```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.decomposition import PCA
from sklearn.preprocessing import scale

data = pd.read_csv('Downloads/Universities.csv')
data
```

	Univ	SAT	Top10	Accept	SFRatio	Expenses	GradRate
0	Brown	1310	89	22	13	22704	94
1	CalTech	1415	100	25	6	63575	81
2	CMU	1260	62	59	9	25026	72
3	Columbia	1310	76	24	12	31510	88
4	Cornell	1280	83	33	13	21864	90
5	Dartmouth	1340	89	23	10	32162	95
6	Duke	1315	90	30	12	31585	95
7	Georgetown	1255	74	24	12	20126	92
8	Harvard	1400	91	14	11	39525	97
9	JohnsHopkins	1305	75	44	7	58691	87
10	MIT	1380	94	30	10	34870	91
11	Northwestern	1260	85	39	11	28052	89
12	NotreDame	1255	81	42	13	15122	94
13	PennState	1081	38	54	18	10185	80
14	Princeton	1375	91	14	8	30220	95

```
divide=data.iloc[:,1:]
divide
```

	SAT	Top10	Accept	SFRatio	Expenses	GradRate
0	1310	89	22	13	22704	94
1	1415	100	25	6	63575	81
2	1260	62	59	9	25026	72
3	1310	76	24	12	31510	88
4	1280	83	33	13	21864	90
5	1340	89	23	10	32162	95
6	1315	90	30	12	31585	95
7	1255	74	24	12	20126	92
8	1400	91	14	11	39525	97
9	1305	75	44	7	58691	87
10	1380	94	30	10	34870	91
11	1260	85	39	11	28052	89
12	1255	81	42	13	15122	94
13	1081	38	54	18	10185	80

```
array=divide.values
array
```

```
array([[ 1310,    89,    22,    13, 22704,    94],
       [ 1415,   100,    25,     6, 63575,    81],
       [ 1260,    62,    59,     9, 25026,    72],
       [ 1310,    76,    24,    12, 31510,    88],
       [ 1280,    83,    33,    13, 21864,    90],
       [ 1340,    89,    23,    10, 32162,    95],
       [ 1315,    90,    30,    12, 31585,    95],
       [ 1255,    74,    24,    12, 20126,    92],
       [ 1400,    91,    14,    11, 39525,    97],
       [ 1305,    75,    44,     7, 58691,    87],
       [ 1380,    94,    30,    10, 34870,    91],
       [ 1260,    85,    39,    11, 28052,    89],
       [ 1255,    81,    42,    13, 15122,    94],
       [ 1081,    38,    54,    18, 10185,    80],
       [ 1375,    91,    14,     8, 30220,    95],
       [ 1005,    28,    90,    19,  9066,    69],
       [ 1360,    90,    20,    12, 36450,    93],
       [ 1075,    49,    67,    25,  8704,    67],
       [ 1240,    95,    40,    17, 15140,    78],
       [ 1290,    75,    50,    13, 38380,    87],
       [ 1180,    65,    68,    16, 15470,    85],
       [ 1285,    80,    36,    11, 27553,    90],
       [ 1225,    77,    44,    14, 13349,    92],
```

scale=scale(array)

scale

```
array([[ 0.41028362,  0.6575195 , -0.88986682,  0.07026045, -0.33141256,
         0.82030265],
       [ 1.39925928,  1.23521235, -0.73465749, -1.68625071,  2.56038138,
        -0.64452351],
       [-0.06065717, -0.76045386,  1.02438157, -0.93346022, -0.16712136,
        -1.65863393],
       [ 0.41028362, -0.02520842, -0.78639393, -0.18066972,  0.29164871,
         0.14422904],
       [ 0.12771914,  0.34241431, -0.32076595,  0.07026045, -0.39084607,
         0.36958691],
       [ 0.69284809,  0.6575195 , -0.83813038, -0.68253005,  0.33778044,
         0.93298158],
       [ 0.4573777 ,  0.71003703, -0.47597528, -0.18066972,  0.29695528,
         0.93298158],
       [-0.10775125, -0.13024348, -0.78639393, -0.18066972, -0.51381683,
         0.59494478],
       [ 1.25797704,  0.76255456, -1.30375836, -0.43159988,  0.85874344,
         1.15833946],
       [ 0.36318954, -0.07772595,  0.24833493, -1.43532055,  2.21481798,
         0.0315501 ],
       [ 1.06960072,  0.92010716, -0.47597528, -0.68253005,  0.52938275,
         0.48226584],
       [-0.06065717,  0.44744937, -0.01034729, -0.43159988,  0.04698077,
```

pca=PCA()

pca_values=pca.fit_transform(scale)

pca_values

```
array([[-1.00987445e+00, -1.06430962e+00,  8.10663051e-02,
         5.69506350e-02, -1.28754245e-01, -3.46496377e-02],
       [-2.82223781e+00,  2.25904458e+00,  8.36828830e-01,
         1.43844644e-01, -1.25961913e-01, -1.80703168e-01],
       [ 1.11246577e+00,  1.63120889e+00, -2.66786839e-01,
         1.07507502e+00, -1.91814148e-01,  3.45679459e-01],
       [-7.41741217e-01, -4.21874699e-02,  6.05008649e-02,
        -1.57208116e-01, -5.77611392e-01,  1.09163092e-01],
       [-3.11912064e-01, -6.35243572e-01,  1.02405189e-02,
         1.71363672e-01,  1.27261287e-02, -1.69212696e-02],
       [-1.69669089e+00, -3.44363283e-01, -2.53407507e-01,
         1.25643278e-02, -5.26606002e-02, -2.71661600e-02],
       [-1.24682093e+00, -4.90983662e-01, -3.20938196e-02,
        -2.05643780e-01,  2.93505340e-01, -7.80119838e-02],
       [-3.38749784e-01, -7.85168589e-01, -4.93584829e-01,
         3.98563085e-02, -5.44978619e-01, -1.55371653e-01],
       [-2.37415013e+00, -3.86538883e-01,  1.16098392e-01,
        -4.53365617e-01, -2.30108300e-01,  2.66983932e-01],
       [-1.40327739e+00,  2.11951503e+00, -4.42827141e-01,
        -6.32543273e-01,  2.30053526e-01, -2.35615124e-01],
       [-1.72610332e+00,  8.82371161e-02,  1.70403663e-01,
         2.60901913e-01,  2.33118380e-01,  2.38968449e-01],
```

var=pca.explained_variance_ratio_
var

```
array([0.76868084, 0.13113602, 0.04776031, 0.02729668, 0.0207177 ,
       0.00440844])
```

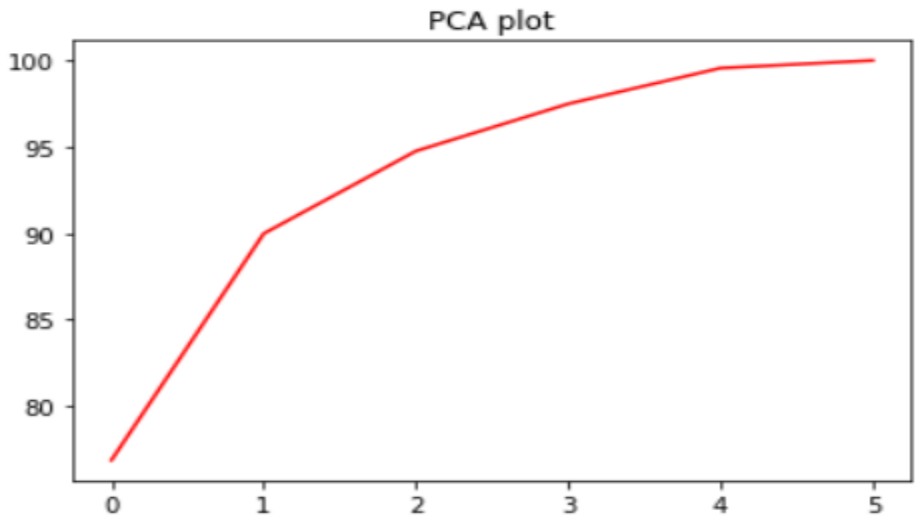
var1=np.cumsum(np.round(var,decimals=4)*100)
var1

```
array([ 76.87,  89.98,  94.76,  97.49,  99.56, 100.  ])
```

pca.components_

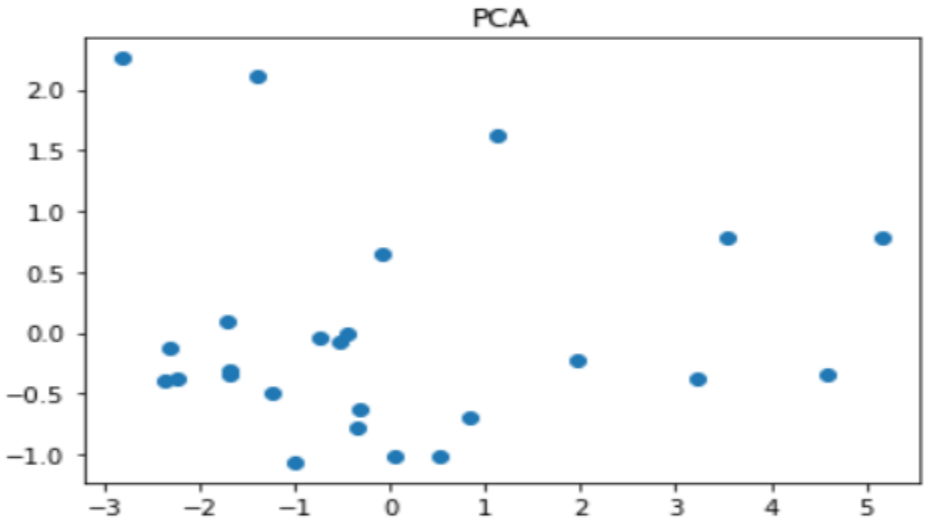
```
array([[-0.45774863, -0.42714437,  0.42430805,  0.39064831, -0.36252316,
        -0.37940403],
       [ 0.03968044, -0.19993153,  0.32089297, -0.43256441,  0.6344864 ,
        -0.51555367],
       [ 0.1870388 ,  0.49780855, -0.15627899,  0.60608085,  0.20474114,
        -0.53247261],
       [ 0.13124033,  0.37489567,  0.0612872 , -0.50739095, -0.62340055,
        -0.43863341],
       [ 0.02064583,  0.4820162 ,  0.8010936 ,  0.07682369,  0.07254775,
         0.33810965],
       [ 0.8580547 , -0.39607492,  0.21693361,  0.1720479 , -0.17376309,
        -0.00353754]])
```

plt.plot(var1,color='red')
plt.title('PCA plot')



```
x=pca_values[:,0:1]
y=pca_values[:,1:2]
plt.scatter(x,y)
plt.title('PCA')
```

```
Text(0.5, 1.0, 'PCA')
```



data.describe()

	SAT	Top10	Accept	SFRatio	Expenses	GradRate
count	25.000000	25.000000	25.000000	25.00000	25.000000	25.000000
mean	1266.440000	76.480000	39.200000	12.72000	27388.000000	86.720000
std	108.359771	19.433905	19.727308	4.06735	14424.883165	9.057778
min	1005.000000	28.000000	14.000000	6.00000	8704.000000	67.000000
25%	1240.000000	74.000000	24.000000	11.00000	15140.000000	81.000000
50%	1285.000000	81.000000	36.000000	12.00000	27553.000000	90.000000
75%	1340.000000	90.000000	50.000000	14.00000	34870.000000	94.000000
max	1415.000000	100.000000	90.000000	25.00000	63575.000000	97.000000