.48374764 -0.25406174 -0.72610665]
 [-0.80643383  0.6110541   0.09877993]]
```

In [34]:

```
x,y=la.eig(C)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [51.01937593+0.j         -2.21706749+1.64307666j -2.21706749-1.6430
7666j
 21.41475904+0.j        ]
Vectors: [[ 0.09491939+0.j          0.48174036+0.31645425j  0.48174036-0.3
1645425j
   0.06737554+0.j        ]
 [ 0.54640177+0.j          0.38777104-0.29569779j  0.38777104+0.29569779j
   0.13505321+0.j        ]
 [ 0.75666769+0.j         -0.59165857+0.j         -0.59165857-0.j
  -0.63816521+0.j        ]
 [ 0.34625053+0.j         -0.26757905+0.09121931j -0.26757905-0.09121931j
   0.75496115+0.j        ]]
```

In [35]:

```
x,y=la.eig(D)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [36.41001577+0.j         -4.49694426+6.60287372j -4.49694426-6.6028
7372j
 -1.06631276+0.j          5.65018551+0.j        ]
Vectors: [[ 0.19021534+0.j          0.09823469-0.01417045j  0.09823469+0.0
1417045j
   0.5518694 +0.j          0.27653325+0.j        ]
 [ 0.52730122+0.j          0.22807759-0.53460462j  0.22807759+0.53460462j
  -0.52130157+0.j         -0.18162573+0.j        ]
 [ 0.2726577 +0.j         -0.68745292+0.j         -0.68745292-0.j
   0.45690317+0.j          0.29607796+0.j        ]
 [ 0.61977104+0.j          0.20466229+0.35756351j  0.20466229-0.35756351j
  -0.45787727+0.j         -0.61926597+0.j        ]
 [ 0.47677372+0.j          0.0682259 +0.07309612j  0.0682259 -0.07309612j
   0.07261358+0.j          0.64760247+0.j        ]]
```

In [36]:

```
x,y=la.eig(E)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [-0.6381817 26.6381817]
Vectors: [[-0.74505324 -0.63926056]
 [ 0.667005   -0.76899021]]
```

In [37]:

```
print(la.eigvals(A))
print(la.eigvals(B))
print(la.eigvals(C))
print(la.eigvals(D))
print(la.eigvals(E))
```

```
[-1.  7.]
[22.81551702 -4.84266929  0.02715227]
[51.01937593+0.j         -2.21706749+1.64307666j -2.21706749-1.64307666j
 21.41475904+0.j        ]
[36.41001577+0.j         -4.49694426+6.60287372j -4.49694426-6.60287372j
 -1.06631276+0.j          5.65018551+0.j        ]
[-0.6381817 26.6381817]
```

In [38]:

```
pip install pandas
```

```
Defaulting to user installation because normal site-packages is not writea
ble
Requirement already satisfied: pandas in c:\programdata\anaconda3\lib\site
-packages (1.5.3)
Requirement already satisfied: python-dateutil>=2.8.1 in c:\programdata\an
aconda3\lib\site-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\programdata\anaconda3\li
b\site-packages (from pandas) (2022.7)
Requirement already satisfied: numpy>=1.21.0 in c:\programdata\anaconda3\l
ib\site-packages (from pandas) (1.24.3)
Requirement already satisfied: six>=1.5 in c:\programdata\anaconda3\lib\si
te-packages (from python-dateutil>=2.8.1->pandas) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

In [14]:

```
import pandas as pd
```

In [28]:

```
d1={
    'Age':pd.Series([10,20,30,40,50]),
    'Weight':pd.Series([35,56,45,78,67]) }
print(d1)
```

```
{'Age': 0    10
1    20
2    30
3    40
4    50
dtype: int64, 'Weight': 0    35
1    56
2    45
3    78
4    67
dtype: int64}
```

In [18]:

```
d2={'Reg no':pd.Series([31,25,35,36,20]),
    'Marks':pd.Series([50,45,30,40,35]) }
print(d2)
```

```
{'Reg no': 0    31
1    25
2    35
3    36
4    20
dtype: int64, 'Marks': 0    50
1    45
2    30
3    40
4    35
dtype: int64}
```

In [23]:

```
d3={'Food':pd.Series([1,2,3]),
    'Price':pd.Series([120,150,160]) }
print(d3)
```

```
{'Food': 0    1
1    2
2    3
dtype: int64, 'Price': 0    120
1    150
2    160
dtype: int64}
```

In [24]:

```
d4={'Drinks':pd.Series([6,7,8]),
    'Price':pd.Series([25,50,75]) }
print(d4)
```

```
{'Drinks': 0    6
1    7
2    8
dtype: int64, 'Price': 0    25
1    50
2    75
dtype: int64}
```

In [25]:

```
d5={'Ice creams':pd.Series([10,11,12,13]),
    'Price':pd.Series([50,60,70,55]) }
print(d5)
```

```
{'Ice creams': 0    10
1    11
2    12
3    13
dtype: int64, 'Price': 0    50
1    60
2    70
3    55
dtype: int64}
```

In [30]:

```
a=pd.DataFrame(d1)
a
```

Out[30]:

	Age	Weight
0	10	35
1	20	56
2	30	45
3	40	78
4	50	67

In [31]:

```
b=pd.DataFrame(d2)
b
```

Out[31]:

	Reg no	Marks
0	31	50
1	25	45
2	35	30
3	36	40
4	20	35

In [32]:

```
c=pd.DataFrame(d3)
c
```

Out[32]:

	Food	Price
0	1	120
1	2	150
2	3	160

In [33]:

```
d=pd.DataFrame(d4)
d
```

Out[33]:

	Drinks	Price
0	6	25
1	7	50
2	8	75

In [34]:

```
e=pd.DataFrame(d5)
e
```

Out[34]:

	Ice creams	Price
0	10	50
1	11	60
2	12	70
3	13	55

In [35]:

```
print(a.mean())
print(a.median())
print(a.mode())
```

```
Age       30.0
Weight    56.2
dtype: float64
Age       30.0
Weight    56.0
dtype: float64
   Age  Weight
0   10      35
1   20      45
2   30      56
3   40      67
4   50      78
```

In [36]:

```
print(b.mean())
print(b.median())
print(b.mode())
```

```
Reg no    29.4
Marks     40.0
dtype: float64
Reg no    31.0
Marks     40.0
dtype: float64
   Reg no  Marks
0      20     30
1      25     35
2      31     40
3      35     45
4      36     50
```

In [37]:

```
print(c.mean())
print(c.median())
print(c.mode())
```

```
Food       2.000000
Price    143.333333
dtype: float64
Food       2.0
Price    150.0
dtype: float64
   Food  Price
0     1    120
1     2    150
2     3    160
```

In [38]:

```
print(d.mean())
print(d.median())
print(d.mode())
```

```
Drinks     7.0
Price     50.0
dtype: float64
Drinks     7.0
Price     50.0
dtype: float64
   Drinks  Price
0       6     25
1       7     50
2       8     75
```

In [39]:

```
print(e.mean())
print(e.median())
print(e.mode())
```

```
Ice creams    11.50
Price         58.75
dtype: float64
Ice creams    11.5
Price         57.5
dtype: float64
   Ice creams  Price
0          10     50
1          11     55
2          12     60
3          13     70
```

In [40]:

```
print(a.sum())
print(a.cumsum())
print(a.count())
print(a.max())
print(a.min())
```

```
Age       150
Weight    281
dtype: int64
   Age  Weight
0   10      35
1   30      91
2   60     136
3  100     214
4  150     281
Age       5
Weight    5
dtype: int64
Age       50
Weight    78
dtype: int64
Age       10
Weight    35
dtype: int64
```

