

In [1]:

```
pip install numpy
```

Defaulting to user installation because normal site-packages is not writeable

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]:

```
A1= np.array([[8,3],[2,5]])  
A1
```

Out[3]:

```
array([[8, 3],  
       [2, 5]])
```

In [4]:

```
A2= np.array([[6,2,8],[7,5,9],[10,7,12]])  
A2
```

Out[4]:

```
array([[ 6,  2,  8],  
       [ 7,  5,  9],  
       [10,  7, 12]])
```

In [5]:

```
A3= np.array([[1,2,8,7],[4,5,9,5],[3,10,11,12],[2,7,1,9]])  
A3
```

Out[5]:

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

In [6]:

```
A4= np.array([[1,2,3,4,5],[13,4,5,16,7],[9,10,9,2,3],[12,11,15,16,1],[6,7,8,9,10]])  
A4
```

Out[6]:

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

In [7]:

```
A5=np.array([[9,13],[4,15]])  
A5
```

Out[7]:

```
array([[ 9, 13],  
       [ 4, 15]])
```

In [8]:

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

In [9]:

```
print(la.det(A1))
```

```
33.99999999999999
```

In [10]:

```
print(la.det(A2))
```

```
-13.999999999999996
```

In [11]:

```
print(la.det(A3))
```

```
854.00000000000003
```

In [12]:

```
print(la.det(A4))
```

```
2799.9999999999973
```

In [13]:

```
print(la.det(A5))
```

```
83.00000000000003
```

In [14]:

```
print(la.inv(A1))
```

```
[[ 0.14705882 -0.08823529]  
 [-0.05882353  0.23529412]]
```

In [15]:

```
print(la.inv(A2))
```

```
[[ 0.21428571 -2.28571429  1.57142857]  
 [-0.42857143  0.57142857 -0.14285714]  
 [ 0.07142857  1.57142857 -1.14285714]]
```

In [16]:

```
print(la.inv(A3))
```

```
[[ 0.05386417  0.40163934 -0.3911007   0.25644028]
 [-0.264637   -0.08196721  0.26932084 -0.10772834]
 [ 0.01639344 -0.00819672  0.09836066 -0.13934426]
 [ 0.19203747 -0.02459016 -0.13348946  0.15339578]]
```

In [17]:

```
print(la.inv(A4))
```

```
[[ 1.45000000e+00  2.14285714e-01  3.92857143e-01 -7.14285714e-02
 -9.85714286e-01]
 [-4.63000000e+00 -4.14285714e-01 -8.92857143e-01  7.14285714e-02
  2.86571429e+00]
 [ 3.80000000e+00  2.50000000e-01  7.50000000e-01 -6.56265166e-16
 -2.30000000e+00]
 [-1.51000000e+00 -1.14285714e-01 -3.92857143e-01  7.14285714e-02
  9.45714286e-01]
 [ 6.90000000e-01  6.42857143e-02  1.42857143e-01 -7.14285714e-02
 -3.25714286e-01]]
```

In [18]:

```
print(la.inv(A5))
```

```
[[ 0.18072289 -0.15662651]
 [-0.04819277  0.10843373]]
```

In [19]:

```
print(la.matrix_rank(A1))
print(np.diag(A1))
print(np.trace(A1))
```

```
2
[8 5]
13
```

In [20]:

```
print(la.matrix_rank(A2))
print(np.diag(A2))
print(np.trace(A2))
```

```
3
[ 6  5 12]
23
```

In [21]:

```
print(la.matrix_rank(A3))
print(np.diag(A3))
print(np.trace(A3))
```

```
4
[ 1  5 11  9]
26
```

In [22]:

```
print(la.matrix_rank(A4))
print(np.diag(A4))
print(np.trace(A4))
```

```
5
[ 1  4  9 16 10]
40
```

In [23]:

```
print(la.matrix_rank(A5))
print(np.diag(A5))
print(np.trace(A5))
```

```
2
[ 9 15]
24
```

In [24]:

```
x,y=la.eig(A1)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [9.37228132 3.62771868]
Vectors: [[ 0.90937671 -0.56576746]
 [ 0.41597356  0.82456484]]
```

In [25]:

```
x,y=la.eig(A2)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [22.75320853  0.91745137 -0.67065989]
Vectors: [[-0.41499446 -0.76663189 -0.74955779]
 [-0.53623952  0.53636988 -0.11054773]
 [-0.73500121  0.35296302  0.65264257]]
```

In [26]:

```
x,y=la.eig(A3)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [24.59115216+0.j          -0.82211262+3.27091411j -0.82211262-3.2709
1411j
 3.05307307+0.j          ]
Vectors: [[ 0.37894524+0.j          -0.72375862+0.j          -0.72375862-0.j
 0.2746452 +0.j          ]
 [ 0.48851911+0.j          0.05891729+0.55266168j  0.05891729-0.55266168j
 -0.59158863+0.j          ]
 [ 0.72045716+0.j          -0.03454601-0.16570599j -0.03454601+0.16570599j
 -0.36360115+0.j          ]
 [ 0.31415134+0.j          0.21104332-0.30671825j  0.21104332+0.30671825j
 0.66512187+0.j          ]]
```

In [27]:

```
x,y=la.eig(A4)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [37.57640911+0.j          -1.34784486+4.66388662j -1.34784486-4.6638
8662j
 0.71840881+0.j          4.40087181+0.j          ]
Vectors: [[ 0.18597075+0.j          0.02367304+0.11765285j  0.02367304-0.1
1765285j
 -0.2259305 +0.j          0.20275142+0.j          ]
 [ 0.5112522 +0.j          0.71681004+0.j          0.71681004-0.j
 0.68985564+0.j          -0.45394431+0.j          ]
 [ 0.32947095+0.j          -0.51547931-0.3829098j -0.51547931+0.3829098j
 -0.61095599+0.j          0.55190641+0.j          ]
 [ 0.61474263+0.j          -0.08419871+0.22616468j -0.08419871-0.22616468j
 0.28890047+0.j          -0.5284284 +0.j          ]
 [ 0.46645091+0.j          -0.0309375 +0.01564968j -0.0309375 -0.01564968j
 -0.12776503+0.j          0.41108292+0.j          ]]
```

In [28]:

```
x,y=la.eig(A5)
print("Roots:",x)
print("Vectors:",y)
```

```
Roots: [ 4.18975032 19.81024968]
Vectors: [[-0.93785598 -0.76889231]
 [ 0.34702473 -0.6393783 ]]
```

In [29]:

```
print(la.eigvals(A1))
print(la.eigvals(A2))
print(la.eigvals(A3))
print(la.eigvals(A4))
print(la.eigvals(A5))
```

```
[9.37228132 3.62771868]
[22.75320853  0.91745137 -0.67065989]
[24.59115216+0.j      -0.82211262+3.27091411j -0.82211262-3.27091411j
 3.05307307+0.j      ]
[37.57640911+0.j      -1.34784486+4.66388662j -1.34784486-4.66388662j
 0.71840881+0.j      4.40087181+0.j      ]
[ 4.18975032 19.81024968]
```

In [30]:

```
pip install pandas
```

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

In [38]:

```
import pandas as pd
```

In [47]:

```
r1={
    'Age':pd.Series([10,20,30,40,50]),
    'Weight':pd.Series([35,56,45,78,67]) }
print(r1)
```

```
{'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 [49]:

```
r2={'Reg no':pd.Series([31,25,35,36,20]),  
   'Marks':pd.Series([50,45,30,40,35]) }  
print(r2)
```

```
{'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 [50]:

```
r3={'curries':pd.Series([1,2,3]),  
   'Price':pd.Series([120,150,160]) }  
print(r3)
```

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

In [51]:

```
r4={'tv channelno':pd.Series([6,7,8]),  
   'Price':pd.Series([25,50,75]) }  
print(r4)
```

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

In [52]:

```
r5={'art':pd.Series([10,11,12,13]),  
    'Price':pd.Series([50,60,70,55]) }  
print(r5)
```

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

In [48]:

```
j=pd.DataFrame(r1)  
j
```

Out[48]:

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

In [53]:

```
k=pd.DataFrame(r2)  
k
```

Out[53]:

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



In [61]:

```
l=pd.DataFrame(r3)
l
```

Out[61]:

	curries	Price
0	1	120
1	2	150
2	3	160

In [62]:

```
m=pd.DataFrame(r4)
m
```

Out[62]:

	tv channelno	Price
0	6	25
1	7	50
2	8	75

In [63]:

```
n=pd.DataFrame(r5)
n
```

Out[63]:

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

In [58]:

```
print(j.mean())
print(j.median())
print(j.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 [59]:

```
print(k.mean())
print(k.median())
print(k.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 [64]:

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

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

In [65]:

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

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

In [66]:

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

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

In [67]:

```
print(j.sum())
print(j.cumsum())
print(j.count())
print(j.max())
print(j.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 [68]:

```
print(k.sum())
print(k.cumsum())
print(k.count())
print(k.max())
print(k.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 [69]:

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

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

In [70]:

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

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

In [71]:

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

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

In [72]:

```
print(j.describe())
print(k.describe())
print(l.describe())
print(m.describe())
print(n.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

	curries	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

	tv channelno	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

	art	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 [73]:

```
from numpy import cov
covariance=cov(j,k)
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 [74]:

```
covariance=cov(k,l)
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 [75]:

```
covariance=cov(l,m)
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 [76]:

```
covariance=cov(m,n)
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 [77]:

```
pip install scipy
```

Defaulting to user installation because normal site-packages is not writeable

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\anaconda3\lib\site-packages (from scipy) (1.24.3)

Note: you may need to restart the kernel to use updated packages.

In [81]:

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

PearsonRResult(statistic=0.767143303518697, pvalue=0.009605641558179966)

In [82]:

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

SignificanceResult(statistic=0.9151515151515152, pvalue=0.0002044724061488323)

In [ ]: