```
import pandas as pd
import seaborn as sns
df=pd.read_csv("C:\Users\Prerna\Downloads\Mall_Customers.csv")
df
```

```
     CustomerID   Genre  Age  Annual Income (k$)  Spending Score (1-
100)
0             1    Male   19                  15
39
1             2    Male   21                  15
81
2             3  Female   20                  16
6
3             4  Female   23                  16
77
4             5  Female   31                  17
40
..          ...     ...  ...                 ...                    .
..
195         196  Female   35                 120
79
196         197  Female   45                 126
28
197         198    Male   32                 126
74
198         199    Male   32                 137
18
199         200    Male   30                 137
83

[200 rows x 5 columns]
```

```
df.isna().sum()
```

```
CustomerID                0
Genre                     0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

```
df['Genre'].replace({"Male":0,"Female":1},inplace=True)
df
```

```
     CustomerID  Genre  Age  Annual Income (k$)  Spending Score (1-
100)
0             1      0   19                  15
39
1             2      0   21                  15
81
2             3      1   20                  16
```

```
6
3             4      1   23                  16
77
4             5      1   31                  17
40
..          ...    ...  ...                 ...                      ..
.
195         196      1   35                 120
79
196         197      1   45                 126
28
197         198      0   32                 126
74
198         199      0   32                 137
18
199         200      0   30                 137
83

[200 rows x 5 columns]
```

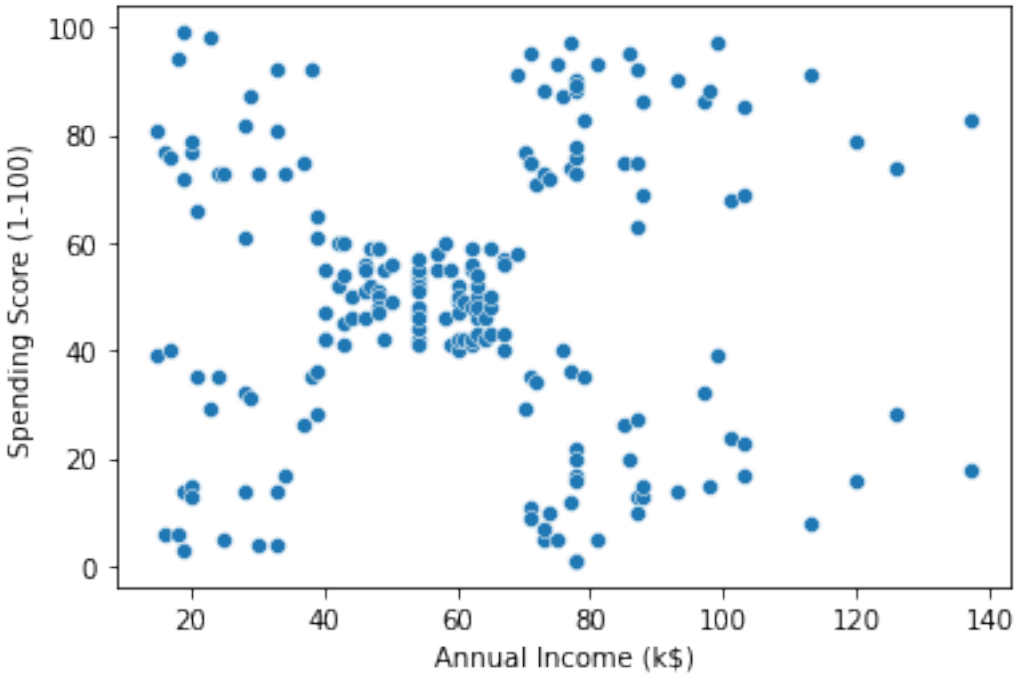
```
df1=df.iloc[:,3:5]
df1
```

```
     Annual Income (k$)  Spending Score (1-100)
0                    15                      39
1                    15                      81
2                    16                       6
3                    16                      77
4                    17                      40
..                  ...                     ...
195                 120                      79
196                 126                      28
197                 126                      74
198                 137                      18
199                 137                      83

[200 rows x 2 columns]
```

```
sns.scatterplot(data=df1,x='Annual Income (k$)',y='Spending Score (1-
100)')
```

```
<AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-
100)'>
```



```
from sklearn.cluster import KMeans
km=KMeans(n_clusters=3,random_state=0).fit(df1)
colors=km.labels_
centroids=km.cluster_centers_
x=[i[0] for i in centroids]
y=[i[1] for i in centroids]
colors
```

```
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, 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, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 0, 2, 0, 2, 0, 2, 0,
2,
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2,
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2,
       0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0,
2,
       0, 2])
```
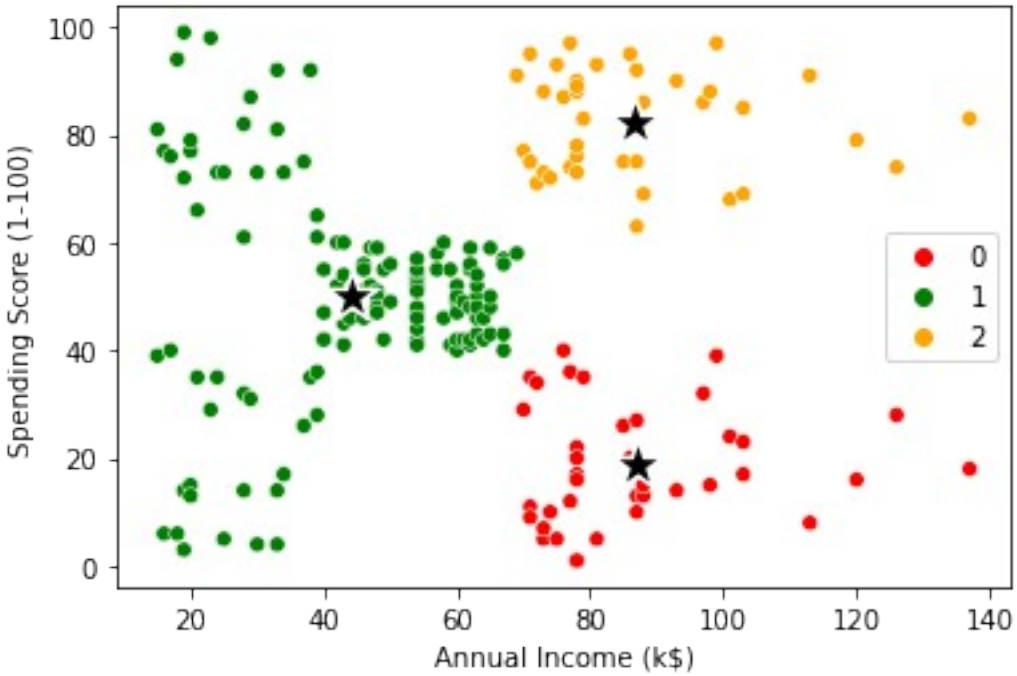

```
sns.scatterplot(data=df1,x='Annual Income (k$)',y='Spending Score (1-
100)',hue=colors,palette=['red','green','orange'])
sns.scatterplot(x=x,y=y,marker="*",s=400,color='Black')
```

```
<AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-
100)'>
```

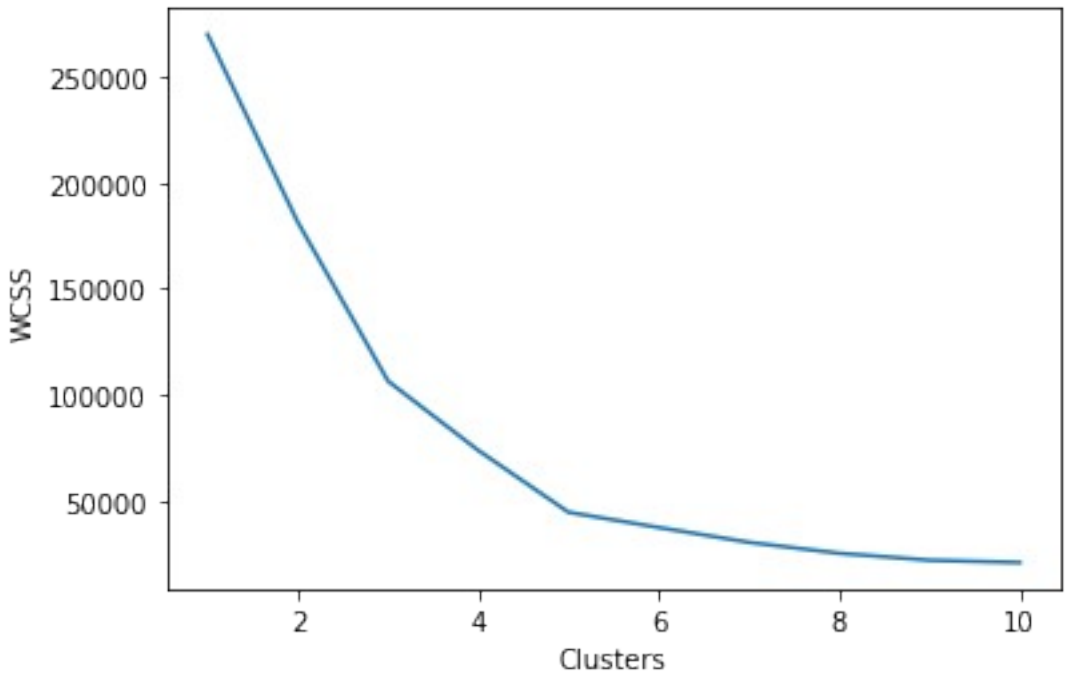



```
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,11):
    km=KMeans(n_clusters=i,init='k-means++',random_state=0).fit(df1)
    wcss.append(km.inertia_)
wcss
```

```
[269981.28,
 181363.59595959593,
 106348.37306211118,
 73679.78903948836,
 44448.45544793371,
 37265.86520484347,
 30259.65720728547,
 25095.703209997548,
 21830.041978049438,
 20736.679938924124]
```

```
sns.lineplot(x=[i for i in
range(1,11)],y=wcss).set(xlabel="Clusters",ylabel="WCSS")
```

```
[Text(0.5, 0, 'Clusters'), Text(0, 0.5, 'WCSS')]
```



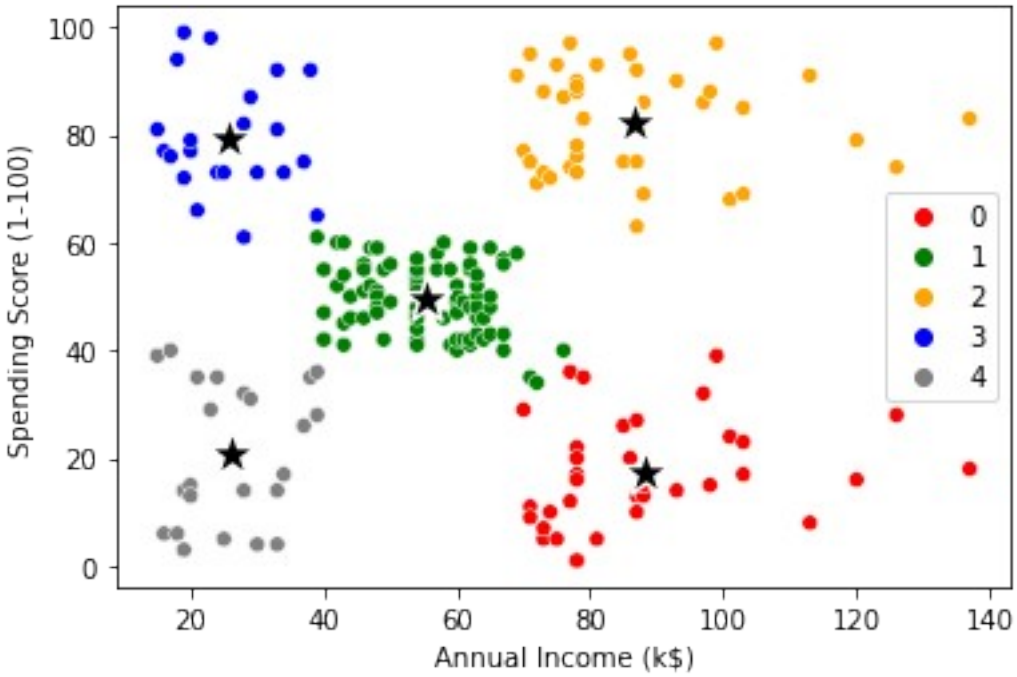

```
from sklearn.cluster import KMeans
km1=KMeans(n_clusters=5,random_state=0).fit(df1)
colors1=km1.labels_
centroids1=km1.cluster_centers_
centroids1
```

```
array([[88.2       , 17.11428571],
       [55.2962963 , 49.51851852],
       [86.53846154, 82.12820513],
       [25.72727273, 79.36363636],
       [26.30434783, 20.91304348]])
```

```
x1=[i[0] for i in centroids1]
y1=[i[1] for i in centroids1]
```

```
sns.scatterplot(data=df1,x='Annual Income (k$)',y='Spending Score (1-
100)',hue=colors1,palette=['red','green','orange','blue','grey'])
sns.scatterplot(x=x1,y=y1,marker='*',s=350,color='Black')
```

```
<AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-
100)'>
```




```
import scipy.cluster.hierarchy as sc
sc.dendrogram(sc.linkage(df1,method='ward'))
```

```
{'icoord': [[15.0, 15.0, 25.0, 25.0],
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  [20.0, 20.0, 40.0, 40.0],
  [5.0, 5.0, 30.0, 30.0],
  [55.0, 55.0, 65.0, 65.0],
  [85.0, 85.0, 95.0, 95.0],
  [115.0, 115.0, 125.0, 125.0],
  [105.0, 105.0, 120.0, 120.0],
  [90.0, 90.0, 112.5, 112.5],
  [75.0, 75.0, 101.25, 101.25],
  [60.0, 60.0, 88.125, 88.125],
  [17.5, 17.5, 74.0625, 74.0625],
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  [185.0, 185.0, 200.0, 200.0],
  [170.0, 170.0, 192.5, 192.5],
  [142.5, 142.5, 181.25, 181.25],
  [45.78125, 45.78125, 161.875, 161.875],
  [225.0, 225.0, 235.0, 235.0],
  [215.0, 215.0, 230.0, 230.0],
  [255.0, 255.0, 265.0, 265.0],
  [245.0, 245.0, 260.0, 260.0],
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  [285.0, 285.0, 295.0, 295.0],
```

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```

```
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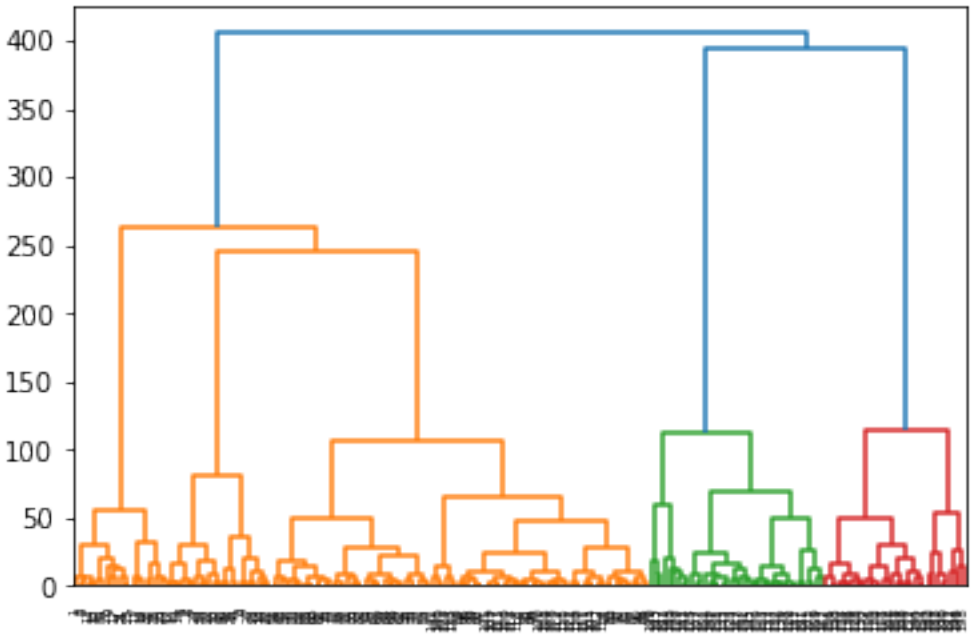


```
from sklearn.cluster import AgglomerativeClustering
clu=AgglomerativeClustering(n_clusters=5).fit(df1)
clu
```

```
AgglomerativeClustering(n_clusters=5)
```

```
color1=clu.labels_
color1
```

```
array([4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4,
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       0, 2], dtype=int64)
```

```
sns.scatterplot(data=df1,x='Annual Income (k$)',y='Spending Score (1-
100)',hue=color1,palette=['red','green','black','orange','cyan'])
```

```
<AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-
100)'>
```