In [3]:

```
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
```

In [4]:

```
data = pd.read_csv('Mall_Customers.csv')
```

In [5]:

```
data.head()
```

Out[5]:

	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

Label Encoding Genre Column

In [6]:

```
from sklearn.preprocessing import LabelEncoder
```

In [7]:

```
lb = LabelEncoder()
```

In [11]:

```
data[['Genre']]  = lb.fit_transform(data[['Genre']])
```

```
C:\Users\Administrator\Anaconda3\envs\deep\lib\site-packages\sklearn\utils\v
alidation.py:73: DataConversionWarning: A column-vector y was passed when a
1d array was expected. Please change the shape of y to (n_samples, ), for ex
ample using ravel().
  return f(**kwargs)
```

In [12]:

```
data.head()
```

Out[12]:

	CustomerID	Genre	Age	Annual Income (k$)	Spending Score (1-100)
0	1	1	19	15	39
1	2	1	21	15	81
2	3	0	20	16	6
3	4	0	23	16	77
4	5	0	31	17	40

In [13]:

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

In [14]:

```
X
```

Out[14]:

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

200 rows × 4 columns

In [15]:

```
wcss = []
```

```
testing histograms
```

In [16]:

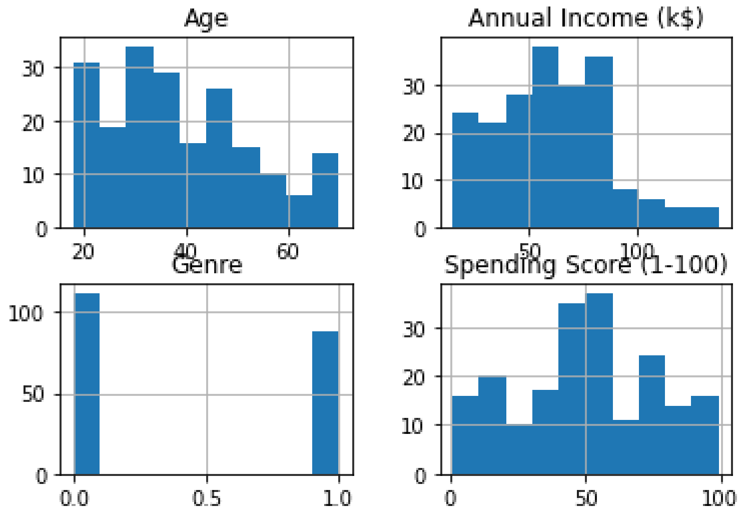
```
test = pd.DataFrame(X)
```

In [17]:

```
test.hist()
```

Out[17]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001DE8C301080
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DE8C5A3320
>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001DE8C5D4588
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001DE8C6047F0
>]],
      dtype=object)
```



In [20]:

```
from sklearn.cluster import KMeans
```

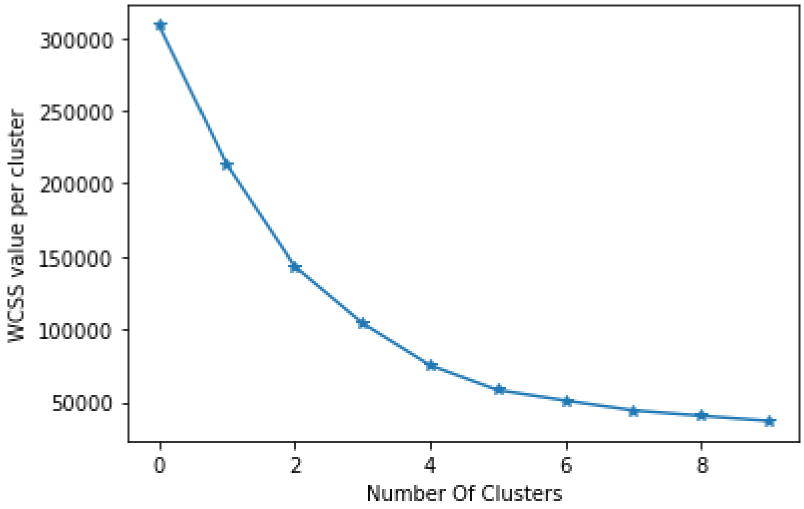
plotting Within Cluster Sum of Squares to find optimal number of clusters in K Means

In [22]:

```
for i in range(1,11):
    km = KMeans(n_clusters = i,init = 'k-means++',random_state = 42)
    km.fit(X)
    wcss.append(km.inertia_)
```

In [24]:

```
plt.plot(wcss,marker = '*')
plt.xlabel('Number Of Clusters')
plt.ylabel('WCSS value per cluster')
plt.show()
```



```
found 4 or 5 clusters to be optimal ... Finding predicted Y based on 4 clusters
```

In [25]:

```
km = KMeans(n_clusters = 4,init ='k-means++',random_state = 42)
```

In [26]:

```
y_km = km.fit_predict(X)
```

In [ ]:

```
Performing Hierarchical Clustering
```

In [ ]:

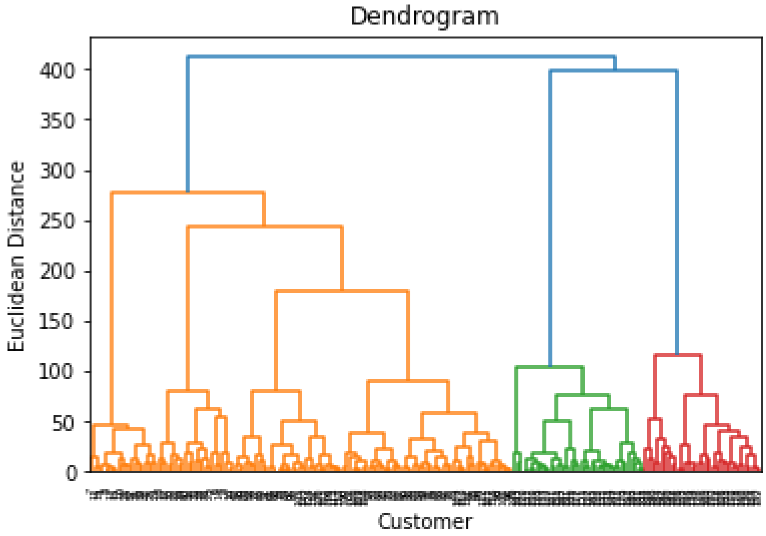
```
Plotting Dendrogram to find optimal numbers of clusters
```

In [29]:

```
import scipy.cluster.hierarchy as dg
```

In [30]:

```
dgr = dg.dendrogram(dg.linkage(X,method = 'ward'))
plt.title('Dendrogram')
plt.xlabel('Customer')
plt.ylabel('Euclidean Distance')
plt.show()
```



In [31]:

```
from sklearn.cluster import AgglomerativeClustering
amc = AgglomerativeClustering(n_clusters = 3,affinity = 'euclidean',linkage = 'ward')
```

In [32]:

```
y_hc = amc.fit_predict(X)
```

In [33]:

```
y_hc
```

Out[33]:

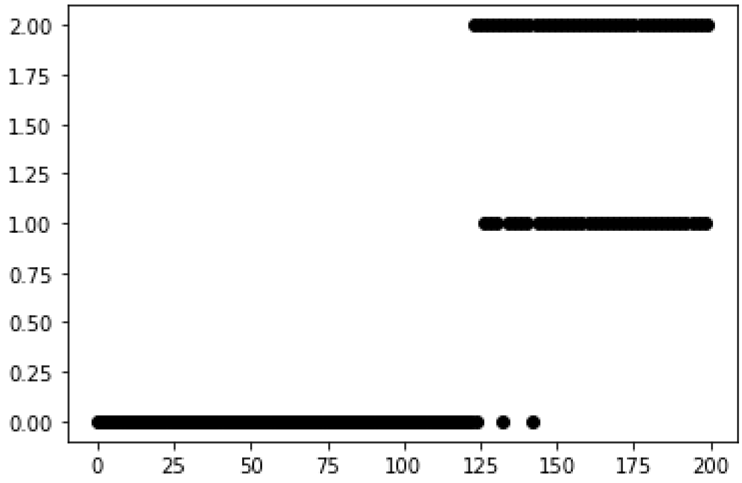
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2, 1, 2, 1, 2, 1, 2,
       0, 2, 1, 2, 1, 2, 1, 2, 1, 2, 0, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2,
       1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2,
       1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1, 2,
       1, 2], dtype=int64)
```

In [38]:

```
plt.plot(y_hc,'ok')
```

Out[38]:

```
[<matplotlib.lines.Line2D at 0x1de8d738e80>]
```

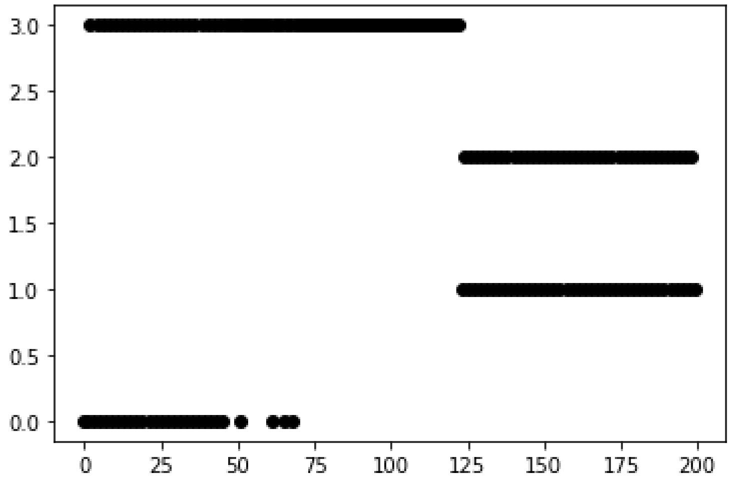


In [40]:

```
plt.plot(y_km,'ok')
```

Out[40]:

```
[<matplotlib.lines.Line2D at 0x1de8d7a9a58>]
```



In [ ]:

```

```