Linear Algebra

In [29]:
```
import  numpy as np
import pandas as pd
from numpy import linalg as la
```

1. Create 5 matrices with five different dimensions (1-D,2-D,...5-D)

In [30]:
```
a1=np.array([6,1,1])
print(a1)
```

```
[6 1 1]
```

In [31]:
```
a2=np.array([[1,2],[4,5]])
a2
```

Out[31]:
```
array([[1, 2],
       [4, 5]])
```

In [34]:
```
a3=np.array([[1,2,3],[4,5,5],[7,8,7]])
a3
```

Out[34]:
```
array([[1, 2, 3],
       [4, 5, 5],
       [7, 8, 7]])
```

In [35]:
```
a4=np.array([[1,2,3,6],[4,5,6,7],[7,8,9,5],[9,8,7,8]])
a4
```

Out[35]:
```
array([[1, 2, 3, 6],
       [4, 5, 6, 7],
       [7, 8, 9, 5],
       [9, 8, 7, 8]])
```

In [43]:
```
a5=np.array([[1,2,3,7,9],[4,5,6,5,4],[7,8,9,4,2],[3,2,5,4,2],[3,2,4,7,6]])
a5
```

Out[43]:
```
array([[1, 2, 3, 7, 9],
       [4, 5, 6, 5, 4],
       [7, 8, 9, 4, 2],
       [3, 2, 5, 4, 2],
       [3, 2, 4, 7, 6]])
```

2. Find determinants of 5 matrices and display your output

In [44]:
```
la.det(a2)
```

Out[44]:
```
-2.9999999999999996
```

In [45]:
```
la.det(a3)
```

Out[45]:
```
-1.3322676295501906e-15
```

In [46]:
```
la.det(a4)
```

Out[46]:
```
2.6151920135614848e-14
```

In [47]:
```
la.det(a5)
```

Out[47]:
```
-129.99999999999986
```

In [50]:
```
a6=np.array([[1,2,3,7,9,4],[4,5,6,5,4,3],[7,8,9,4,2,1],[3,2,5,4,2,6],[3,2,4,7,6,4],[5,6
a6
la.det(a6)
```

Out[50]:
```
-402.9999999999995
```

3. Find inverse of the above 5 matrices and display your output

In [52]:
```
la.inv(a2)
```

Out[52]:
```
array([[-1.66666667,  0.66666667],
       [ 1.33333333, -0.33333333]])
```

In [53]:
```
la.inv(a3)
```

Out[53]:
```
array([[ 3.75299969e+15, -7.50599938e+15,  3.75299969e+15],
       [-5.25419957e+15,  1.05083991e+16, -5.25419957e+15],
       [ 2.25179981e+15, -4.50359963e+15,  2.25179981e+15]])
```

In [54]:
```
la.inv(a3)
```

Out[54]:
```
array([[ 3.75299969e+15, -7.50599938e+15,  3.75299969e+15],
       [-5.25419957e+15,  1.05083991e+16, -5.25419957e+15],
       [ 2.25179981e+15, -4.50359963e+15,  2.25179981e+15]])
```

In [55]:
```
la.inv(a4)
```

Out[55]:
```
array([[-2.71490581e+15,  3.59438234e+15, -1.22361952e+15,
        -3.44142990e+14],
       [ 5.42981163e+15, -7.18876469e+15,  2.44723904e+15,
         6.88285981e+14],
       [-2.71490581e+15,  3.59438234e+15, -1.22361952e+15,
        -3.44142990e+14],
```

```
        [ 3.81132075e-01, -2.79245283e-01, -1.13207547e-02,
          9.05660377e-02]])
```

In [56]:

```
la.inv(a5)
```

Out[56]:

```
array([[ 0.15384615, -1.61538462,  0.86923077, -0.22307692,  0.63076923],
       [-0.30769231,  1.23076923, -0.43846154, -0.45384615, -0.06153846],
       [ 0.30769231, -0.23076923,  0.03846154,  0.65384615, -0.53846154],
       [-0.61538462,  1.46153846, -0.77692308, -0.20769231,  0.27692308],
       [ 0.53846154, -1.15384615,  0.59230769,  0.06923077, -0.09230769]])
```

In [57]:

```
la.inv(a6)
```

Out[57]:

```
array([[-0.5483871 , -0.91315136,  0.09677419, -0.01240695,  0.34987593,
         0.70223325],
       [-0.61290323,  1.53598015, -0.77419355, -0.36228288, -0.18362283,
         0.30521092],
       [ 1.06451613, -0.98759305,  0.87096774,  0.42679901, -0.23573201,
        -0.75682382],
       [-0.29032258,  1.13647643, -0.41935484, -0.30521092,  0.40694789,
        -0.32506203],
       [ 0.32258065, -0.93796526,  0.35483871,  0.13399504, -0.17866005,
         0.21588089],
       [-0.32258065,  0.32258065, -0.35483871,  0.09677419, -0.12903226,
         0.32258065]])
```

4. Find the rank, diagonal and trace of the 5 matrices

In [63]:

```
print(la.matrix_rank(a2))
print(np.diag(a2))
print(np.trace(a2))
```

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

In [64]:

```
print(la.matrix_rank(a3))
print(np.diag(a3))
print(np.trace(a3))
```

```
2
[1 5 7]
13
```

In [65]:

```
print(la.matrix_rank(a4))
print(np.diag(a4))
print(np.trace(a4))
```

```
3
[1 5 9 8]
23
```

In [66]:

```
print(la.matrix_rank(a5))
print(np.diag(a5))
print(np.trace(a5))
```

```
5
[1 5 9 4 6]
25
```

In [67]:

```
print(la.matrix_rank(a6))
print(np.diag(a6))
print(np.trace(a6))
```

```
6
[1 5 9 4 6 5]
30
```

5. Find Eigen value and eigen vector for 5 matrices

In [69]:

```
print(la.eig(a2))
print(la.eigvals(a2))
```

```
(array([-0.46410162,  6.46410162]), array([[-0.80689822, -0.34372377],
       [ 0.59069049, -0.9390708 ]]))
[-0.46410162  6.46410162]
```

In [70]:

```
print(la.eig(a3))
print(la.eigvals(a3))
```

```
(array([ 1.45156098e+01, -1.51560977e+00,  2.71523103e-16]), array([[ 0.2577526 ,  0.750
34662,  0.5488213 ],
       [ 0.53211766,  0.04543257, -0.76834982],
       [ 0.80648273, -0.65948148,  0.32929278]]))
[ 1.45156098e+01 -1.51560977e+00  2.71523103e-16]
```

In [71]:

```
print(la.eig(a4))
print(la.eigvals(a4))
```

```
(array([ 2.42774636e+01, -4.15930040e+00,  9.95019352e-16,  2.88183685e+00]), array([[
2.73598687e-01,  6.88130470e-01,  4.08248290e-01,
         3.25112384e-01],
       [ 4.60430758e-01,  3.41782948e-01, -8.16496581e-01,
         1.94879441e-02],
       [ 5.70300058e-01, -3.77414899e-01,  4.08248290e-01,
        -8.04013142e-01],
       [ 6.22820295e-01, -5.16932168e-01, -2.15525517e-16,
         4.97478667e-01]]))
[ 2.42774636e+01 -4.15930040e+00  9.95019352e-16  2.88183685e+00]
```

In [72]:

```
print(la.eig(a5))
print(la.eigvals(a5))
```

```
(array([22.94636983+0.j        , -1.53531838+0.j        ,
        1.31854869+1.46223336j,  1.31854869-1.46223336j,
        0.95185118+0.j        ]), array([[ 0.3894755 +0.j        ,  0.80095933+0.j
,
        -0.67107107+0.j        , -0.67107107-0.j        ,
         0.69556085+0.j        ],
       [ 0.46721119+0.j        ,  0.02298222+0.j        ,
         0.09356739-0.02921578j,  0.09356739+0.02921578j,
        -0.27728727+0.j        ],
       [ 0.61067244+0.j        , -0.57005652+0.j        ,
         0.42183324+0.21381507j,  0.42183324-0.21381507j,
```

```
         -0.23751818+0.j        ],
        [ 0.3141611 +0.j        ,  0.121334  +0.j        ,
          0.31349914-0.18173793j,  0.31349914+0.18173793j,
         -0.414486  +0.j        ],
        [ 0.39800066+0.j        , -0.13509109+0.j        ,
         -0.42898859-0.03245674j, -0.42898859+0.03245674j,
          0.45944896+0.j        ]]))
[22.94636983+0.j         -1.53531838+0.j          1.31854869+1.46223336j
  1.31854869-1.46223336j  0.95185118+0.j        ]
```

In [73]:

```python
print(la.eig(a6))
print(la.eigvals(a6))
```

```
(array([28.2439417 +0.j        ,  4.43152217+0.j        ,
       -1.50437056+0.j        ,  0.41517182+0.j        ,
       -0.79313256+2.12746896j, -0.79313256-2.12746896j]), array([[ 0.36043552+0.j
,  0.5255467 +0.j        ,
          0.81151376+0.j        , -0.19364587+0.j        ,
         -0.50703755-0.20750093j, -0.50703755+0.20750093j],
        [ 0.37636368+0.j        , -0.1802991 +0.j        ,
          0.0241678 +0.j        ,  0.64768812+0.j        ,
          0.01616387-0.03851695j,  0.01616387+0.03851695j],
        [ 0.42279771+0.j        , -0.70198836+0.j        ,
         -0.56797352+0.j        , -0.54660863+0.j        ,
          0.12581679+0.23487324j,  0.12581679-0.23487324j],
        [ 0.33035705+0.j        , -0.00303161+0.j        ,
          0.07055297+0.j        ,  0.30128142+0.j        ,
          0.6170445 +0.j        ,  0.6170445 -0.j        ],
        [ 0.3624315 +0.j        ,  0.36036721+0.j        ,
         -0.11083187+0.j        , -0.29699726+0.j        ,
         -0.25824376-0.24689019j, -0.25824376+0.24689019j],
        [ 0.55604526+0.j        ,  0.26197621+0.j        ,
          0.03171746+0.j        ,  0.25542615+0.j        ,
         -0.2635646 +0.22194898j, -0.2635646 -0.22194898j]]))
[28.2439417 +0.j          4.43152217+0.j         -1.50437056+0.j
  0.41517182+0.j         -0.79313256+2.12746896j -0.79313256-2.12746896j]
```

In [ ]: