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Project Domain = Data Science

Project Name = CUSTOMER SEGMENTATION USING K-MEANS CLUSTERING

Company Name = Exposys Data Labs

Importing the Dependencies

In [80]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans
```

Data Collection & Analysis

In [81]:
```
# First 5 rows in the dataframe
df = pd.read_csv("Mall_Customers.csv")
df.head()
```

Out[81]:

	CustomerID	Gender	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

In [79]:
```
#finding the number of rows and columes in dataset
df.shape
```

Out[79]:
```
(200, 5)
```

In [82]:
```
# getting the info about the dataset
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

In [83]:
```
df.describe()
```

Out[83]:

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000
mean	100.500000	38.850000	60.560000	50.200000
std	57.879185	13.969007	26.264721	25.823522
min	1.000000	18.000000	15.000000	1.000000
25%	50.750000	28.750000	41.500000	34.750000
50%	100.500000	36.000000	61.500000	50.000000
75%	150.250000	49.000000	78.000000	73.000000
max	200.000000	70.000000	137.000000	99.000000

In [84]:
```
df.dtypes
```

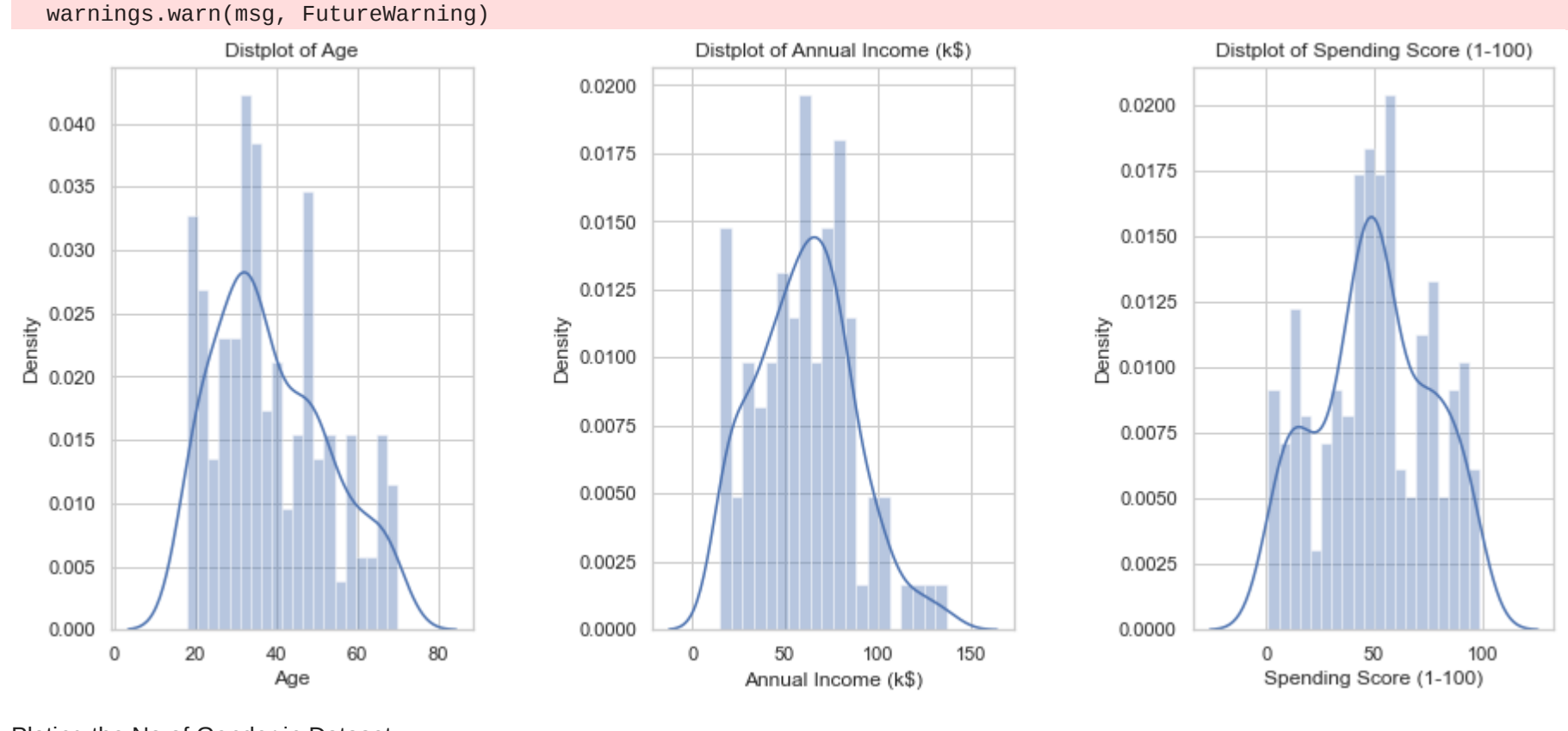
Out[84]:
```
CustomerID                 int64
Gender                    object
Age                        int64
Annual Income (k$)         int64
Spending Score (1-100)     int64
dtype: object
```

In [85]:
```
# checking the missing values
df.isnull().sum()
```

Out[85]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

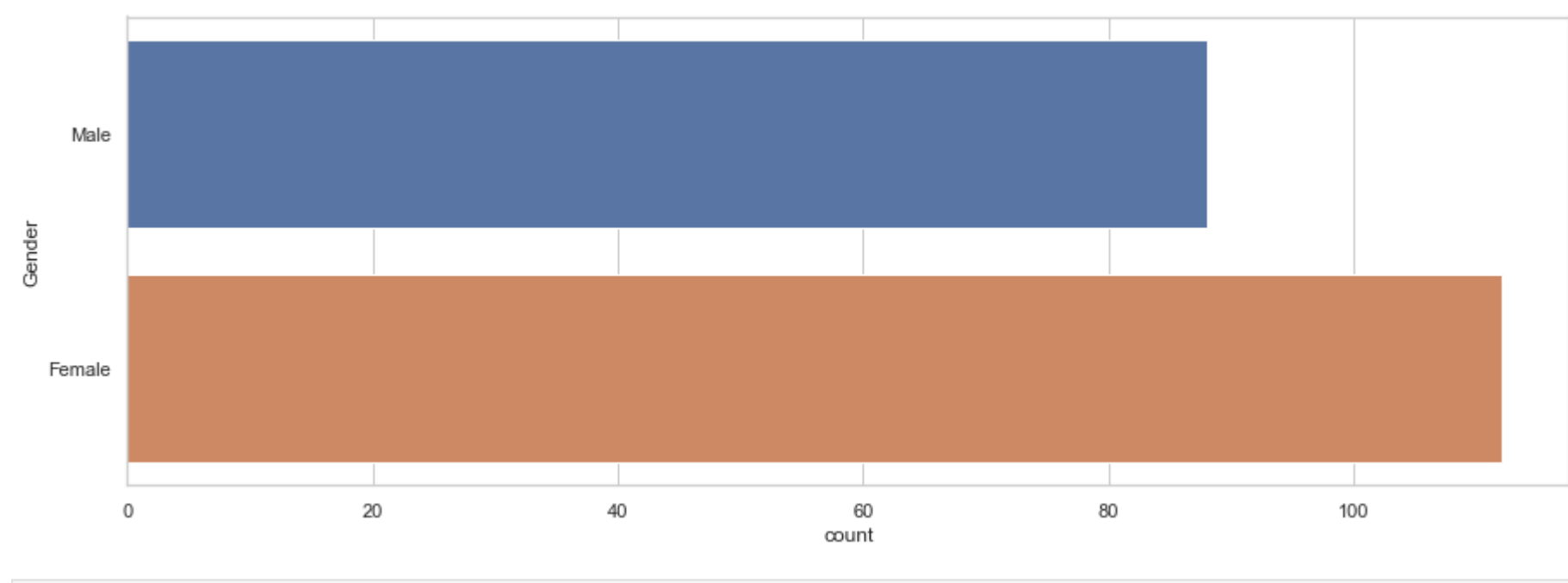
In [86]:
```
plt.figure(1, figsize=(15,6))
n=0
for x in ['Age','Annual Income (k$)', 'Spending Score (1-100)']:
    n+=1
    plt.subplot(1 , 3 , n)
    plt.subplots_adjust(hspace =0.5 , wspace = 0.5)
    sns.distplot(df[x] , bins = 20)
    plt.title('Distplot of {}'.format(x))
plt.show()
```

```
c:\users\hp\appdata\local\programs\python\python39\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
c:\users\hp\appdata\local\programs\python\python39\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
c:\users\hp\appdata\local\programs\python\python39\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

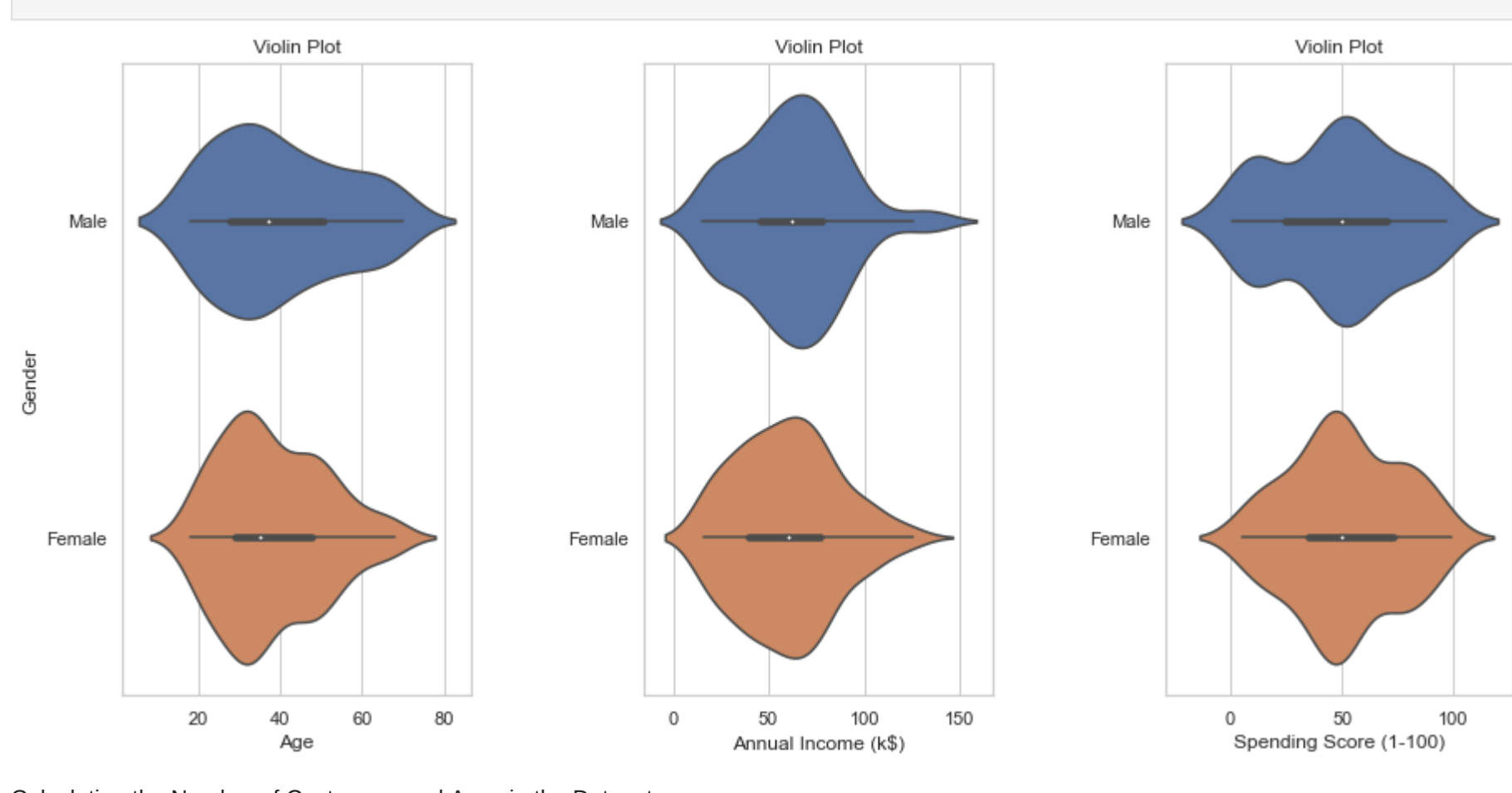


Ploting the No.of Gender in Dataset

In [87]:
```
plt.figure(figsize=(15,5))
sns.countplot(y='Gender',data=df)
plt.show()
```

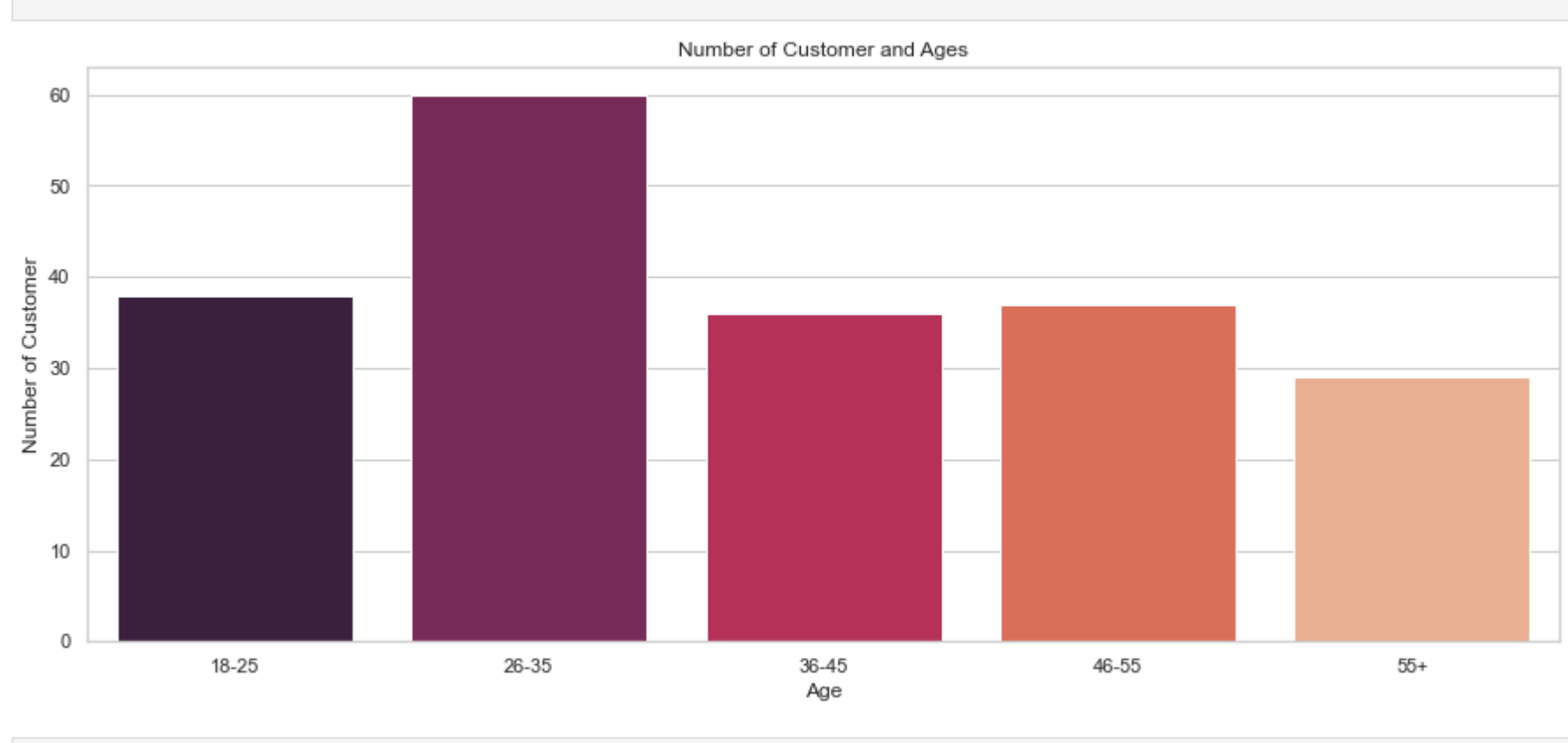


In [88]:
```
plt.figure(1,figsize=(15,7))
n=0
for cols in ['Age' , 'Annual Income (k$)' , 'Spending Score (1-100)']:
    n+=1
    plt.subplot(1 , 3 , n)
    sns.set(style="whitegrid")
    plt.subplots_adjust(hspace = 0.5 , wspace = 0.5)
    sns.violinplot(x = cols , y = 'Gender' , data = df )
    plt.ylabel('Gender' if n == 1 else '')
    plt.title('Violin Plot' )
plt.show()
```



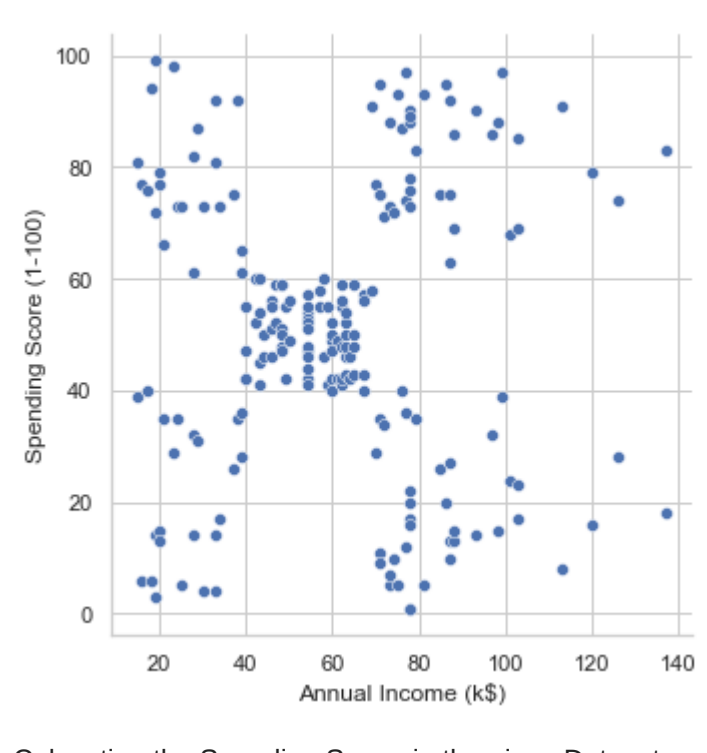
Calculating the Number of Customers and Ages in the Dataset

In [89]:
```
age_18_25 = df.Age[(df.Age >=18) & (df.Age <=25)]
age_26_35 = df.Age[(df.Age >=26) & (df.Age <=35)]
age_36_45 = df.Age[(df.Age >=36) & (df.Age <=45)]
age_46_55 = df.Age[(df.Age >=46) & (df.Age <=55)]
age_55above = df.Age[df.Age >= 56]

agex = ["18-25","26-35","36-45","46-55","55+"]
agey = [len(age_18_25.values),len(age_26_35.values),len(age_36_45.values),len(age_46_55.values),len(age_55above.values)]

plt.figure(figsize=(15,6))
sns.barplot(x= agex, y= agey, palette="rocket")
plt.title("Number of Customer and Ages")
plt.xlabel("Age")
plt.ylabel("Number of Customer")
plt.show()
```



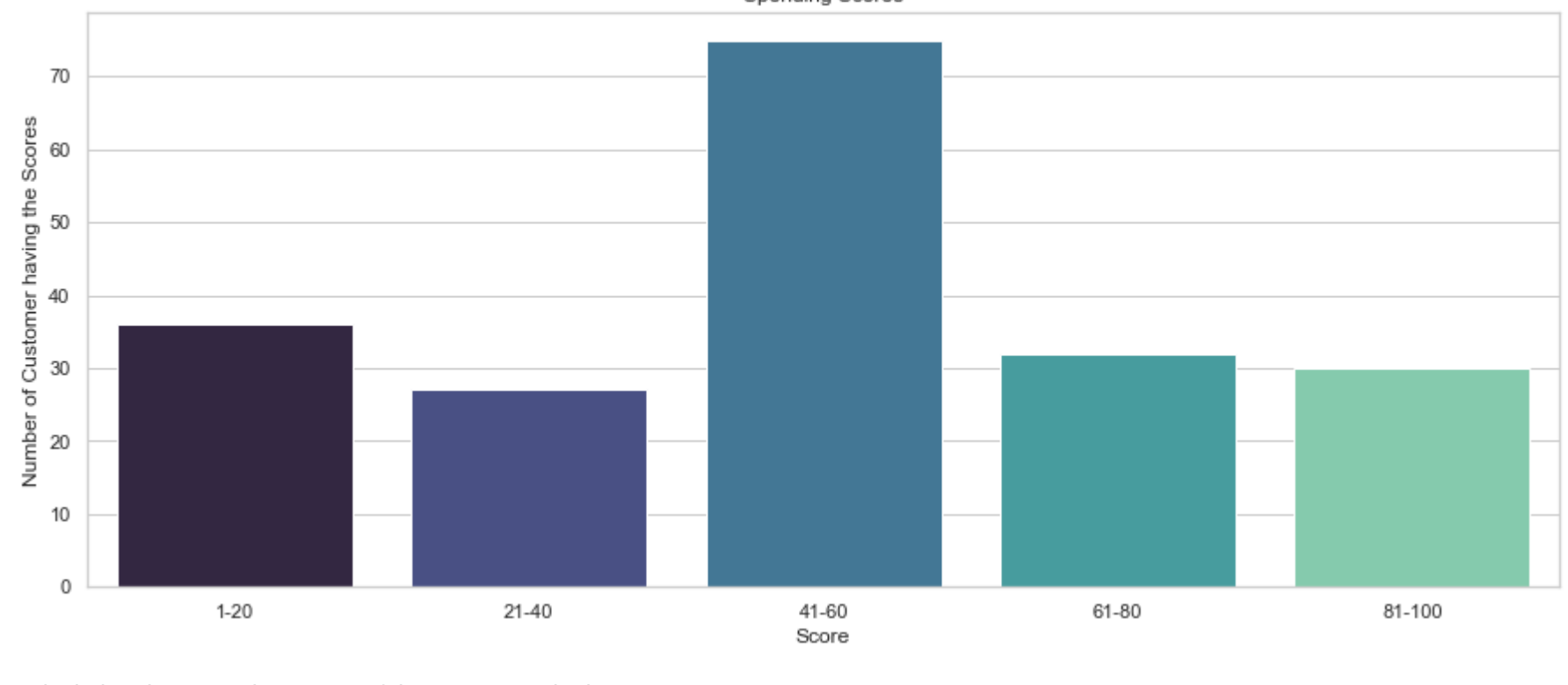
In [90]:
```
sns.relplot(x="Annual Income (k$)", y="Spending Score (1-100)", data=df)
```

Out[90]:
```
<seaborn.axisgrid.FacetGrid at 0x2a2c41df7c0>
```



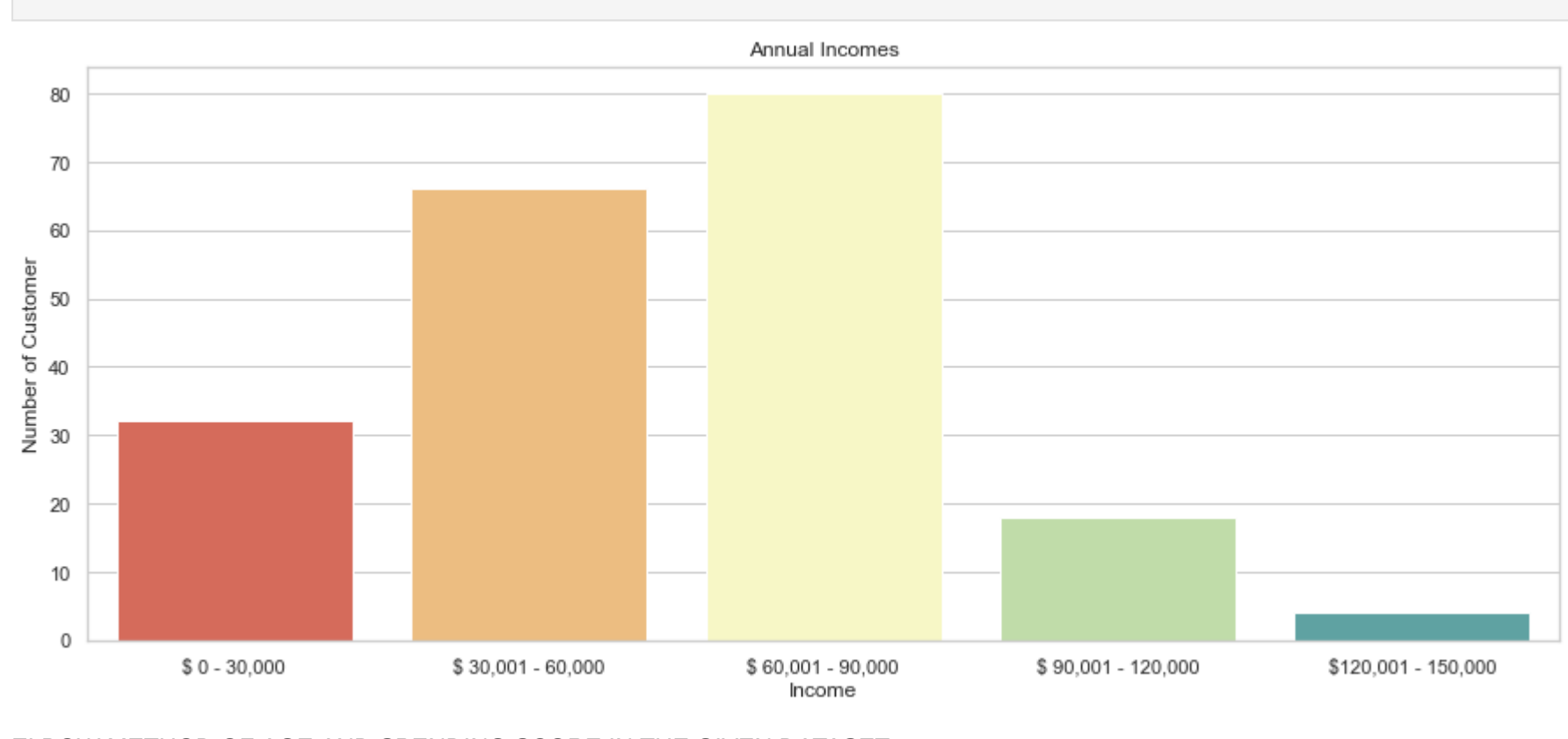
Calcuating the Spending Scoresin the given Dataset

In [91]:
```
ss_1_20 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"] >= 1) & (df["Spending Score (1-100)"] <= 20)]
ss_21_40 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"] >= 21) & (df["Spending Score (1-100)"] <= 40)]
ss_41_60 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"] >= 41) & (df["Spending Score (1-100)"] <= 60)]
ss_61_80 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"] >= 61) & (df["Spending Score (1-100)"] <= 80)]
ss_81_100 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"] >= 81) & (df["Spending Score (1-100)"] <= 100)]

ssx = ["1-20", "21-40", "41-60", "61-80", "81-100"]
ssy = [len(ss_1_20.values), len(ss_21_40.values), len(ss_41_60.values), len(ss_61_80.values), len(ss_81_100.values)]



plt.figure(figsize=(15,6))
sns.barplot(x= ssx, y= ssy, palette="mako")
plt.title("Spending Scores")
plt.xlabel("Score")
plt.ylabel("Number of Customer having the Scores")
plt.show()
```



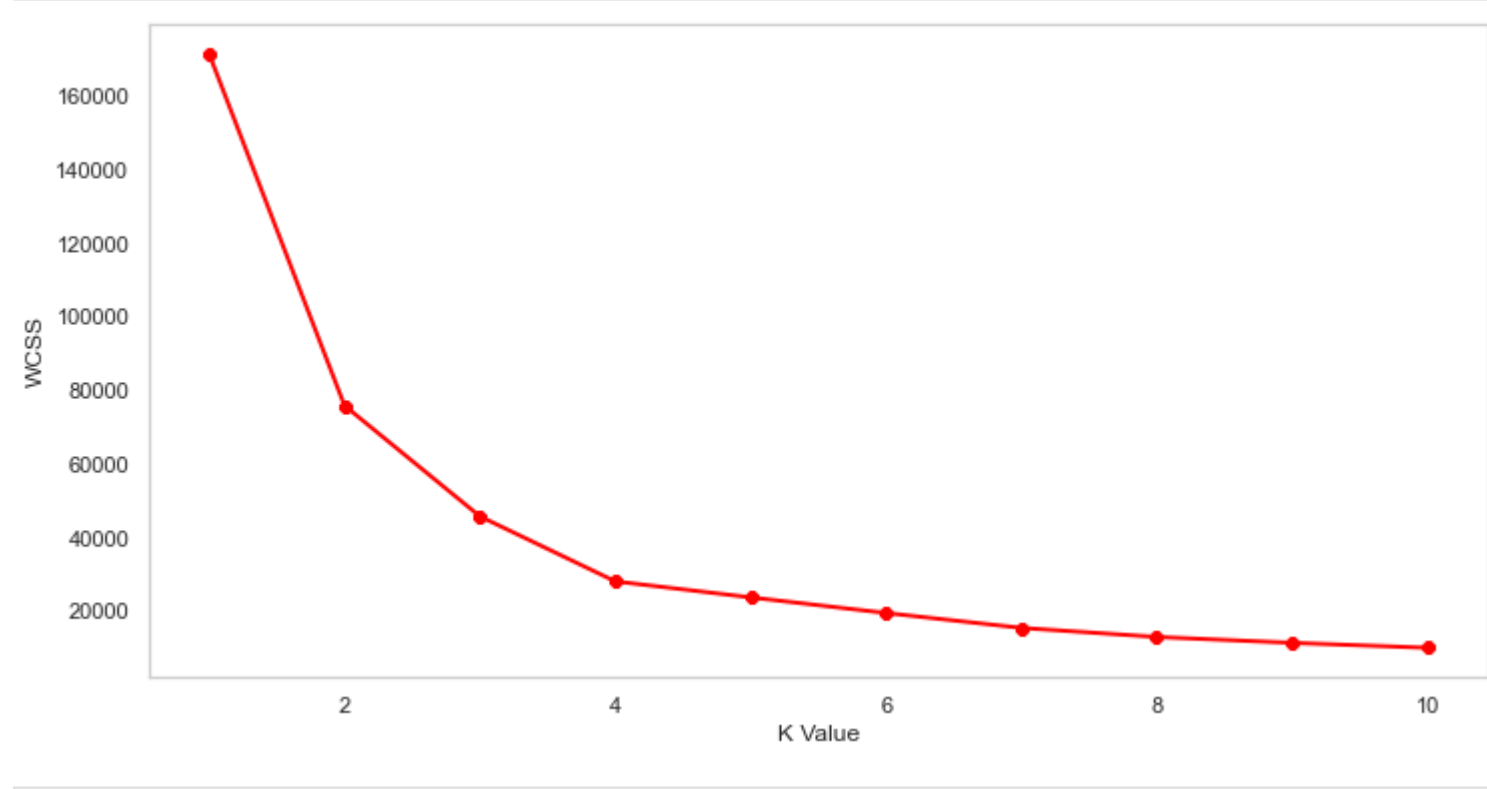
Calculating the Annual Incomes of the customers in the Dataset

In [92]:
```
ai0_30 = df["Annual Income (k$)"][(df["Annual Income (k$)"] >= 0) & (df["Annual Income (k$)"] <= 30)]
ai31_60 = df["Annual Income (k$)"][(df["Annual Income (k$)"] >= 31) & (df["Annual Income (k$)"] <= 60)]
ai61_90 = df["Annual Income (k$)"][(df["Annual Income (k$)"] >= 61) & (df["Annual Income (k$)"] <= 90)]
ai91_120 = df["Annual Income (k$)"][(df["Annual Income (k$)"] >= 91) & (df["Annual Income (k$)"] <= 120)]
ai121_150 = df["Annual Income (k$)"][(df["Annual Income (k$)"] >= 121) & (df["Annual Income (k$)"] <= 150)]

aix = ["$ 0 - 30,000", "$ 30,001 - 60,000", "$ 60,001 - 90,000", "$ 90,001 - 120,000","$120,001 - 150,000"]
aiy = [len(ai0_30.values), len(ai31_60.values), len(ai61_90.values), len(ai91_120.values), len(ai121_150.values)]

plt.figure(figsize=(15,6))
sns.barplot(x= aix, y= aiy, palette="Spectral")
plt.title("Annual Incomes")
plt.xlabel("Income")
plt.ylabel("Number of Customer")
plt.show()
```



ELBOW METHOD OF AGE AND SPENDING SCORE IN THE GIVEN DATASET

In [93]:
```
X1= df.loc[:, ["Age","Spending Score (1-100)"]].values
from sklearn.cluster import KMeans
wcss = []
for k in range(1,11):
    kmeans = KMeans(n_clusters=k, init="k-means++")
    kmeans.fit(X1)
    wcss.append(kmeans.inertia_)
plt.figure(figsize=(12,6))
plt.grid()
plt.plot(range(1,11),wcss, linewidth=2, color="red", marker ="8")
plt.xlabel("K Value")
plt.ylabel("WCSS")
plt.show()
```



In [94]:
```
kmeans = KMeans(n_clusters=4)

label = kmeans.fit_predict(X1)

print(label)
```

```
[2 1 0 1 2 1 0 1 0 1 0 1 0 1 0 1 2 2 0 1 2 1 0 1 0 1 0 2 0 1 0 1 0 1 0 1 0 1 0 1 0
 1 0 1 3 1 3 2 0 2 3 2 2 2 2 2 3 2 3 3 3 3 3 2 3 3 3 3 2 3 2 3 3 3 3 3 3
 3 2 3 2 2 3 3 2 3 3 3 2 3 3 2 2 2 3 3 2 3 2 2 2 3 2 3 2 2 3 3 2 3 3 3 3 3
 2 2 2 2 2 3 3 3 3 2 2 2 2 1 2 1 3 1 0 1 0 1 2 1 0 1 0 1 0 1 0 1 2 1 0 1 3 1
 0 1 0 1 0 1 0 1 0 1 0 1 3 1 0 1 0 1 0 1 0 2 0 1 0 1 0 1 0 1 0 1 0 1 0 1 2
 1 0 1 0 1 0 1 0 1 0 1 0 1]
```

In [95]:
```
print(kmeans.cluster_centers_)
```

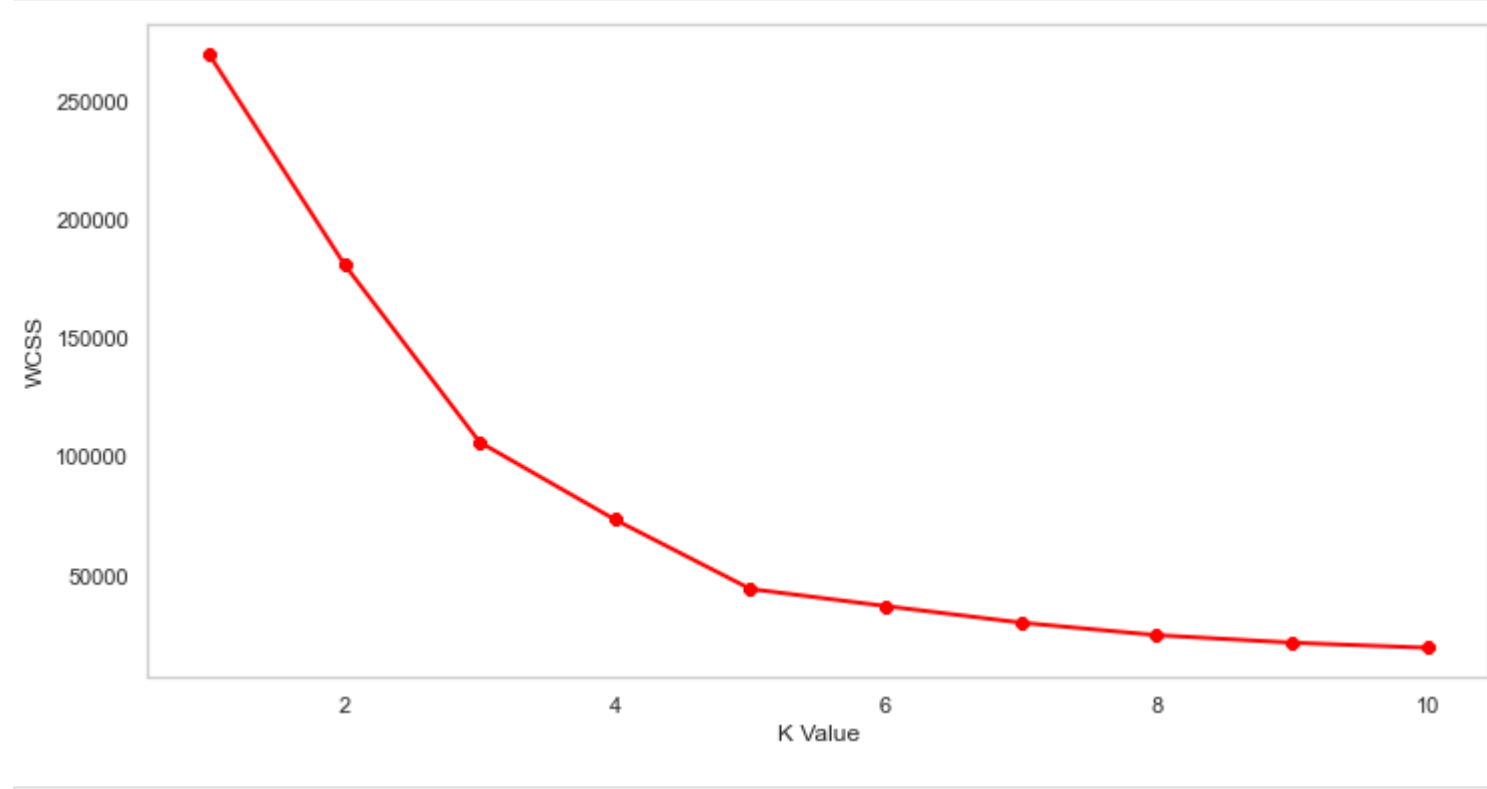
```
[[43.29166667 15.02083333]
 [30.1754386  82.35087719]
 [27.61702128 49.14893617]
 [55.70833333 48.22916667]]
```

Cluster plotting between AGE and SPENDING SCORES

In [96]:
```
plt.scatter(X1[:,0], X1[:,1], c=kmeans.labels_, cmap="rainbow")
plt.scatter(kmeans.cluster_centers_[:,0] ,kmeans.cluster_centers_[:,1], color="black")
plt.title("Clusters of Customers")
plt.xlabel("Age")
plt.ylabel("Spending Score(1-100)")
plt.show()
```

ELBOW METHOD between Annual Income and Spending scores

In [121…
```
X2=df.loc[:, ["Annual Income (k$)","Spending Score (1-100)"]].values

from sklearn.cluster import KMeans
wcss = []
for k in range(1,11):
    kmeans = KMeans(n_clusters=k, init="k-means++")
    kmeans.fit(X2)
    wcss.append(kmeans.inertia_)
plt.figure(figsize=(12,6))
plt.grid()
plt.plot(range(1,11),wcss, linewidth=2, color="red", marker ="8")
plt.xlabel("K Value")
plt.ylabel("WCSS")
plt.show()
```



In [108…
```
kmeans = KMeans(n_clusters=5)

label = kmeans.fit_predict(X2)

print(label)
```

```
[2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2
 3 2 3 2 3 2 0 2 3 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 4 1 4 0 4 1 4 1 4 0 4 1 4 1 4 1 4 1 4 1 4 0 4 1 4 1 4
 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1
 4 1 4 1 4 1 4 1 4 1 4 1 4]
```

In [109…
```
print(kmeans.cluster_centers_)
```

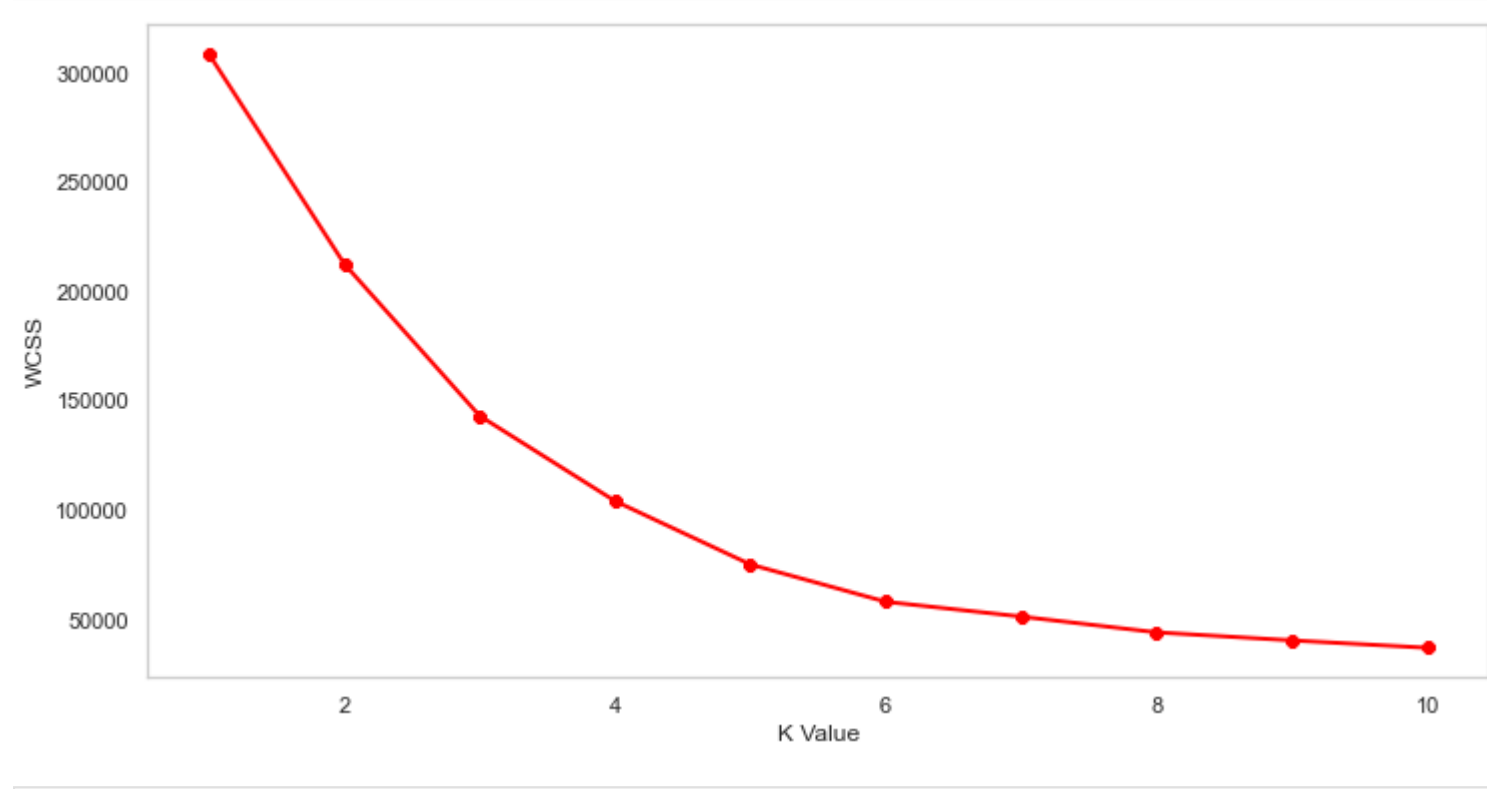
```
[[55.2962963  49.51851852]
 [88.2        17.11428571]
 [26.30434783 20.91304348]
 [25.72727273 79.36363636]
 [86.53846154 82.12820513]]
```

SCATTER PLOT between Annual Income and Spending Scores

In [110…
```
plt.scatter(X2[:,0], X1[:,1], c=kmeans.labels_, cmap="rainbow")
plt.scatter(kmeans.cluster_centers_[:,0] ,kmeans.cluster_centers_[:,1], color="black")
plt.title("Clusters of Customers")
plt.xlabel("Annual Income (k$)")
plt.ylabel("Spending Score(1-100)")
plt.show()
```

ELBOW METHOD FOR ALL AGE ,ANNUAL INCOME ,SPENDING SCORES.

In [122…
```
X3=df.loc[:, ["Age","Annual Income (k$)","Spending Score (1-100)"]].values

wcss= []
for k in range(1,11):
    kmeans = KMeans(n_clusters=k, init="k-means++")
    kmeans.fit(X3)
    wcss.append(kmeans.inertia_)
plt.figure(figsize=(12,6))
plt.grid()
plt.plot(range(1,11),wcss, linewidth=2, color="red", marker ="8")
plt.xlabel("K Value")
plt.ylabel("WCSS")
plt.show()
```



In [123…
```
kmeans = KMeans(n_clusters = 5)

label = kmeans.fit_predict(X3)

print(label)
```

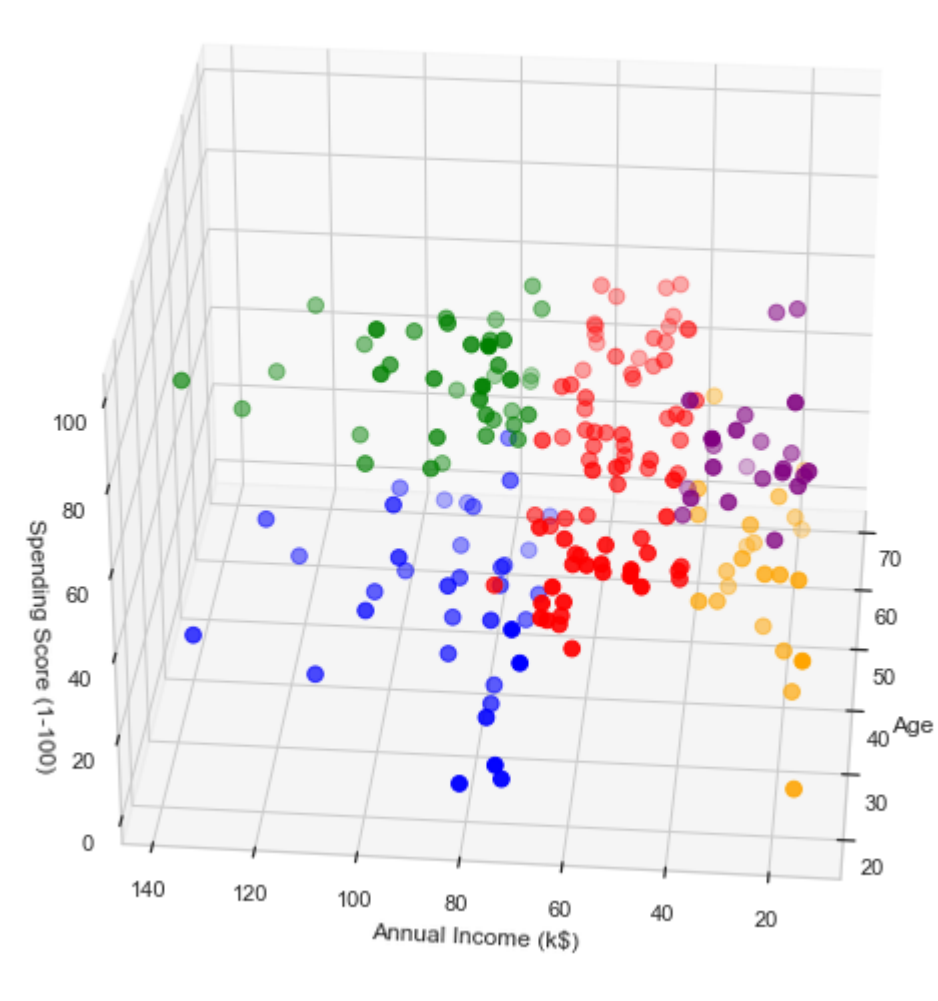
```
[3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3 1 3
 1 3 1 3 1 3 1 3 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 2 2 2 2 2 2 2 2 2 2 2 2 4 0 4 2 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 2 4 0 4 0 4
 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0 4 0
 4 0 4 0 4 0 4 0 4 0 4 0 4]
```

In [125…
```
print(kmeans.cluster_centers_)
```

```
[[40.66666667 87.75       17.58333333]
 [25.52173913 26.30434783 78.56521739]
 [43.08860759 55.29113924 49.56962025]
 [45.2173913  26.30434783 20.91304348]
 [32.69230769 86.53846154 82.12820513]]
```

In [ ]:
```
3-D PLOTTING OF ANNUAL INCOME ,AGE AND SPENDING SCORES
```

In [126…
```
clusters = kmeans.fit_predict(X3)
df["label"]= clusters

from mpl_toolkits.mplot3d import Axes3D
fig = plt.figure(figsize=(20,10))
ax = fig.add_subplot(111, projection="3d")
ax.scatter(df.Age[df.label == 0], df["Annual Income (k$)"][df.label == 0], df["Spending Score (1-100)"][df.label == 0], c="blue", s=60)
ax.scatter(df.Age[df.label == 1], df["Annual Income (k$)"][df.label == 1], df["Spending Score (1-100)"][df.label == 1], c="red", s=60)
ax.scatter(df.Age[df.label == 2], df["Annual Income (k$)"][df.label == 2], df["Spending Score (1-100)"][df.label == 2], c="green", s=60)
ax.scatter(df.Age[df.label == 3], df["Annual Income (k$)"][df.label == 3], df["Spending Score (1-100)"][df.label == 3], c="orange", s=60)
ax.scatter(df.Age[df.label == 4], df["Annual Income (k$)"][df.label == 4], df["Spending Score (1-100)"][df.label == 4], c="purple", s=60)
ax.view_init(30, 185)

plt.xlabel("Age")
plt.ylabel("Annual Income (k$)")
ax.set_zlabel("Spending Score (1-100)")

plt.show()
```



In [ ]: