In [1]:
```
import scipy.cluster.hierarchy as sch
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import seaborn as sns
```

In [2]:
```
crime=pd.read_csv("C:\\Users\\Admin\\Downloads\\assignment 4\\crime_data.csv")
crime.head()
```

Out[2]:

| | 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 |

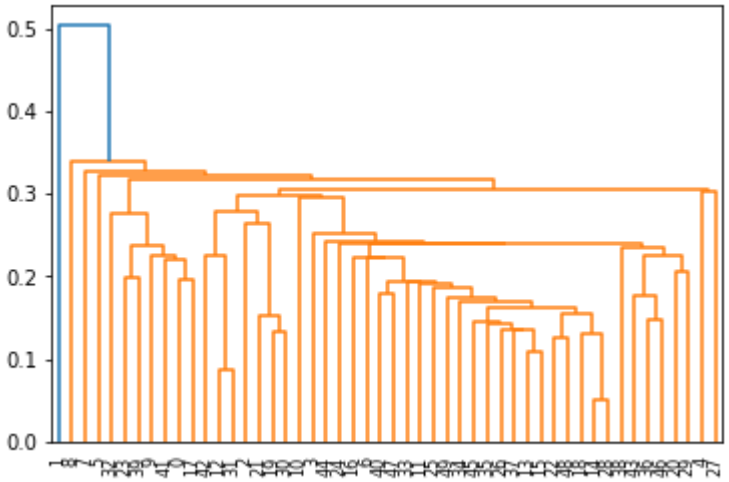
In [3]:
```
crime.shape
```

Out[3]:
```
(50, 5)
```

In [4]:
```
def norm_func(i):
    x= (i-i.min())/(i.max()-i.min())
    return(x)
```

In [5]:
```
df_norm =norm_func(crime.iloc[:,1:])
```

In [6]:
```
dendrogram=sch.dendrogram(sch.linkage(df_norm,method='single'))
```




In [7]:
```
from sklearn.cluster import AgglomerativeClustering
```

In [8]:
```
hc=AgglomerativeClustering(n_clusters=2, affinity='euclidean',linkage='single')
```

In [9]:
```
y_hc=hc.fit_predict(df_norm)
Clusters=pd.DataFrame(y_hc,columns=['Clusters'])
```

In [10]:
```
Clusters
```

Out[10]:

| | Clusters |
|---|---|
| **0** | 0 |
| **1** | 1 |
| **2** | 0 |
| **3** | 0 |
| **4** | 0 |
| **5** | 0 |
| **6** | 0 |
| **7** | 0 |
| **8** | 0 |
| **9** | 0 |
| **10** | 0 |
| **11** | 0 |
| **12** | 0 |
| **13** | 0 |
| **14** | 0 |
| **15** | 0 |
| **16** | 0 |
| **17** | 0 |
| **18** | 0 |
| **19** | 0 |
| **20** | 0 |
| **21** | 0 |
| **22** | 0 |
| **23** | 0 |
| **24** | 0 |

| | Clusters |
|---|---|
| **25** | 0 |
| **26** | 0 |
| **27** | 0 |
| **28** | 0 |
| **29** | 0 |
| **30** | 0 |
| **31** | 0 |
| **32** | 0 |
| **33** | 0 |
| **34** | 0 |
| **35** | 0 |
| **36** | 0 |
| **37** | 0 |
| **38** | 0 |
| **39** | 0 |
| **40** | 0 |
| **41** | 0 |
| **42** | 0 |
| **43** | 0 |
| **44** | 0 |
| **45** | 0 |
| **46** | 0 |
| **47** | 0 |
| **48** | 0 |
| **49** | 0 |

In [13]:
```
crime['h_clusterid']=Clusters
```

In [14]:
```
crime
```

Out[14]:

| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid |
|---|---|---|---|---|---|---|
| **0** | Alabama | 13.2 | 236 | 58 | 21.2 | 0 |
| **1** | Alaska | 10.0 | 263 | 48 | 44.5 | 1 |
| **2** | Arizona | 8.1 | 294 | 80 | 31.0 | 0 |
| **3** | Arkansas | 8.8 | 190 | 50 | 19.5 | 0 |
| **4** | California | 9.0 | 276 | 91 | 40.6 | 0 |
| **5** | Colorado | 7.9 | 204 | 78 | 38.7 | 0 |
| **6** | Connecticut | 3.3 | 110 | 77 | 11.1 | 0 |
| **7** | Delaware | 5.9 | 238 | 72 | 15.8 | 0 |
| **8** | Florida | 15.4 | 335 | 80 | 31.9 | 0 |
| **9** | Georgia | 17.4 | 211 | 60 | 25.8 | 0 |
| **10** | Hawaii | 5.3 | 46 | 83 | 20.2 | 0 |
| **11** | Idaho | 2.6 | 120 | 54 | 14.2 | 0 |
| **12** | Illinois | 10.4 | 249 | 83 | 24.0 | 0 |
| **13** | Indiana | 7.2 | 113 | 65 | 21.0 | 0 |
| **14** | Iowa | 2.2 | 56 | 57 | 11.3 | 0 |
| **15** | Kansas | 6.0 | 115 | 66 | 18.0 | 0 |
| **16** | Kentucky | 9.7 | 109 | 52 | 16.3 | 0 |
| **17** | Louisiana | 15.4 | 249 | 66 | 22.2 | 0 |
| **18** | Maine | 2.1 | 83 | 51 | 7.8 | 0 |
| **19** | Maryland | 11.3 | 300 | 67 | 27.8 | 0 |
| **20** | Massachusetts | 4.4 | 149 | 85 | 16.3 | 0 |
| **21** | Michigan | 12.1 | 255 | 74 | 35.1 | 0 |
| **22** | Minnesota | 2.7 | 72 | 66 | 14.9 | 0 |
| **23** | Mississippi | 16.1 | 259 | 44 | 17.1 | 0 |
| **24** | Missouri | 9.0 | 178 | 70 | 28.2 | 0 |

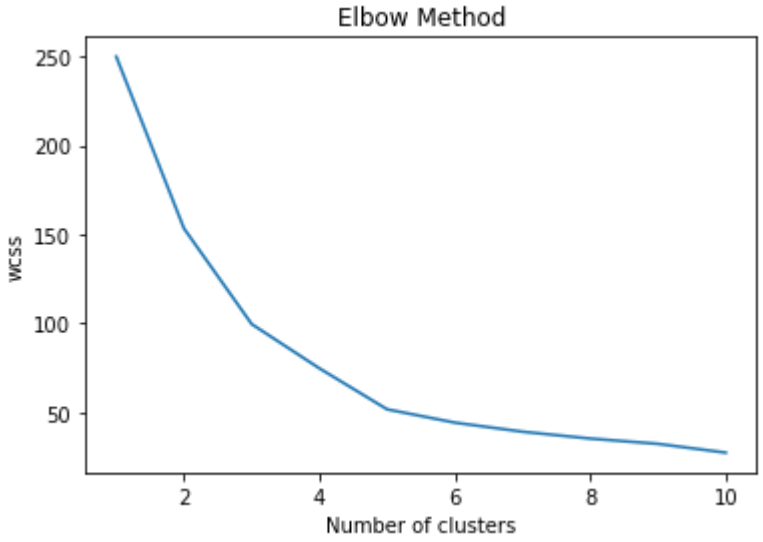
| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid |
|---|---|---|---|---|---|---|
| **25** | Montana | 6.0 | 109 | 53 | 16.4 | 0 |
| **26** | Nebraska | 4.3 | 102 | 62 | 16.5 | 0 |
| **27** | Nevada | 12.2 | 252 | 81 | 46.0 | 0 |
| **28** | New Hampshire | 2.1 | 57 | 56 | 9.5 | 0 |
| **29** | New Jersey | 7.4 | 159 | 89 | 18.8 | 0 |
| **30** | New Mexico | 11.4 | 285 | 70 | 32.1 | 0 |
| **31** | New York | 11.1 | 254 | 86 | 26.1 | 0 |
| **32** | North Carolina | 13.0 | 337 | 45 | 16.1 | 0 |
| **33** | North Dakota | 0.8 | 45 | 44 | 7.3 | 0 |
| **34** | Ohio | 7.3 | 120 | 75 | 21.4 | 0 |
| **35** | Oklahoma | 6.6 | 151 | 68 | 20.0 | 0 |
| **36** | Oregon | 4.9 | 159 | 67 | 29.3 | 0 |
| **37** | Pennsylvania | 6.3 | 106 | 72 | 14.9 | 0 |
| **38** | Rhode Island | 3.4 | 174 | 87 | 8.3 | 0 |
| **39** | South Carolina | 14.4 | 279 | 48 | 22.5 | 0 |
| **40** | South Dakota | 3.8 | 86 | 45 | 12.8 | 0 |
| **41** | Tennessee | 13.2 | 188 | 59 | 26.9 | 0 |
| **42** | Texas | 12.7 | 201 | 80 | 25.5 | 0 |
| **43** | Utah | 3.2 | 120 | 80 | 22.9 | 0 |
| **44** | Vermont | 2.2 | 48 | 32 | 11.2 | 0 |
| **45** | Virginia | 8.5 | 156 | 63 | 20.7 | 0 |
| **46** | Washington | 4.0 | 145 | 73 | 26.2 | 0 |
| **47** | West Virginia | 5.7 | 81 | 39 | 9.3 | 0 |
| **48** | Wisconsin | 2.6 | 53 | 66 | 10.8 | 0 |
| **49** | Wyoming | 6.8 | 161 | 60 | 15.6 | 0 |

In [16]:
```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
scaler=StandardScaler()
scaled_crime_df=scaler.fit_transform(crime.iloc[:,1:])
```

In [17]:
```
wcss=[]
for i in range (1, 11):
    kmeans=KMeans(n_clusters=i,random_state=0)
    kmeans.fit(scaled_crime_df)
    wcss.append(kmeans.inertia_)

plt.plot(range(1,11),wcss)
plt.title('Elbow Method')
plt.xlabel('Number of clusters')
plt.ylabel('wcss')
plt.show()
```

```
C:\Users\Admin\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:881: UserWarning: KMeans is known to hav
e a memory leak on Windows with MKL, when there are less chunks than available threads. You can avoid it by se
tting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```



In [19]:
```
from sklearn.cluster import KMeans
clusters_new=KMeans(4,random_state=42)
clusters_new.fit(scaled_crime_df)
```

Out[19]:
```
KMeans(n_clusters=4, random_state=42)
```

In [21]:
```
clusters_new.labels_
```

Out[21]:
```
array([3, 2, 3, 1, 3, 3, 0, 0, 3, 3, 0, 1, 3, 0, 1, 0, 1, 3, 1, 3, 0, 3,
       1, 3, 3, 1, 1, 3, 1, 0, 3, 3, 3, 1, 0, 0, 0, 0, 0, 3, 1, 3, 3, 0,
       1, 0, 0, 1, 1, 0])
```

In [22]:
```
crime['clusterid_new']=clusters_new.labels_
```

In [23]:
```
crime
```

Out[23]:

| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new |
|---|---|---|---|---|---|---|---|
| **0** | Alabama | 13.2 | 236 | 58 | 21.2 | 0 | 3 |
| **1** | Alaska | 10.0 | 263 | 48 | 44.5 | 1 | 2 |
| **2** | Arizona | 8.1 | 294 | 80 | 31.0 | 0 | 3 |
| **3** | Arkansas | 8.8 | 190 | 50 | 19.5 | 0 | 1 |
| **4** | California | 9.0 | 276 | 91 | 40.6 | 0 | 3 |
| **5** | Colorado | 7.9 | 204 | 78 | 38.7 | 0 | 3 |
| **6** | Connecticut | 3.3 | 110 | 77 | 11.1 | 0 | 0 |
| **7** | Delaware | 5.9 | 238 | 72 | 15.8 | 0 | 0 |
| **8** | Florida | 15.4 | 335 | 80 | 31.9 | 0 | 3 |
| **9** | Georgia | 17.4 | 211 | 60 | 25.8 | 0 | 3 |
| **10** | Hawaii | 5.3 | 46 | 83 | 20.2 | 0 | 0 |
| **11** | Idaho | 2.6 | 120 | 54 | 14.2 | 0 | 1 |
| **12** | Illinois | 10.4 | 249 | 83 | 24.0 | 0 | 3 |
| **13** | Indiana | 7.2 | 113 | 65 | 21.0 | 0 | 0 |
| **14** | Iowa | 2.2 | 56 | 57 | 11.3 | 0 | 1 |
| **15** | Kansas | 6.0 | 115 | 66 | 18.0 | 0 | 0 |
| **16** | Kentucky | 9.7 | 109 | 52 | 16.3 | 0 | 1 |
| **17** | Louisiana | 15.4 | 249 | 66 | 22.2 | 0 | 3 |
| **18** | Maine | 2.1 | 83 | 51 | 7.8 | 0 | 1 |
| **19** | Maryland | 11.3 | 300 | 67 | 27.8 | 0 | 3 |
| **20** | Massachusetts | 4.4 | 149 | 85 | 16.3 | 0 | 0 |
| **21** | Michigan | 12.1 | 255 | 74 | 35.1 | 0 | 3 |
| **22** | Minnesota | 2.7 | 72 | 66 | 14.9 | 0 | 1 |
| **23** | Mississippi | 16.1 | 259 | 44 | 17.1 | 0 | 3 |
| **24** | Missouri | 9.0 | 178 | 70 | 28.2 | 0 | 3 |

| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new |
|---|---|---|---|---|---|---|---|
| **25** | Montana | 6.0 | 109 | 53 | 16.4 | 0 | 1 |
| **26** | Nebraska | 4.3 | 102 | 62 | 16.5 | 0 | 1 |
| **27** | Nevada | 12.2 | 252 | 81 | 46.0 | 0 | 3 |
| **28** | New Hampshire | 2.1 | 57 | 56 | 9.5 | 0 | 1 |
| **29** | New Jersey | 7.4 | 159 | 89 | 18.8 | 0 | 0 |
| **30** | New Mexico | 11.4 | 285 | 70 | 32.1 | 0 | 3 |
| **31** | New York | 11.1 | 254 | 86 | 26.1 | 0 | 3 |
| **32** | North Carolina | 13.0 | 337 | 45 | 16.1 | 0 | 3 |
| **33** | North Dakota | 0.8 | 45 | 44 | 7.3 | 0 | 1 |
| **34** | Ohio | 7.3 | 120 | 75 | 21.4 | 0 | 0 |
| **35** | Oklahoma | 6.6 | 151 | 68 | 20.0 | 0 | 0 |
| **36** | Oregon | 4.9 | 159 | 67 | 29.3 | 0 | 0 |
| **37** | Pennsylvania | 6.3 | 106 | 72 | 14.9 | 0 | 0 |
| **38** | Rhode Island | 3.4 | 174 | 87 | 8.3 | 0 | 0 |