In [41]:

```
print(b.sum())
print(b.cumsum())
print(b.count())
print(b.max())
print(b.min())
```

```
Reg no    147
Marks     200
dtype: int64
   Reg no  Marks
0      31     50
1      56     95
2      91    125
3     127    165
4     147    200
Reg no    5
Marks     5
dtype: int64
Reg no    36
Marks     50
dtype: int64
Reg no    20
Marks     30
dtype: int64
```

In [42]:

```
print(c.sum())
print(c.cumsum())
print(c.count())
print(c.max())
print(c.min())
```

```
Food       6
Price    430
dtype: int64
   Food  Price
0     1    120
1     3    270
2     6    430
Food     3
Price    3
dtype: int64
Food       3
Price    160
dtype: int64
Food       1
Price    120
dtype: int64
```

In [43]:

```
print(d.sum())
print(d.cumsum())
print(d.count())
print(d.max())
print(d.min())
```

```
Drinks     21
Price     150
dtype: int64
   Drinks  Price
0       6     25
1      13     75
2      21    150
Drinks    3
Price     3
dtype: int64
Drinks     8
Price     75
dtype: int64
Drinks     6
Price     25
dtype: int64
```

In [44]:

```
print(e.sum())
print(e.cumsum())
print(e.count())
print(e.max())
print(e.min())
```

```
Ice creams     46
Price         235
dtype: int64
   Ice creams  Price
0          10     50
1          21    110
2          33    180
3          46    235
Ice creams    4
Price         4
dtype: int64
Ice creams    13
Price         70
dtype: int64
Ice creams    10
Price         50
dtype: int64
```

In [45]:

```
print(a.describe())
print(b.describe())
print(c.describe())
print(d.describe())
print(e.describe())
```

```
             Age     Weight
count   5.000000   5.000000
mean   30.000000  56.200000
std    15.811388  17.079227
min    10.000000  35.000000
25%    20.000000  45.000000
50%    30.000000  56.000000
75%    40.000000  67.000000
max    50.000000  78.000000
         Reg no      Marks
count   5.00000   5.000000
mean   29.40000  40.000000
std     6.80441   7.905694
min    20.00000  30.000000
25%    25.00000  35.000000
50%    31.00000  40.000000
75%    35.00000  45.000000
max    36.00000  50.000000
       Food       Price
count   3.0    3.000000
mean    2.0  143.333333
std     1.0   20.816660
min     1.0  120.000000
25%     1.5  135.000000
50%     2.0  150.000000
75%     2.5  155.000000
max     3.0  160.000000
       Drinks  Price
count     3.0    3.0
mean      7.0   50.0
std       1.0   25.0
min       6.0   25.0
25%       6.5   37.5
50%       7.0   50.0
75%       7.5   62.5
max       8.0   75.0
       Ice creams      Price
count    4.000000   4.000000
mean    11.500000  58.750000
std      1.290994   8.539126
min     10.000000  50.000000
25%     10.750000  53.750000
50%     11.500000  57.500000
75%     12.250000  62.500000
max     13.000000  70.000000
```

In [46]:

```
from numpy import cov
covariance=cov(a,b)
print(covariance)
```

```
[[312.5 450.  187.5 475.  212.5 237.5 250.  -62.5  50.  187.5]
 [450.  648.  270.  684.  306.  342.  360.  -90.   72.  270. ]
 [187.5 270.  112.5 285.  127.5 142.5 150.  -37.5  30.  112.5]
 [475.  684.  285.  722.  323.  361.  380.  -95.   76.  285. ]
 [212.5 306.  127.5 323.  144.5 161.5 170.  -42.5  34.  127.5]
 [237.5 342.  142.5 361.  161.5 180.5 190.  -47.5  38.  142.5]
 [250.  360.  150.  380.  170.  190.  200.  -50.   40.  150. ]
 [-62.5 -90.  -37.5 -95.  -42.5 -47.5 -50.   12.5 -10.  -37.5]
 [ 50.   72.   30.   76.   34.   38.   40.  -10.    8.   30. ]
 [187.5 270.  112.5 285.  127.5 142.5 150.  -37.5  30.  112.5]]
```

In [47]:

```
covariance=cov(b,c)
print(covariance)
```

```
[[ 1.80500e+02  1.90000e+02 -4.75000e+01  3.80000e+01  1.42500e+02
   1.13050e+03  1.40600e+03  1.49150e+03]
 [ 1.90000e+02  2.00000e+02 -5.00000e+01  4.00000e+01  1.50000e+02
   1.19000e+03  1.48000e+03  1.57000e+03]
 [-4.75000e+01 -5.00000e+01  1.25000e+01 -1.00000e+01 -3.75000e+01
  -2.97500e+02 -3.70000e+02 -3.92500e+02]
 [ 3.80000e+01  4.00000e+01 -1.00000e+01  8.00000e+00  3.00000e+01
   2.38000e+02  2.96000e+02  3.14000e+02]
 [ 1.42500e+02  1.50000e+02 -3.75000e+01  3.00000e+01  1.12500e+02
   8.92500e+02  1.11000e+03  1.17750e+03]
 [ 1.13050e+03  1.19000e+03 -2.97500e+02  2.38000e+02  8.92500e+02
   7.08050e+03  8.80600e+03  9.34150e+03]
 [ 1.40600e+03  1.48000e+03 -3.70000e+02  2.96000e+02  1.11000e+03
   8.80600e+03  1.09520e+04  1.16180e+04]
 [ 1.49150e+03  1.57000e+03 -3.92500e+02  3.14000e+02  1.17750e+03
   9.34150e+03  1.16180e+04  1.23245e+04]]
```

In [48]:

```
covariance=cov(c,d)
print(covariance)
```

```
[[ 7080.5  8806.   9341.5  1130.5  2558.5  3986.5]
 [ 8806.  10952.  11618.   1406.   3182.   4958. ]
 [ 9341.5 11618.  12324.5  1491.5  3375.5  5259.5]
 [ 1130.5  1406.   1491.5   180.5   408.5   636.5]
 [ 2558.5  3182.   3375.5   408.5   924.5  1440.5]
 [ 3986.5  4958.   5259.5   636.5  1440.5  2244.5]]
```

In [49]:

```
covariance=cov(d,e)
print(covariance)
```

```
[[ 180.5  408.5  636.5  380.   465.5  551.   399. ]
 [ 408.5  924.5 1440.5  860.  1053.5 1247.   903. ]
 [ 636.5 1440.5 2244.5 1340.  1641.5 1943.  1407. ]
 [ 380.   860.  1340.   800.   980.  1160.   840. ]
 [ 465.5 1053.5 1641.5  980.  1200.5 1421.  1029. ]
 [ 551.  1247.  1943.  1160.  1421.  1682.  1218. ]
 [ 399.   903.  1407.   840.  1029.  1218.   882. ]]
```

In [50]:

```
pip install scipy
```

```
Defaulting to user installation because normal site-packages is not writea
ble
Requirement already satisfied: scipy in c:\programdata\anaconda3\lib\site-
packages (1.10.1)
Requirement already satisfied: numpy<1.27.0,>=1.19.5 in c:\programdata\ana
conda3\lib\site-packages (from scipy) (1.24.3)
Note: you may need to restart the kernel to use updated packages.
```

In [51]:

```
from scipy.stats import pearsonr
a=[1,2,3,4,5,6,7,8,9,10]
b=[11,13,15,16,24,56,34,25,39,90]
corr=pearsonr(a,b)
print(corr)
```

```
PearsonRResult(statistic=0.767143303518697, pvalue=0.009605641558179966)
```

In [52]:

```
from scipy.stats import spearmanr
a=[1,2,3,4,5,6,7,8,9,10]
b=[11,13,15,16,24,56,34,25,39,90]
corr=spearmanr(a,b)
print(corr)
```

```
SignificanceResult(statistic=0.9151515151515152, pvalue=0.0002044724061488
323)
```

In [ ]:

```

```