—----------import important libraries—----------

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.cluster.hierarchy as sch
from sklearn.cluster import AgglomerativeClustering
```

—---------read dataset—----------

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

	Unnamed: 0	Murder	Assault	UrbanPop	Rape
0	Alabama	13.2	236	58	21.2
1	Alaska	10.0	263	48	44.5
2	Arizona	8.1	294	80	31.0
3	Arkansas	8.8	190	50	19.5
4	California	9.0	276	91	40.6
5	Colorado	7.9	204	78	38.7
6	Connecticut	3.3	110	77	11.1
7	Delaware	5.9	238	72	15.8
8	Florida	15.4	335	80	31.9
9	Georgia	17.4	211	60	25.8
10	Hawaii	5.3	46	83	20.2
11	Idaho	2.6	120	54	14.2
12	Illinois	10.4	249	83	24.0
13	Indiana	7.2	113	65	21.0

—----------normalize—----------

```
def norm_func(i):
    x = (i-i.min())/(i.max()-i.min())
    return (x)
```

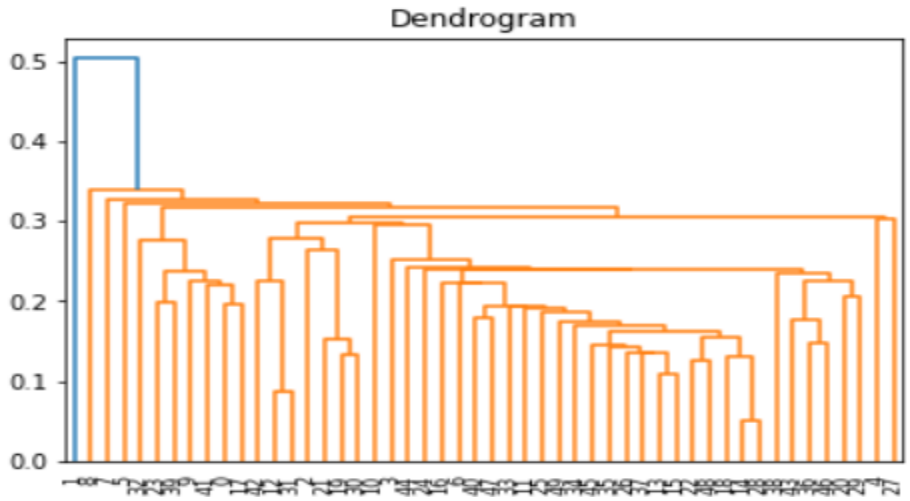
—--------divide—----------

```
divide = norm_func(data.iloc[:,1:])
divide
```

	Murder	Assault	UrbanPop	Rape
0	0.746988	0.654110	0.440678	0.359173
1	0.554217	0.746575	0.271186	0.961240
2	0.439759	0.852740	0.813559	0.612403
3	0.481928	0.496575	0.305085	0.315245
4	0.493976	0.791096	1.000000	0.860465
5	0.427711	0.544521	0.779661	0.811370
6	0.150602	0.222603	0.762712	0.098191
7	0.307229	0.660959	0.677966	0.219638
8	0.879518	0.993151	0.813559	0.635659
9	1.000000	0.568493	0.474576	0.478036

——————plot———————————
dendrogram = sch.dendrogram(sch.linkage(divide,method='single'))
plt.title('Dendrogram')

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



——————clustering——————

```
a = AgglomerativeClustering (n_clusters=4, affinity='euclidean', linkage='single')
a
```

```
AgglomerativeClustering(linkage='single', n_clusters=4)
```

——————prediction——————
predict = a.fit_predict(divide)
clusters = pd.DataFrame(predict,columns=['clusters'])
clusters

	clusters
0	0
1	3
2	0
3	0
4	0
5	0
6	0
7	1
8	2
9	0
10	0
11	0
12	0
13	0
14	0
15	0

—----------kmeans—---------------------
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
```

—----------read dataset—----------------
```
data = pd.read_csv('Downloads/crime_data.csv')
data
```

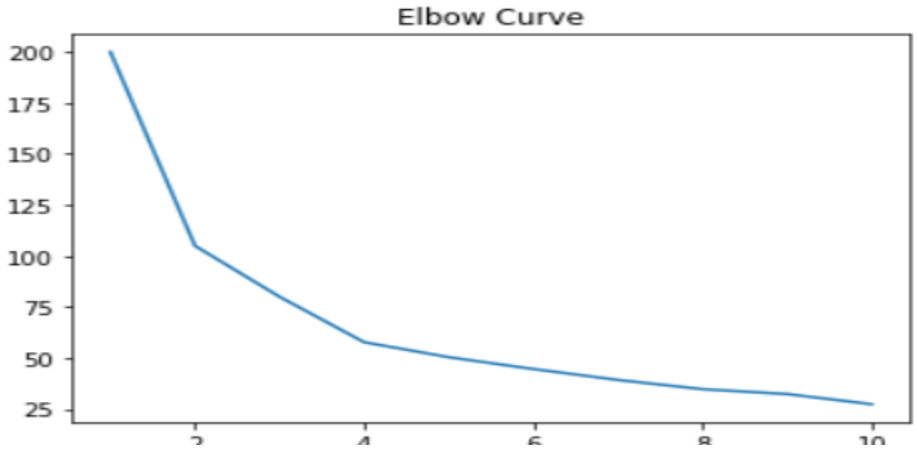
	Unnamed: 0	Murder	Assault	UrbanPop	Rape
0	Alabama	13.2	236	58	21.2
1	Alaska	10.0	263	48	44.5
2	Arizona	8.1	294	80	31.0
3	Arkansas	8.8	190	50	19.5
4	California	9.0	276	91	40.6
5	Colorado	7.9	204	78	38.7
6	Connecticut	3.3	110	77	11.1
7	Delaware	5.9	238	72	15.8
8	Florida	15.4	335	80	31.9
9	Georgia	17.4	211	60	25.8
10	Hawaii	5.3	46	83	20.2
11	Idaho	2.6	120	54	14.2
12	Illinois	10.4	249	83	24.0
13	Indiana	7.2	113	65	21.0

—----------scale—---------------------
```
scaler = StandardScaler()
scaled = scaler.fit_transform(data.iloc[:,1:])
scaled
```

```
array([[ 1.25517927,  0.79078716, -0.52619514, -0.00345116],
       [ 0.51301858,  1.11805959, -1.22406668,  2.50942392],
       [ 0.07236067,  1.49381682,  1.00912225,  1.05346626],
       [ 0.23470832,  0.23321191, -1.08449238, -0.18679398],
       [ 0.28109336,  1.2756352 ,  1.77678094,  2.08881393],
       [ 0.02597562,  0.40290872,  0.86954794,  1.88390137],
       [-1.04088037, -0.73648418,  0.79976079, -1.09272319],
       [-0.43787481,  0.81502956,  0.45082502, -0.58583422],
       [ 1.76541475,  1.99078607,  1.00912225,  1.1505301 ],
       [ 2.22926518,  0.48775713, -0.38662083,  0.49265293],
       [-0.57702994, -1.51224105,  1.21848371, -0.11129987],
       [-1.20322802, -0.61527217, -0.80534376, -0.75839217],
       [ 0.60578867,  0.94836277,  1.21848371,  0.29852525],
       [-0.13637203, -0.70012057, -0.03768506, -0.0250209 ],
       [-1.29599811, -1.39102904, -0.5959823 , -1.07115345],
       [-0.41468229, -0.67587817,  0.03210209, -0.34856705],
       [ 0.44344101, -0.74860538, -0.94491807, -0.53190987],
       [ 1.76541475,  0.94836277,  0.03210209,  0.10439756],
       [-1.31919063, -1.06375661, -1.01470522, -1.44862395],
```

—————function————————————
wss = []
for i in range (1,11):
    kmeans = KMeans (n_clusters=i)
    kmeans.fit(scaled)
    wss.append(kmeans.inertia_)

—————plot————————————
plt.plot(range(1,11),wss)
plt.title('Elbow Curve')



—————————clusters————————————

```
clusters = KMeans (n_clusters=3)
clusters.fit(scaled)
```

```
KMeans(n_clusters=3)
```

```
clusters.labels_
```

```
array([1, 1, 1, 2, 1, 1, 0, 0, 1, 1, 0, 2, 1, 0, 2, 0, 2, 1, 2, 1, 0, 1,
       2, 1, 1, 2, 2, 1, 2, 0, 1, 1, 1, 2, 0, 0, 0, 0, 0, 1, 2, 1, 1, 0,
       2, 0, 0, 2, 2, 0])
```

```
data['New Clusters'] = clusters.labels_
```

```
clusters.cluster_centers_
```

```
array([[-0.49440658, -0.3864845 ,  0.58167593, -0.26431024],
       [ 1.01513667,  1.02412028,  0.19959126,  0.85556386],
       [-0.88515915, -1.0213324 , -0.94990286, -0.92016524]])
```

—————grouping—————————

```
data.groupby('New Clusters').agg(['mean']).reset_index(drop=True)
```

	Murder	Assault	UrbanPop	Rape
	mean	mean	mean	mean
0	5.656250	138.875	73.875000	18.78125
1	12.165000	255.250	68.400000	29.16500
2	3.971429	86.500	51.928571	12.70000

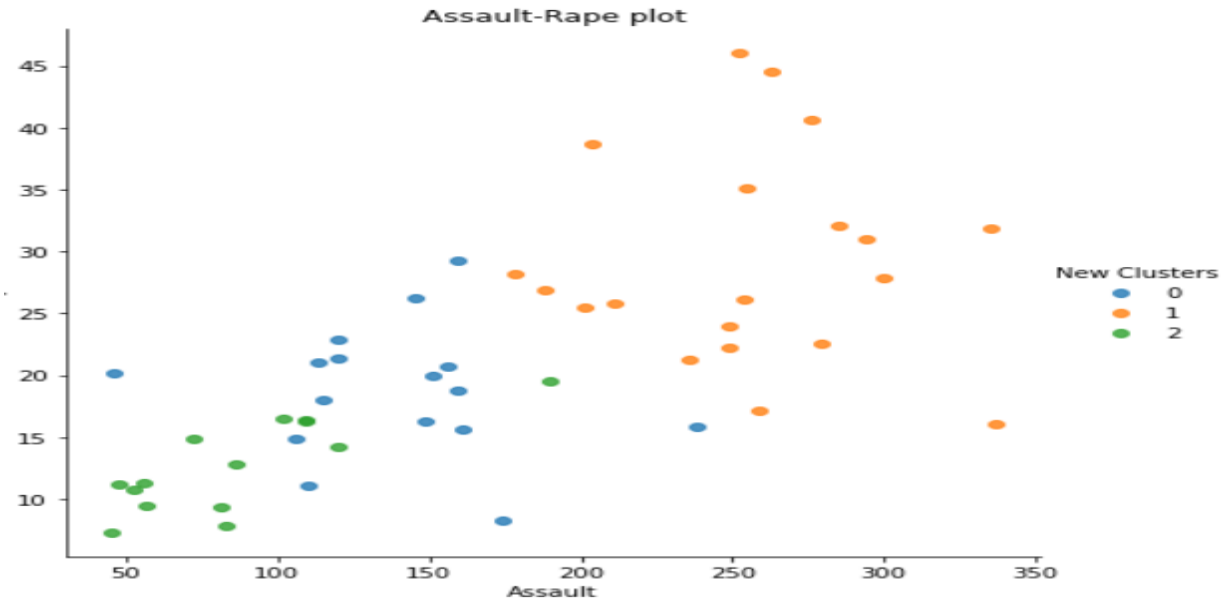
—————data—————————

data

	Unnamed: 0	Murder	Assault	UrbanPop	Rape	New Clusters
0	Alabama	13.2	236	58	21.2	1
1	Alaska	10.0	263	48	44.5	1
2	Arizona	8.1	294	80	31.0	1
3	Arkansas	8.8	190	50	19.5	2
4	California	9.0	276	91	40.6	1
5	Colorado	7.9	204	78	38.7	1
6	Connecticut	3.3	110	77	11.1	0
7	Delaware	5.9	238	72	15.8	0

—————————plot—————————

```
sns.lmplot('Assault','Rape',data=data,hue='New Clusters',fit_reg=False,size=6)
plt.title('Assault-Rape plot')
```



—----------dbscan—---------------------
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import DBSCAN
from sklearn.preprocessing import StandardScaler
```

—----------read data—--------------------
```
data = pd.read_csv('Downloads/crime_data.csv')
data
```

	Unnamed: 0	Murder	Assault	UrbanPop	Rape
0	Alabama	13.2	236	58	21.2
1	Alaska	10.0	263	48	44.5
2	Arizona	8.1	294	80	31.0
3	Arkansas	8.8	190	50	19.5
4	California	9.0	276	91	40.6
5	Colorado	7.9	204	78	38.7
6	Connecticut	3.3	110	77	11.1
7	Delaware	5.9	238	72	15.8
8	Florida	15.4	335	80	31.9
9	Georgia	17.4	211	60	25.8
10	Hawaii	5.3	46	83	20.2
11	Idaho	2.6	120	54	14.2
12	Illinois	10.4	249	83	24.0
13	Indiana	7.2	113	65	21.0

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

	Murder	Assault	UrbanPop	Rape
0	13.2	236	58	21.2
1	10.0	263	48	44.5
2	8.1	294	80	31.0
3	8.8	190	50	19.5
4	9.0	276	91	40.6
5	7.9	204	78	38.7
6	3.3	110	77	11.1
7	5.9	238	72	15.8
8	15.4	335	80	31.9
9	17.4	211	60	25.8
10	5.3	46	83	20.2
11	2.6	120	54	14.2
12	10.4	249	83	24.0

——————array——————————
array = divide.values
array

```
array([[ 13.2, 236. ,  58. ,  21.2],
       [ 10. , 263. ,  48. ,  44.5],
       [  8.1, 294. ,  80. ,  31. ],
       [  8.8, 190. ,  50. ,  19.5],
       [  9. , 276. ,  91. ,  40.6],
       [  7.9, 204. ,  78. ,  38.7],
       [  3.3, 110. ,  77. ,  11.1],
       [  5.9, 238. ,  72. ,  15.8],
       [ 15.4, 335. ,  80. ,  31.9],
       [ 17.4, 211. ,  60. ,  25.8],
       [  5.3,  46. ,  83. ,  20.2],
       [  2.6, 120. ,  54. ,  14.2],
       [ 10.4, 249. ,  83. ,  24. ],
       [  7.2, 113. ,  65. ,  21. ],
       [  2.2,  56. ,  57. ,  11.3],
       [  6. , 115. ,  66. ,  18. ],
       [  9.7, 109. ,  52. ,  16.3],
       [ 15.4, 249. ,  66. ,  22.2],
       [  2.1,  83. ,  51. ,   7.8],
```

——————scaler——————————————
scaler = StandardScaler()
scaled = scaler.fit_transform(array)
scaled

```
array([[ 1.25517927,  0.79078716, -0.52619514, -0.00345116],
       [ 0.51301858,  1.11805959, -1.22406668,  2.50942392],
       [ 0.07236067,  1.49381682,  1.00912225,  1.05346626],
       [ 0.23470832,  0.23321191, -1.08449238, -0.18679398],
       [ 0.28109336,  1.2756352 ,  1.77678094,  2.08881393],
       [ 0.02597562,  0.40290872,  0.86954794,  1.88390137],
       [-1.04088037, -0.73648418,  0.79976079, -1.09272319],
       [-0.43787481,  0.81502956,  0.45082502, -0.58583422],
       [ 1.76541475,  1.99078607,  1.00912225,  1.1505301 ],
       [ 2.22926518,  0.48775713, -0.38662083,  0.49265293],
       [-0.57702994, -1.51224105,  1.21848371, -0.11129987],
       [-1.20322802, -0.61527217, -0.80534376, -0.75839217],
       [ 0.60578867,  0.94836277,  1.21848371,  0.29852525],
       [-0.13637203, -0.70012057, -0.03768506, -0.0250209 ],
       [-1.29599811, -1.39102904, -0.5959823 , -1.07115345],
       [-0.41468229, -0.67587817,  0.03210209, -0.34856705],
       [ 0.44344101, -0.74860538, -0.94491807, -0.53190987],
       [ 1.76541475,  0.94836277,  0.03210209,  0.10439756],
```

——————dbscan——————————————
dbscan = DBSCAN (eps=0.6,min_samples=16)
dbscan.fit(scaled)

```
DBSCAN(eps=0.6, min_samples=16)
```

——————labels——————————
dbscan.labels_

```
array([-1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1,
       -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1,
       -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1],
      dtype=int64)
```

—----------dataframe—----------
clusters = pd.DataFrame(dbscan.labels_,columns=['clusters'])
clusters

	clusters
0	-1
1	-1
2	-1
3	-1
4	-1
5	-1
6	-1
7	-1
8	-1
9	-1
10	-1