| **39** | South Carolina | 14.4 | 279 | 48 | 22.5 | 0 | 3 |
| **40** | South Dakota | 3.8 | 86 | 45 | 12.8 | 0 | 1 |
| **41** | Tennessee | 13.2 | 188 | 59 | 26.9 | 0 | 3 |
| **42** | Texas | 12.7 | 201 | 80 | 25.5 | 0 | 3 |
| **43** | Utah | 3.2 | 120 | 80 | 22.9 | 0 | 0 |
| **44** | Vermont | 2.2 | 48 | 32 | 11.2 | 0 | 1 |
| **45** | Virginia | 8.5 | 156 | 63 | 20.7 | 0 | 0 |
| **46** | Washington | 4.0 | 145 | 73 | 26.2 | 0 | 0 |
| **47** | West Virginia | 5.7 | 81 | 39 | 9.3 | 0 | 1 |
| **48** | Wisconsin | 2.6 | 53 | 66 | 10.8 | 0 | 1 |
| **49** | Wyoming | 6.8 | 161 | 60 | 15.6 | 0 | 0 |

In [25]:
```
clusters_new.cluster_centers_
```

Out[25]:
```
array([[-0.49440658, -0.3864845 ,  0.58167593, -0.26431024, -0.14285714],
       [-0.88515915, -1.0213324 , -0.94990286, -0.92016524, -0.14285714],
       [ 0.51301858,  1.11805959, -1.22406668,  2.50942392,  7.        ],
       [ 1.04156394,  1.01917611,  0.27452063,  0.7685186 , -0.14285714]])
```

In [26]:
```
crime.groupby('clusterid_new').agg(['mean']).reset_index()
```

Out[26]:

| | clusterid_new | Murder | Assault | UrbanPop | Rape | h_clusterid |
|---|---|---|---|---|---|---|
| | | mean | mean | mean | mean | mean |
| **0** | 0 | 5.656250 | 138.875000 | 73.875000 | 18.781250 | 0.0 |
| **1** | 1 | 3.971429 | 86.500000 | 51.928571 | 12.700000 | 0.0 |
| **2** | 2 | 10.000000 | 263.000000 | 48.000000 | 44.500000 | 1.0 |
| **3** | 3 | 12.278947 | 254.842105 | 69.473684 | 28.357895 | 0.0 |

In [27]:
```
crime
```

Out[27]:

| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new |
|---|---|---|---|---|---|---|---|
| **0** | Alabama | 13.2 | 236 | 58 | 21.2 | 0 | 3 |
| **1** | Alaska | 10.0 | 263 | 48 | 44.5 | 1 | 2 |
| **2** | Arizona | 8.1 | 294 | 80 | 31.0 | 0 | 3 |
| **3** | Arkansas | 8.8 | 190 | 50 | 19.5 | 0 | 1 |
| **4** | California | 9.0 | 276 | 91 | 40.6 | 0 | 3 |
| **5** | Colorado | 7.9 | 204 | 78 | 38.7 | 0 | 3 |
| **6** | Connecticut | 3.3 | 110 | 77 | 11.1 | 0 | 0 |
| **7** | Delaware | 5.9 | 238 | 72 | 15.8 | 0 | 0 |
| **8** | Florida | 15.4 | 335 | 80 | 31.9 | 0 | 3 |
| **9** | Georgia | 17.4 | 211 | 60 | 25.8 | 0 | 3 |
| **10** | Hawaii | 5.3 | 46 | 83 | 20.2 | 0 | 0 |
| **11** | Idaho | 2.6 | 120 | 54 | 14.2 | 0 | 1 |
| **12** | Illinois | 10.4 | 249 | 83 | 24.0 | 0 | 3 |
| **13** | Indiana | 7.2 | 113 | 65 | 21.0 | 0 | 0 |
| **14** | Iowa | 2.2 | 56 | 57 | 11.3 | 0 | 1 |
| **15** | Kansas | 6.0 | 115 | 66 | 18.0 | 0 | 0 |
| **16** | Kentucky | 9.7 | 109 | 52 | 16.3 | 0 | 1 |
| **17** | Louisiana | 15.4 | 249 | 66 | 22.2 | 0 | 3 |
| **18** | Maine | 2.1 | 83 | 51 | 7.8 | 0 | 1 |
| **19** | Maryland | 11.3 | 300 | 67 | 27.8 | 0 | 3 |
| **20** | Massachusetts | 4.4 | 149 | 85 | 16.3 | 0 | 0 |
| **21** | Michigan | 12.1 | 255 | 74 | 35.1 | 0 | 3 |
| **22** | Minnesota | 2.7 | 72 | 66 | 14.9 | 0 | 1 |
| **23** | Mississippi | 16.1 | 259 | 44 | 17.1 | 0 | 3 |
| **24** | Missouri | 9.0 | 178 | 70 | 28.2 | 0 | 3 |

| | Unnamed: 0 | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new |
|---|---|---|---|---|---|---|---|
| **25** | Montana | 6.0 | 109 | 53 | 16.4 | 0 | 1 |
| **26** | Nebraska | 4.3 | 102 | 62 | 16.5 | 0 | 1 |
| **27** | Nevada | 12.2 | 252 | 81 | 46.0 | 0 | 3 |
| **28** | New Hampshire | 2.1 | 57 | 56 | 9.5 | 0 | 1 |
| **29** | New Jersey | 7.4 | 159 | 89 | 18.8 | 0 | 0 |
| **30** | New Mexico | 11.4 | 285 | 70 | 32.1 | 0 | 3 |
| **31** | New York | 11.1 | 254 | 86 | 26.1 | 0 | 3 |
| **32** | North Carolina | 13.0 | 337 | 45 | 16.1 | 0 | 3 |
| **33** | North Dakota | 0.8 | 45 | 44 | 7.3 | 0 | 1 |
| **34** | Ohio | 7.3 | 120 | 75 | 21.4 | 0 | 0 |
| **35** | Oklahoma | 6.6 | 151 | 68 | 20.0 | 0 | 0 |
| **36** | Oregon | 4.9 | 159 | 67 | 29.3 | 0 | 0 |
| **37** | Pennsylvania | 6.3 | 106 | 72 | 14.9 | 0 | 0 |
| **38** | Rhode Island | 3.4 | 174 | 87 | 8.3 | 0 | 0 |
| **39** | South Carolina | 14.4 | 279 | 48 | 22.5 | 0 | 3 |
| **40** | South Dakota | 3.8 | 86 | 45 | 12.8 | 0 | 1 |
| **41** | Tennessee | 13.2 | 188 | 59 | 26.9 | 0 | 3 |
| **42** | Texas | 12.7 | 201 | 80 | 25.5 | 0 | 3 |
| **43** | Utah | 3.2 | 120 | 80 | 22.9 | 0 | 0 |
| **44** | Vermont | 2.2 | 48 | 32 | 11.2 | 0 | 1 |
| **45** | Virginia | 8.5 | 156 | 63 | 20.7 | 0 | 0 |
| **46** | Washington | 4.0 | 145 | 73 | 26.2 | 0 | 0 |
| **47** | West Virginia | 5.7 | 81 | 39 | 9.3 | 0 | 1 |
| **48** | Wisconsin | 2.6 | 53 | 66 | 10.8 | 0 | 1 |
| **49** | Wyoming | 6.8 | 161 | 60 | 15.6 | 0 | 0 |

In [28]:
```
from sklearn .cluster import DBSCAN
```

In [32]:
```
crime.drop(['Unnamed: 0'],axis=1,inplace=True)
```

In [33]:
```
array=crime.values
```

In [34]:
```
array
```

Out[34]:
```
array([[ 13.2, 236. ,  58. ,  21.2,   0. ,   3. ],
       [ 10. , 263. ,  48. ,  44.5,   1. ,   2. ],
       [  8.1, 294. ,  80. ,  31. ,   0. ,   3. ],
       [  8.8, 190. ,  50. ,  19.5,   0. ,   1. ],
       [  9. , 276. ,  91. ,  40.6,   0. ,   3. ],
       [  7.9, 204. ,  78. ,  38.7,   0. ,   3. ],
       [  3.3, 110. ,  77. ,  11.1,   0. ,   0. ],
       [  5.9, 238. ,  72. ,  15.8,   0. ,   0. ],
       [ 15.4, 335. ,  80. ,  31.9,   0. ,   3. ],
       [ 17.4, 211. ,  60. ,  25.8,   0. ,   3. ],
       [  5.3,  46. ,  83. ,  20.2,   0. ,   0. ],
       [  2.6, 120. ,  54. ,  14.2,   0. ,   1. ],
       [ 10.4, 249. ,  83. ,  24. ,   0. ,   3. ],
       [  7.2, 113. ,  65. ,  21. ,   0. ,   0. ],
       [  2.2,  56. ,  57. ,  11.3,   0. ,   1. ],
       [  6. , 115. ,  66. ,  18. ,   0. ,   0. ],
       [  9.7, 109. ,  52. ,  16.3,   0. ,   1. ],
       [ 15.4, 249. ,  66. ,  22.2,   0. ,   3. ],
       [  2.1,  83. ,  51. ,   7.8,   0. ,   1. ],
       [ 11.3, 300. ,  67. ,  27.8,   0. ,   3. ],
       [  4.4, 149. ,  85. ,  16.3,   0. ,   0. ],
       [ 12.1, 255. ,  74. ,  35.1,   0. ,   3. ],
       [  2.7,  72. ,  66. ,  14.9,   0. ,   1. ],
       [ 16.1, 259. ,  44. ,  17.1,   0. ,   3. ],
       [  9. , 178. ,  70. ,  28.2,   0. ,   3. ],
       [  6. , 109. ,  53. ,  16.4,   0. ,   1. ],
       [  4.3, 102. ,  62. ,  16.5,   0. ,   1. ],
       [ 12.2, 252. ,  81. ,  46. ,   0. ,   3. ],
       [  2.1,  57. ,  56. ,   9.5,   0. ,   1. ],
       [  7.4, 159. ,  89. ,  18.8,   0. ,   0. ],
       [ 11.4, 285. ,  70. ,  32.1,   0. ,   3. ],
       [ 11.1, 254. ,  86. ,  26.1,   0. ,   3. ],
       [ 13. , 337. ,  45. ,  16.1,   0. ,   3. ],
       [  0.8,  45. ,  44. ,   7.3,   0. ,   1. ],
       [  7.3, 120. ,  75. ,  21.4,   0. ,   0. ],
       [  6.6, 151. ,  68. ,  20. ,   0. ,   0. ],
       [  4.9, 159. ,  67. ,  29.3,   0. ,   0. ],
       [  6.3, 106. ,  72. ,  14.9,   0. ,   0. ],
       [  3.4, 174. ,  87. ,   8.3,   0. ,   0. ],
       [ 14.4, 279. ,  48. ,  22.5,   0. ,   3. ],
       [  3.8,  86. ,  45. ,  12.8,   0. ,   1. ],
```

```
[ 13.2, 188. ,  59. ,  26.9,   0. ,   3. ],
[ 12.7, 201. ,  80. ,  25.5,   0. ,   3. ],
[  3.2, 120. ,  80. ,  22.9,   0. ,   0. ],
[  2.2,  48. ,  32. ,  11.2,   0. ,   1. ],
[  8.5, 156. ,  63. ,  20.7,   0. ,   0. ],
[  4. , 145. ,  73. ,  26.2,   0. ,   0. ],
[  5.7,  81. ,  39. ,   9.3,   0. ,   1. ],
[  2.6,  53. ,  66. ,  10.8,   0. ,   1. ],
[  6.8, 161. ,  60. ,  15.6,   0. ,   0. ]])
```

In [35]:
```
stscaler=StandardScaler().fit(array)
x=stscaler.transform(array)
```

In [36]:
```
x
```

Out[36]:
```
array([[ 1.25517927e+00,  7.90787158e-01, -5.26195142e-01,
        -3.45115891e-03, -1.42857143e-01,  1.19947008e+00],
       [ 5.13018579e-01,  1.11805959e+00, -1.22406668e+00,
         2.50942392e+00,  7.00000000e+00,  4.20593403e-01],
       [ 7.23606675e-02,  1.49381682e+00,  1.00912225e+00,
         1.05346626e+00, -1.42857143e-01,  1.19947008e+00],
       [ 2.34708319e-01,  2.33211909e-01, -1.08449238e+00,
        -1.86793976e-01, -1.42857143e-01, -3.58283270e-01],
       [ 2.81093362e-01,  1.27563520e+00,  1.77678094e+00,
         2.08881393e+00, -1.42857143e-01,  1.19947008e+00],
       [ 2.59756242e-02,  4.02908724e-01,  8.69547941e-01,
         1.88390137e+00, -1.42857143e-01,  1.19947008e+00],
       [-1.04088037e+00, -7.36484178e-01,  7.99760786e-01,
        -1.09272319e+00, -1.42857143e-01, -1.13715994e+00],
       [-4.37874809e-01,  8.15029561e-01,  4.50825016e-01,
        -5.85834225e-01, -1.42857143e-01, -1.13715994e+00],
       [ 1.76541475e+00,  1.99078607e+00,  1.00912225e+00,
         1.15053010e+00, -1.42857143e-01,  1.19947008e+00],
       [ 2.22926518e+00,  4.87757131e-01, -3.86620834e-01,
         4.92652934e-01, -1.42857143e-01,  1.19947008e+00],
       [-5.77029938e-01, -1.51224105e+00,  1.21848371e+00,
        -1.11299875e-01, -1.42857143e-01, -1.13715994e+00],
       [-1.20322802e+00, -6.15272167e-01, -8.05343759e-01,
        -7.58392170e-01, -1.42857143e-01, -3.58283270e-01],
       [ 6.05788665e-01,  9.48362772e-01,  1.21848371e+00,
         2.98525246e-01, -1.42857143e-01,  1.19947008e+00],
       [-1.36372027e-01, -7.00120574e-01, -3.76850632e-02,
        -2.50209021e-02, -1.42857143e-01, -1.13715994e+00],
       [-1.29599811e+00, -1.39102904e+00, -5.95982296e-01,
        -1.07115345e+00, -1.42857143e-01, -3.58283270e-01],
       [-4.14682287e-01, -6.75878172e-01,  3.21020909e-02,
        -3.48567050e-01, -1.42857143e-01, -1.13715994e+00],
       [ 4.43441014e-01, -7.48605379e-01, -9.44918067e-01,
        -5.31909867e-01, -1.42857143e-01, -3.58283270e-01],
       [ 1.76541475e+00,  9.48362772e-01,  3.21020909e-02,
         1.04397557e-01, -1.42857143e-01,  1.19947008e+00],
       [-1.31919063e+00, -1.06375661e+00, -1.01470522e+00,
        -1.44862395e+00, -1.42857143e-01, -3.58283270e-01],
       [ 8.14521360e-01,  1.56654403e+00,  1.01889245e-01,
         7.08350366e-01, -1.42857143e-01,  1.19947008e+00],
       [-7.85762633e-01, -2.63757335e-01,  1.35805802e+00,
```

```
 -5.31909867e-01, -1.42857143e-01, -1.13715994e+00],
[ 1.00006153e+00,  1.02108998e+00,  5.90399324e-01,
  1.49564599e+00, -1.42857143e-01,  1.19947008e+00],
[-1.18003550e+00, -1.19708982e+00,  3.21020909e-02,
 -6.82898069e-01, -1.42857143e-01, -3.58283270e-01],
[ 1.92776240e+00,  1.06957478e+00, -1.50321530e+00,
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[ 2.81093362e-01,  8.77574958e-02,  3.11250707e-01,
  7.51489853e-01, -1.42857143e-01,  1.19947008e+00],
[-4.14682287e-01, -7.48605379e-01, -8.75130913e-01,
 -5.21124995e-01, -1.42857143e-01, -3.58283270e-01],
[-8.08955155e-01, -8.33453786e-01, -2.47046526e-01,
 -5.10340124e-01, -1.42857143e-01, -3.58283270e-01],
[ 1.02325405e+00,  9.84726376e-01,  1.07890940e+00,
  2.67119700e+00, -1.42857143e-01,  1.19947008e+00],
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[ 7.68136317e-01,  1.00896878e+00,  1.42784517e+00,
  5.25007549e-01, -1.42857143e-01,  1.19947008e+00],
[ 1.20879423e+00,  2.01502847e+00, -1.43342815e+00,
 -5.53479610e-01, -1.42857143e-01,  1.19947008e+00],
[-1.62069341e+00, -1.52436225e+00, -1.50321530e+00,
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  1.81185843e-02, -1.42857143e-01, -1.13715994e+00],
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  8.70123440e-01, -1.42857143e-01, -1.13715994e+00],
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[-1.01768785e+00,  3.92726915e-02,  1.49763233e+00,
 -1.39469959e+00, -1.42857143e-01, -1.13715994e+00],
[ 1.53348953e+00,  1.31199880e+00, -1.22406668e+00,
  1.36752172e-01, -1.42857143e-01,  1.19947008e+00],
[-9.24917763e-01, -1.02739300e+00, -1.43342815e+00,
 -9.09380373e-01, -1.42857143e-01, -3.58283270e-01],
[ 1.25517927e+00,  2.08969507e-01, -4.56407988e-01,
  6.11286522e-01, -1.42857143e-01,  1.19947008e+00],
```

```
[ 1.13921666e+00,  3.66545121e-01,  1.00912225e+00,
  4.60298320e-01, -1.42857143e-01,  1.19947008e+00],
[-1.06407289e+00, -6.15272167e-01,  1.00912225e+00,
  1.79891658e-01, -1.42857143e-01, -1.13715994e+00],
[-1.29599811e+00, -1.48799864e+00, -2.34066115e+00,
 -1.08193832e+00, -1.42857143e-01, -3.58283270e-01],
[ 1.65130754e-01, -1.78908928e-01, -1.77259372e-01,
 -5.73755169e-02, -1.42857143e-01, -1.13715994e+00],
[-8.78532720e-01, -3.12242140e-01,  5.20612170e-01,
  5.35792421e-01, -1.42857143e-01, -1.13715994e+00],
[-4.84259852e-01, -1.08799901e+00, -1.85215107e+00,
 -1.28685088e+00, -1.42857143e-01, -3.58283270e-01],
[-1.20322802e+00, -1.42739264e+00,  3.21020909e-02,
 -1.12507780e+00, -1.42857143e-01, -3.58283270e-01],
[-2.29142114e-01, -1.18302923e-01, -3.86620834e-01,
 -6.07403968e-01, -1.42857143e-01, -1.13715994e+00]])
```

In [37]:
```
dbscan=DBSCAN(eps=0.8,min_samples=6)
dbscan.fit(x)
```

Out[37]:
```
DBSCAN(eps=0.8, min_samples=6)
```

In [38]:
```
dbscan.labels_
```

Out[38]:
```
array([-1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1,  0, -1,  0, -1,
       -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1, -1,
        0,  0, -1,  0, -1, -1, -1, -1, -1, -1, -1,  0, -1, -1, -1,  0],
      dtype=int64)
```

In [39]:
```
c1=pd.DataFrame(dbscan.labels_,columns=['clusters'])
```

In [40]:
```
c1
```

Out[40]:

| | clusters |
|---|---|
| **0** | -1 |
| **1** | -1 |
| **2** | -1 |
| **3** | -1 |
| **4** | -1 |
| **5** | -1 |
| **6** | -1 |
| **7** | -1 |
| **8** | -1 |
| **9** | -1 |
| **10** | -1 |
| **11** | -1 |
| **12** | -1 |
| **13** | 0 |
| **14** | -1 |
| **15** | 0 |
| **16** | -1 |
| **17** | -1 |
| **18** | -1 |
| **19** | -1 |
| **20** | -1 |
| **21** | -1 |
| **22** | -1 |
| **23** | -1 |
| **24** | -1 |

| | clusters |
|---|---|
| **25** | -1 |
| **26** | -1 |
| **27** | -1 |
| **28** | -1 |
| **29** | -1 |
| **30** | -1 |
| **31** | -1 |
| **32** | -1 |
| **33** | -1 |
| **34** | 0 |
| **35** | 0 |
| **36** | -1 |
| **37** | 0 |
| **38** | -1 |
| **39** | -1 |
| **40** | -1 |
| **41** | -1 |
| **42** | -1 |
| **43** | -1 |
| **44** | -1 |
| **45** | 0 |
| **46** | -1 |
| **47** | -1 |
| **48** | -1 |
| **49** | 0 |

In [42]:
```
pd.concat([crime,c1],axis=1)
```

Out[42]:

| | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new | clusters |
|---|---|---|---|---|---|---|---|
| **0** | 13.2 | 236 | 58 | 21.2 | 0 | 3 | -1 |
| **1** | 10.0 | 263 | 48 | 44.5 | 1 | 2 | -1 |
| **2** | 8.1 | 294 | 80 | 31.0 | 0 | 3 | -1 |
| **3** | 8.8 | 190 | 50 | 19.5 | 0 | 1 | -1 |
| **4** | 9.0 | 276 | 91 | 40.6 | 0 | 3 | -1 |
| **5** | 7.9 | 204 | 78 | 38.7 | 0 | 3 | -1 |
| **6** | 3.3 | 110 | 77 | 11.1 | 0 | 0 | -1 |
| **7** | 5.9 | 238 | 72 | 15.8 | 0 | 0 | -1 |
| **8** | 15.4 | 335 | 80 | 31.9 | 0 | 3 | -1 |
| **9** | 17.4 | 211 | 60 | 25.8 | 0 | 3 | -1 |
| **10** | 5.3 | 46 | 83 | 20.2 | 0 | 0 | -1 |
| **11** | 2.6 | 120 | 54 | 14.2 | 0 | 1 | -1 |
| **12** | 10.4 | 249 | 83 | 24.0 | 0 | 3 | -1 |
| **13** | 7.2 | 113 | 65 | 21.0 | 0 | 0 | 0 |
| **14** | 2.2 | 56 | 57 | 11.3 | 0 | 1 | -1 |
| **15** | 6.0 | 115 | 66 | 18.0 | 0 | 0 | 0 |
| **16** | 9.7 | 109 | 52 | 16.3 | 0 | 1 | -1 |
| **17** | 15.4 | 249 | 66 | 22.2 | 0 | 3 | -1 |
| **18** | 2.1 | 83 | 51 | 7.8 | 0 | 1 | -1 |
| **19** | 11.3 | 300 | 67 | 27.8 | 0 | 3 | -1 |
| **20** | 4.4 | 149 | 85 | 16.3 | 0 | 0 | -1 |
| **21** | 12.1 | 255 | 74 | 35.1 | 0 | 3 | -1 |
| **22** | 2.7 | 72 | 66 | 14.9 | 0 | 1 | -1 |
| **23** | 16.1 | 259 | 44 | 17.1 | 0 | 3 | -1 |

| | Murder | Assault | UrbanPop | Rape | h_clusterid | clusterid_new | clusters |
|---|---|---|---|---|---|---|---|
| **24** | 9.0 | 178 | 70 | 28.2 | 0 | 3 | -1 |
| **25** | 6.0 | 109 | 53 | 16.4 | 0 | 1 | -1 |
| **26** | 4.3 | 102 | 62 | 16.5 | 0 | 1 | -1 |
| **27** | 12.2 | 252 | 81 | 46.0 | 0 | 3 | -1 |
| **28** | 2.1 | 57 | 56 | 9.5 | 0 | 1 | -1 |
| **29** | 7.4 | 159 | 89 | 18.8 | 0 | 0 | -1 |
| **30** | 11.4 | 285 | 70 | 32.1 | 0 | 3 | -1 |
| **31** | 11.1 | 254 | 86 | 26.1 | 0 | 3 | -1 |
| **32** | 13.0 | 337 | 45 | 16.1 | 0 | 3 | -1 |
| **33** | 0.8 | 45 | 44 | 7.3 | 0 | 1 | -1 |
| **34** | 7.3 | 120 | 75 | 21.4 | 0 | 0 | 0 |
| **35** | 6.6 | 151 | 68 | 20.0 | 0 | 0 | 0 |
| **36** | 4.9 | 159 | 67 | 29.3 | 0 | 0 | -1 |
| **37** | 6.3 | 106 | 72 | 14.9 | 0 | 0 | 0 |
| **38** | 3.4 | 174 | 87 | 8.3 | 0 | 0 | -1 |
| **39** | 14.4 | 279 | 48 | 22.5 | 0 | 3 | -1 |
| **40** | 3.8 | 86 | 45 | 12.8 | 0 | 1 | -1 |
| **41** | 13.2 | 188 | 59 | 26.9 | 0 | 3 | -1 |
| **42** | 12.7 | 201 | 80 | 25.5 | 0 | 3 | -1 |
| **43** | 3.2 | 120 | 80 | 22.9 | 0 | 0 | -1 |
| **44** | 2.2 | 48 | 32 | 11.2 | 0 | 1 | -1 |
| **45** | 8.5 | 156 | 63 | 20.7 | 0 | 0 | 0 |
| **46** | 4.0 | 145 | 73 | 26.2 | 0 | 0 | -1 |
| **47** | 5.7 | 81 | 39 | 9.3 | 0 | 1 | -1 |
| **48** | 2.6 | 53 | 66 | 10.8 | 0 | 1 | -1 |
| **49** | 6.8 | 161 | 60 | 15.6 | 0 | 0 | 0 |

In [ ]: