

```
In [92]: import numpy as np  
import pandas as pd  
import matplotlib.pyplot as plt  
import seaborn as sns
```

```
In [93]: df=pd.read_csv("Mall_Customers.csv")  
df.head()
```

Out[93]:

	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 [94]: df.rename(columns={'Gender':'Gen'},inplace=True) # Rename the Columns as per our requirements.  
df.head()
```

Out[94]:

	CustomerID	Gen	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 [95]: df.shape # It shows No. of Rows and Columns.
```

Out[95]: (200, 5)

```
In [96]: df.describe() # It explains the data that we have.
```

Out[96]:

	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 [97]: `df.dtypes # It shows the data types we have in the dataset.`

Out[97]:

CustomerID	int64
Gen	object
Age	int64
Annual Income (k\$)	int64
Spending Score (1-100)	int64
dtype:	object

In [98]: `df.isnull().sum() # This used as to show does datasets contains any Null value.`

Out[98]:

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

In [99]: `df.drop(["CustomerID"],axis=1,inplace=True) # used to Drop the Column.`

In [100...]: `df.head()`

Out[100]:

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

In [101...]

```
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\kumar\AppData\Local\Temp\ipykernel_17524\3113687261.py:7: UserWarning:  
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.
```

Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
<https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
sns.distplot(df[x],bins=20)
```

```
C:\Users\kumar\AppData\Local\Temp\ipykernel_17524\3113687261.py:7: UserWarning:  
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.
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<https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

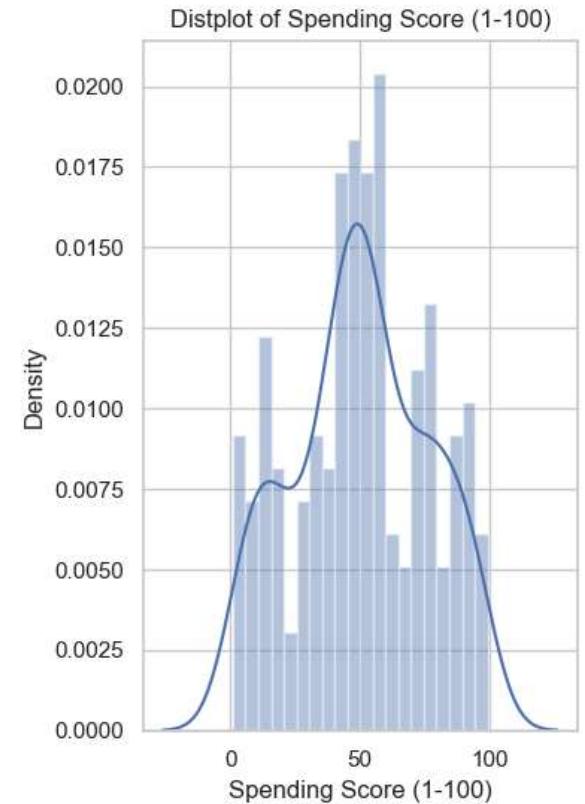
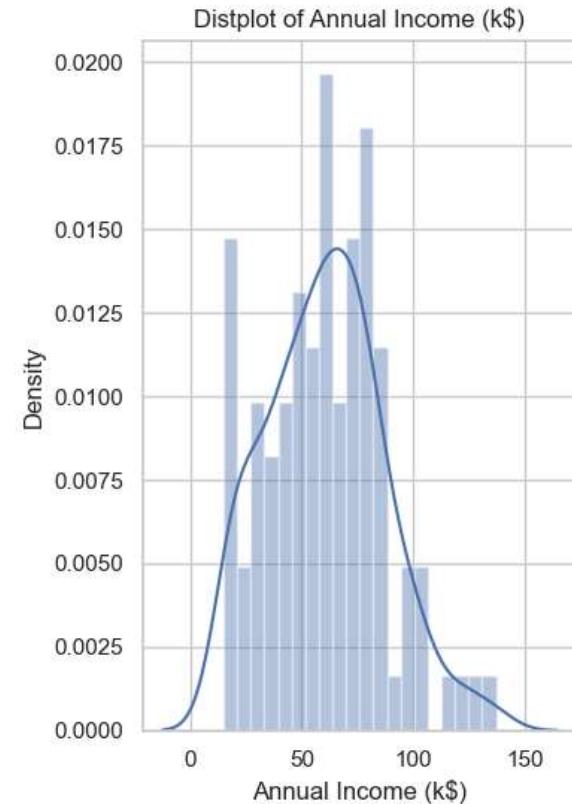
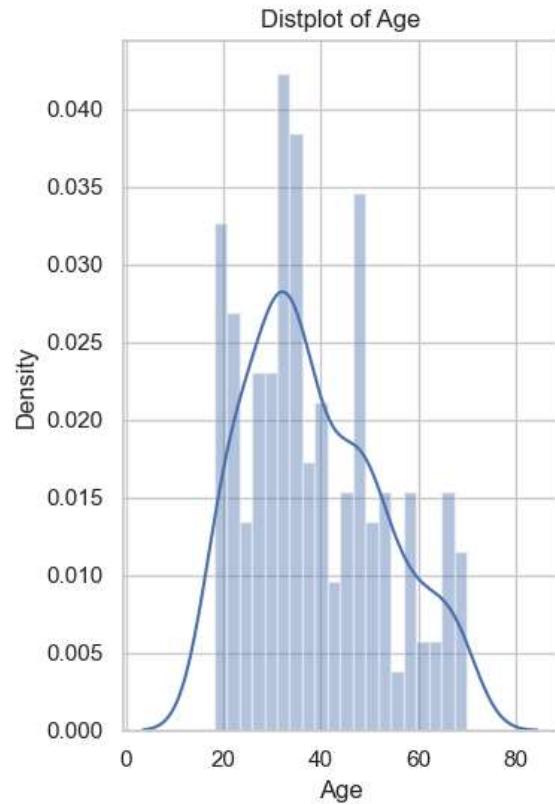
```
sns.distplot(df[x],bins=20)
```

```
C:\Users\kumar\AppData\Local\Temp\ipykernel_17524\3113687261.py:7: UserWarning:  
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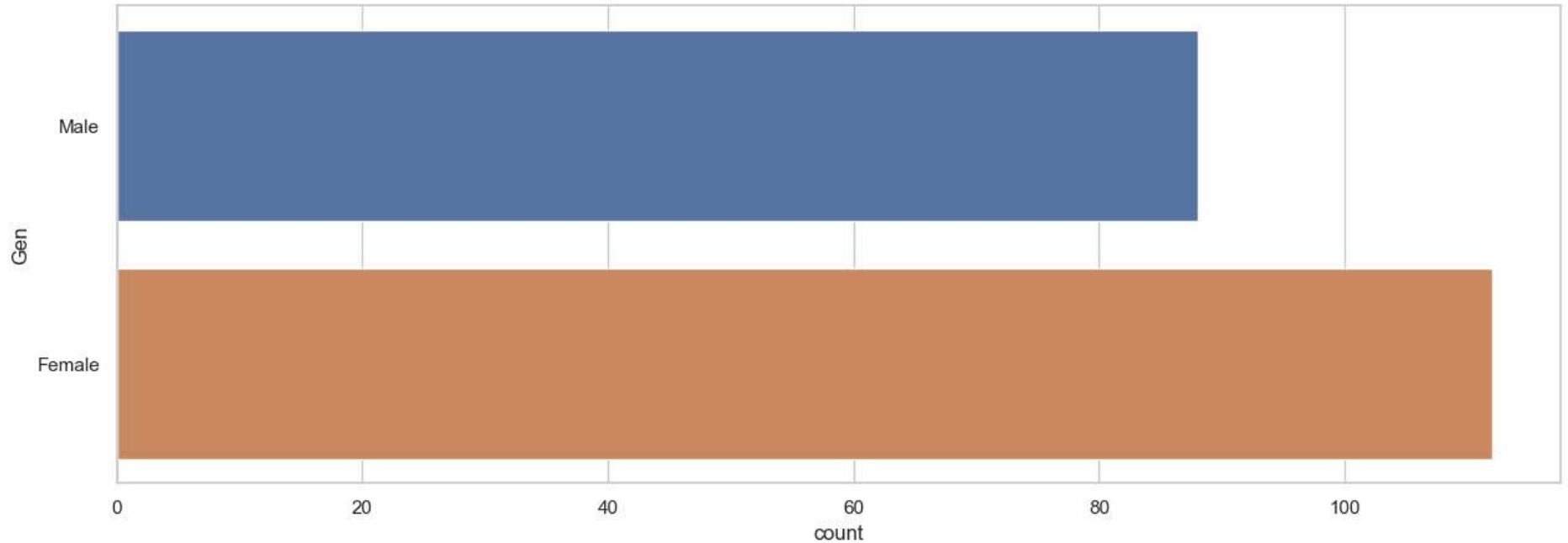
For a guide to updating your code to use the new functions, please see
<https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
sns.distplot(df[x],bins=20)
```

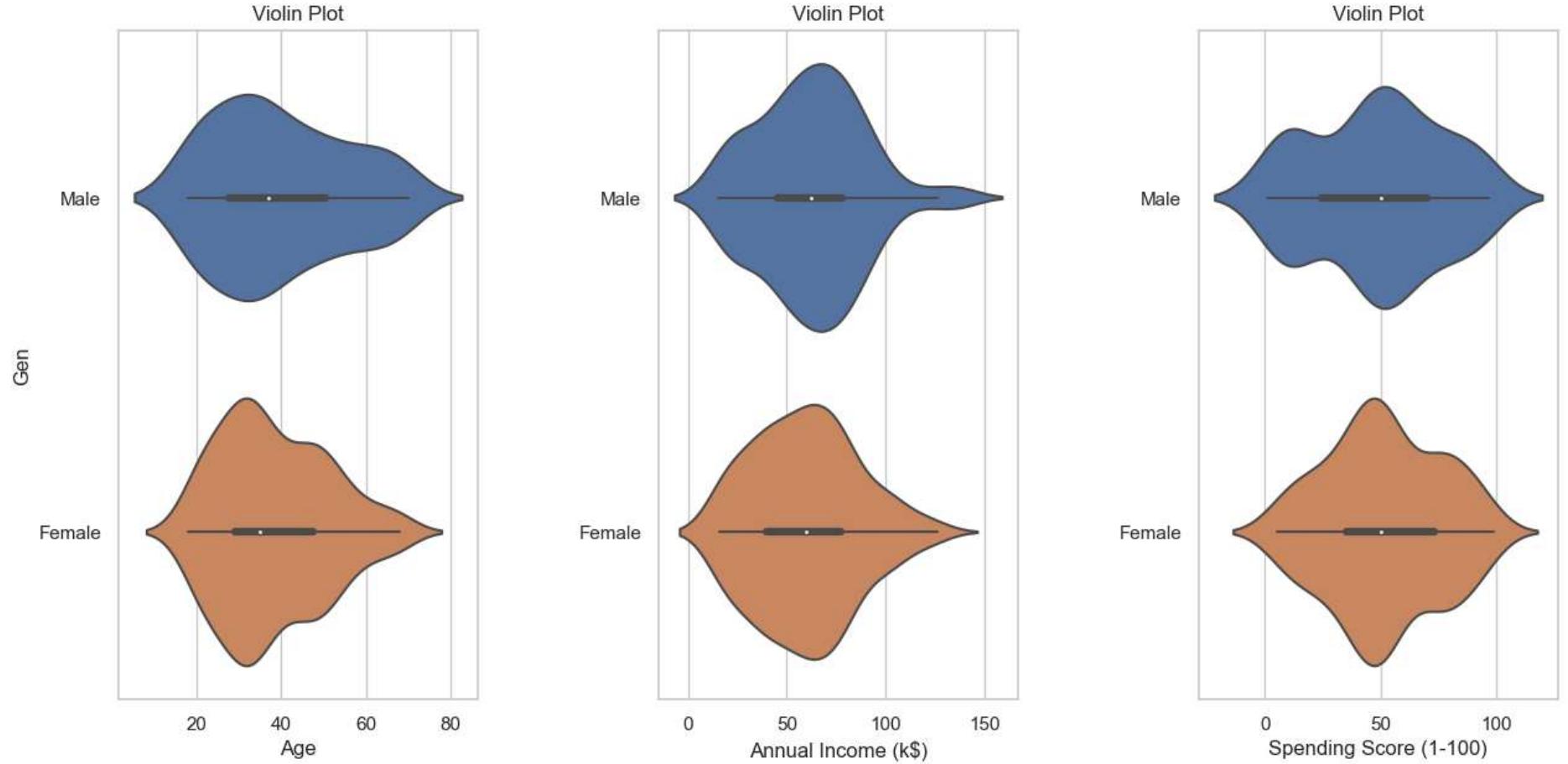


In [102...]

```
plt.figure(figsize=(15,5))
sns.countplot(y='Gen',data=df)
plt.show()
```



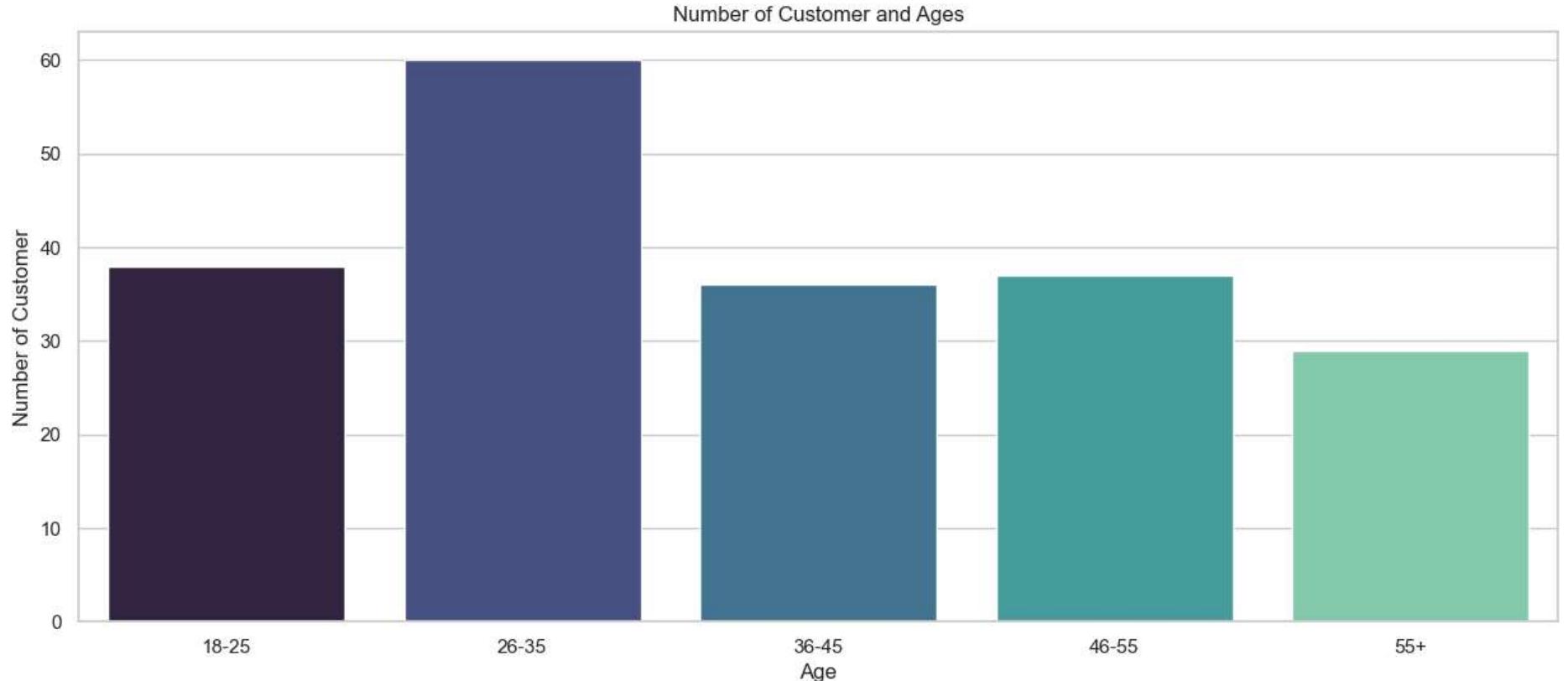
```
In [103]: plt.figure(1,figsize=(15,7))
n=0
for cols in ['Age','Annual Income (k$)','Spending Score (1-100)']:
    n+=1
    plt.subplot(1,3,n)
    sns.set(style="whitegrid")
    plt.subplots_adjust(hspace=0.5, wspace=0.5)
    sns.violinplot(x = cols,y='Gen',data=df)
    plt.ylabel('Gen' if n==1 else '')
    plt.title('Violin Plot')
plt.show()
```



```
In [104...]: 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)]

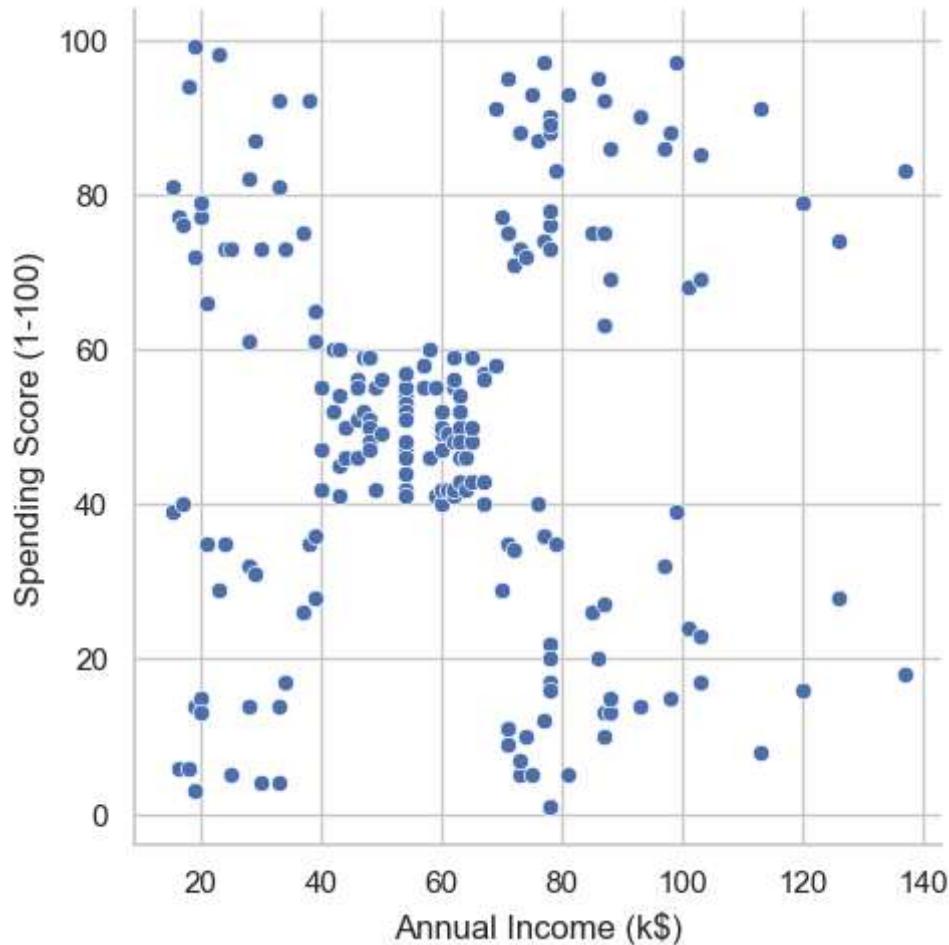
agex = ["18-25", "26-35", "36-45", "46-55", "55+"]
agey =[len(age_18_25.values), len(age_26_35.values), len(age_36_45.values), len(age_46_55.values), len(age_55above.values)]

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



```
In [105]: sns.relplot(x='Annual Income (k$)',y='Spending Score (1-100)',data=df)
```

```
Out[105]: <seaborn.axisgrid.FacetGrid at 0x2558d519e10>
```



In [106]:

```

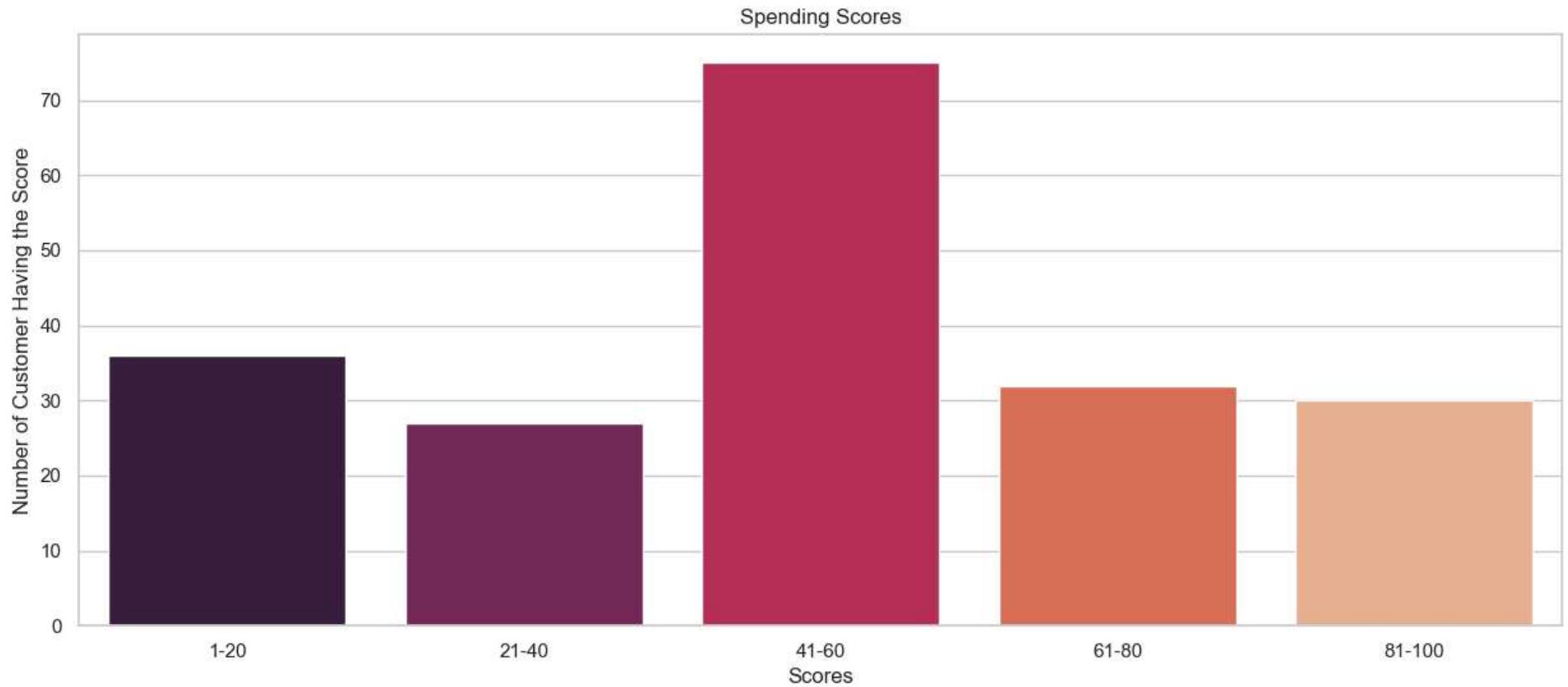
ss_1_20 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"]>=1) & (df["Spending Score (1-100)"]<=20)]
ss_21_40 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"]>=21) & (df["Spending Score (1-100)"]<=40)]
ss_41_60 = df["Spending Score (1-100)"][(df["Spending Score (1-100)"]>=41) & (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="rocket")
plt.title("Spending Scores")
plt.xlabel("Scores")

```

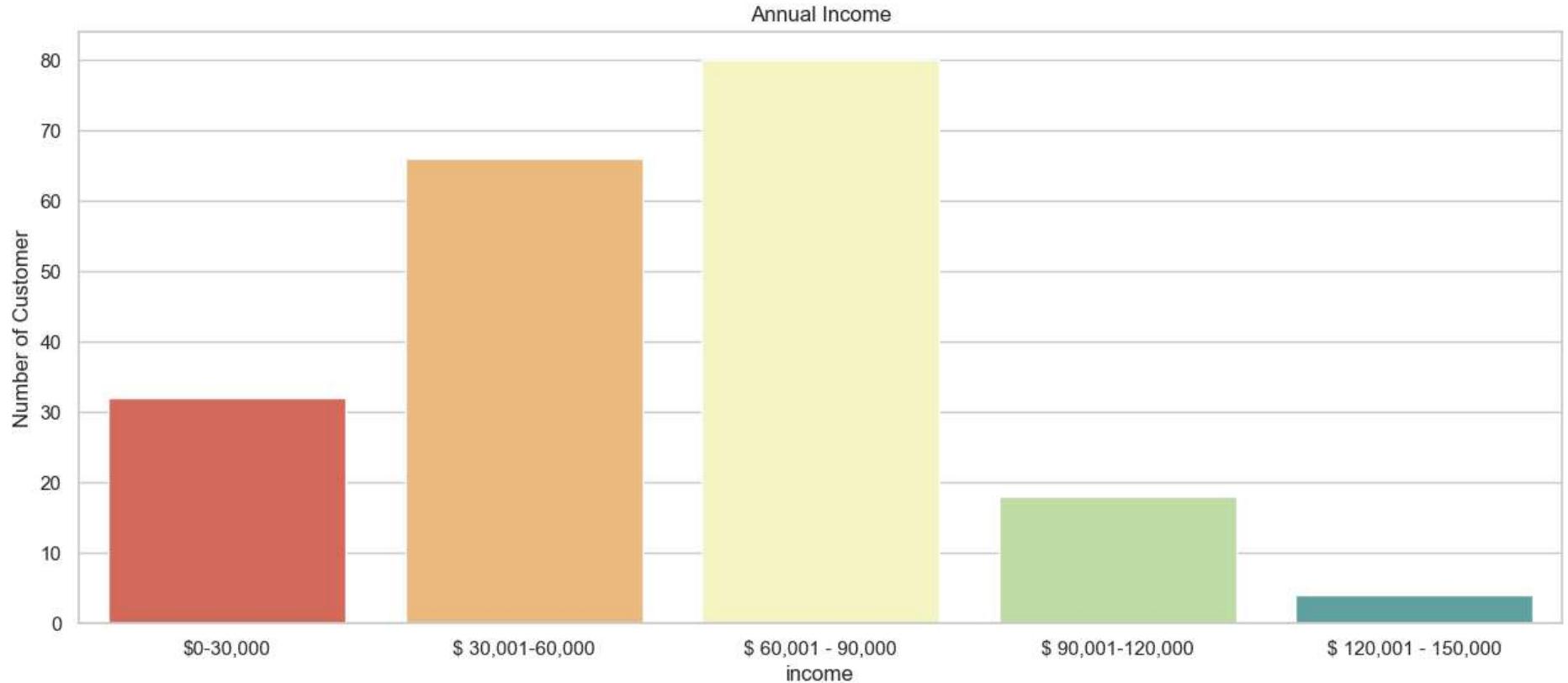
```
plt.ylabel("Number of Customer Having the Score")
plt.show()
```



```
In [107]: 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)]

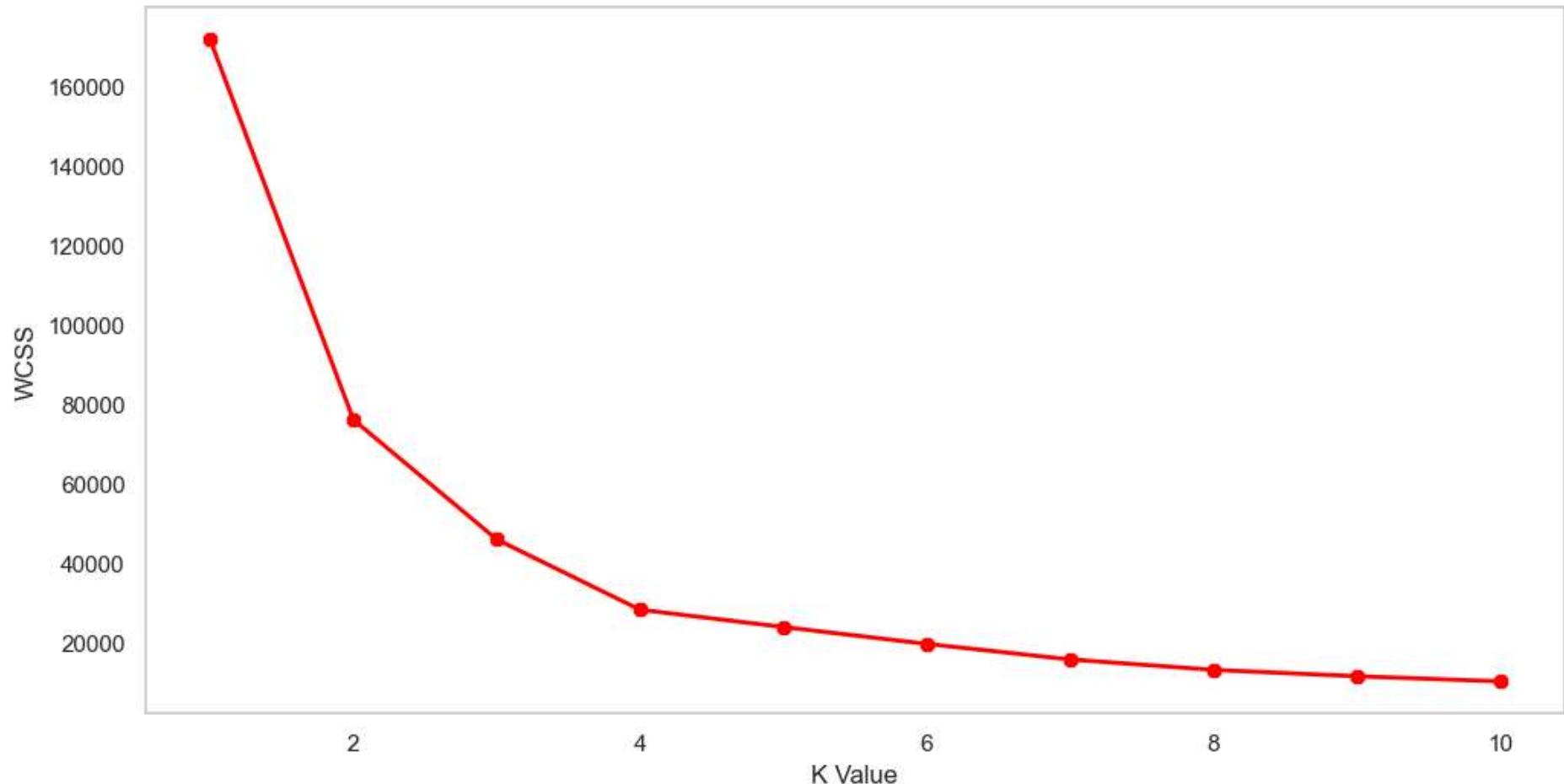
plt.figure(figsize=(15,6))
sns.barplot(x=aix , y=aiy , palette="Spectral")
plt.title("Annual Income")
plt.xlabel("income")
plt.ylabel("Number of Customer")
plt.show()
```



```
In [108]: 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()
```

```
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
ult value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning  
    super().__check_params_vs_input(X, default_n_init=10)  
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
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ult value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning  
    super().__check_params_vs_input(X, default_n_init=10)
```



In [109...]

```
# Initialize the class objects
kmeans = KMeans(n_clusters= 4)

# Predict the Labels of Clusters.
label = kmeans.fit_predict(X1)
print(label)

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

```
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
    super().__check_params_vs_input(X, default_n_init=10)
```

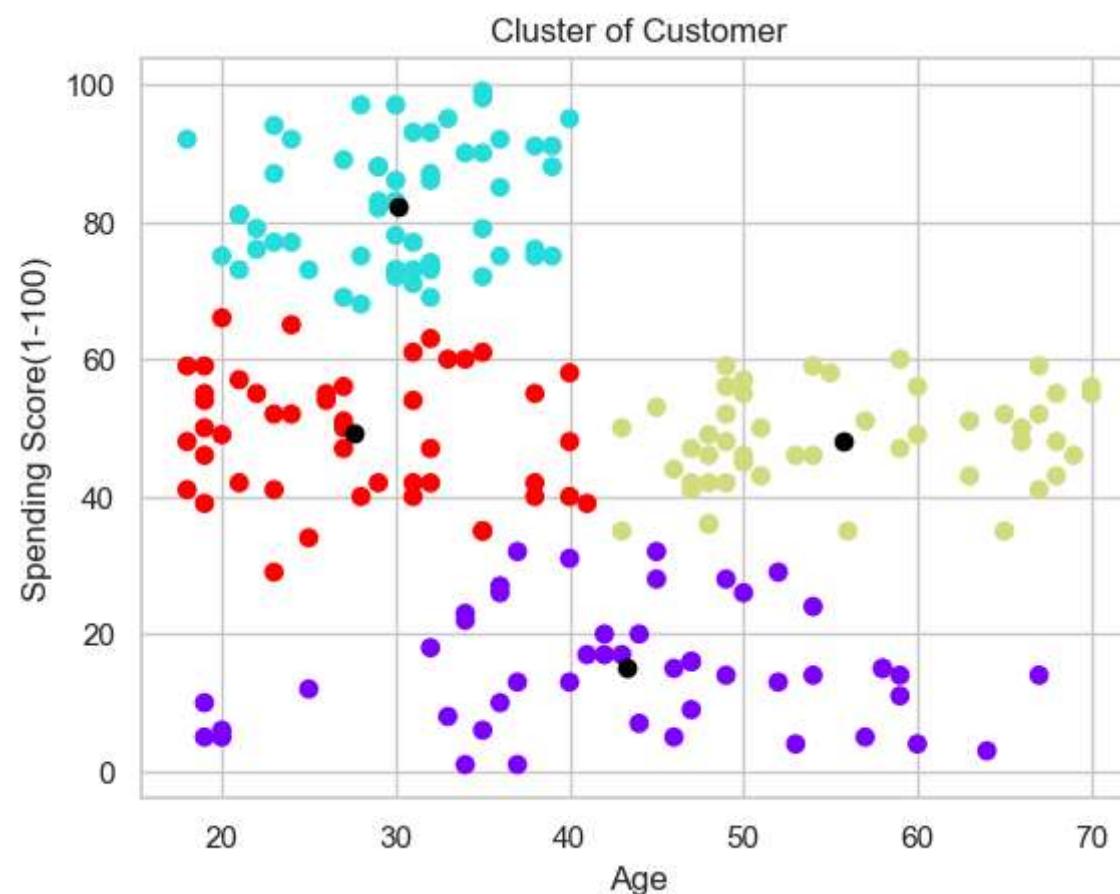
In [110]:

```
print(kmeans.cluster_centers_)

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

In [111]:

```
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('Cluster of Customer')
plt.xlabel('Age')
plt.ylabel('Spending Score(1-100)')
plt.show()
```

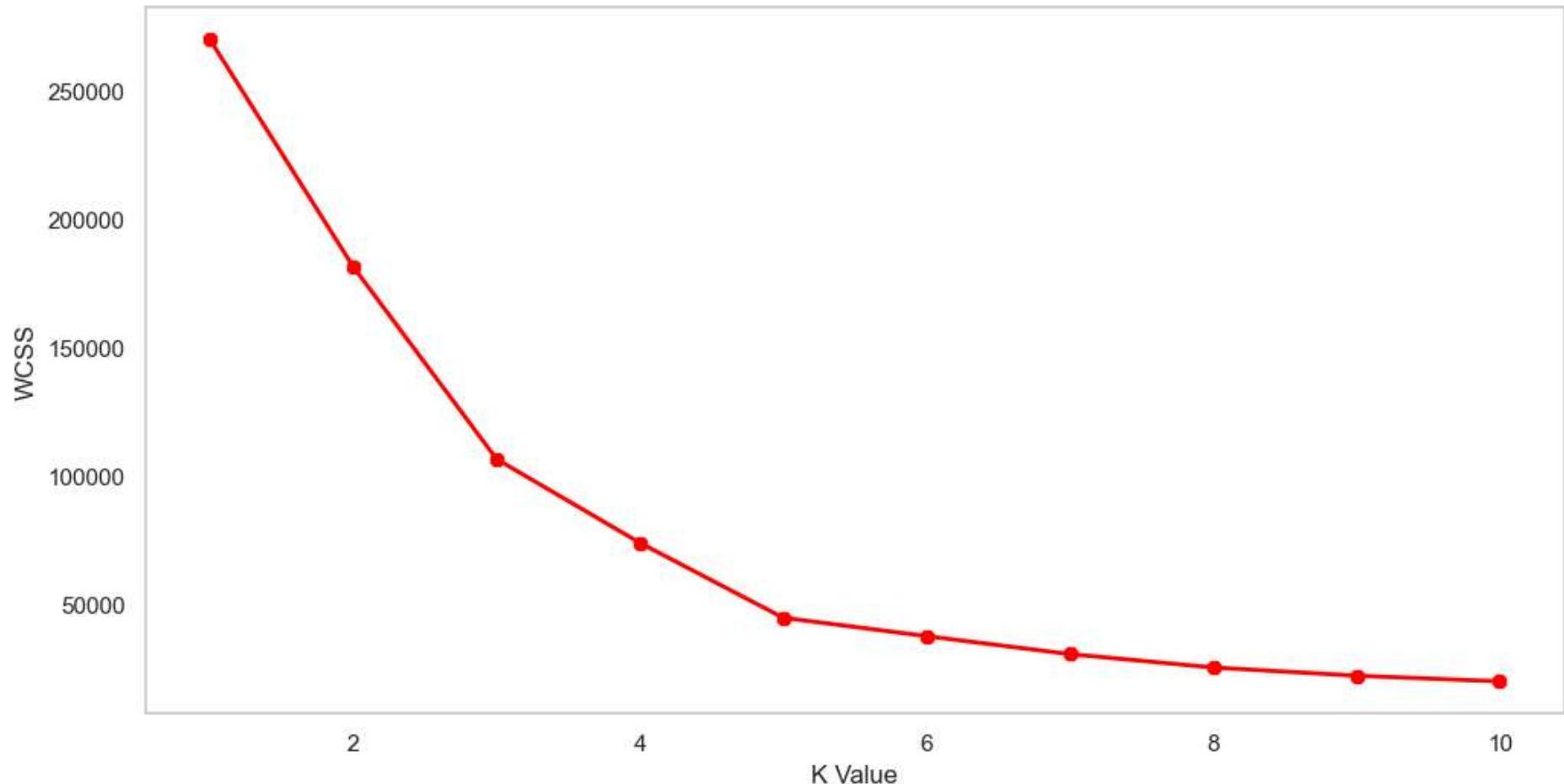


In [112...]

```
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()
```

```
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
ult value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning  
    super().__check_params_vs_input(X, default_n_init=10)  
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
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C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
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C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The defa  
ult value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning  
    super().__check_params_vs_input(X, default_n_init=10)
```



In [113...]

```
kmeans = KMeans(n_clusters= 5)
label = kmeans.fit_predict(X2)
print(label)
```

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

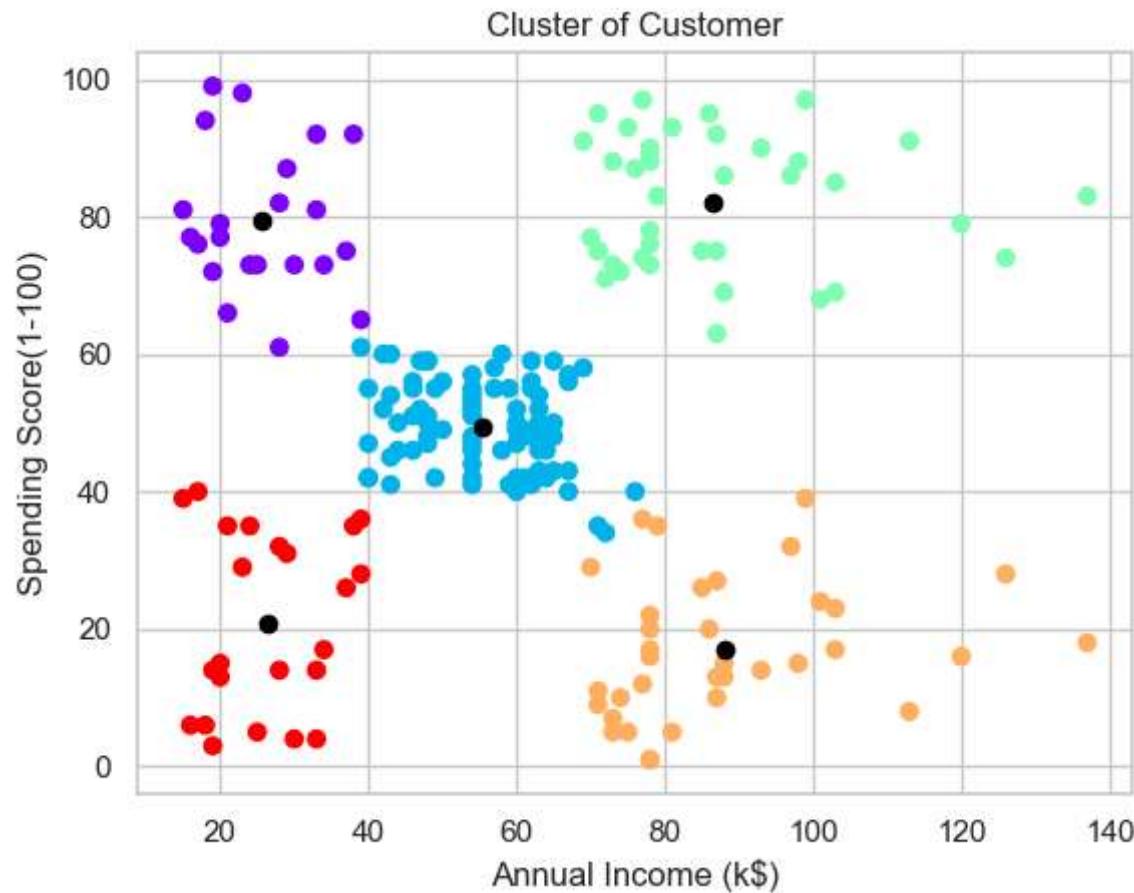
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
super().__check_params_vs_input(X, default_n_init=10)

In [114...]

```
print(kmeans.cluster_centers_)
```

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

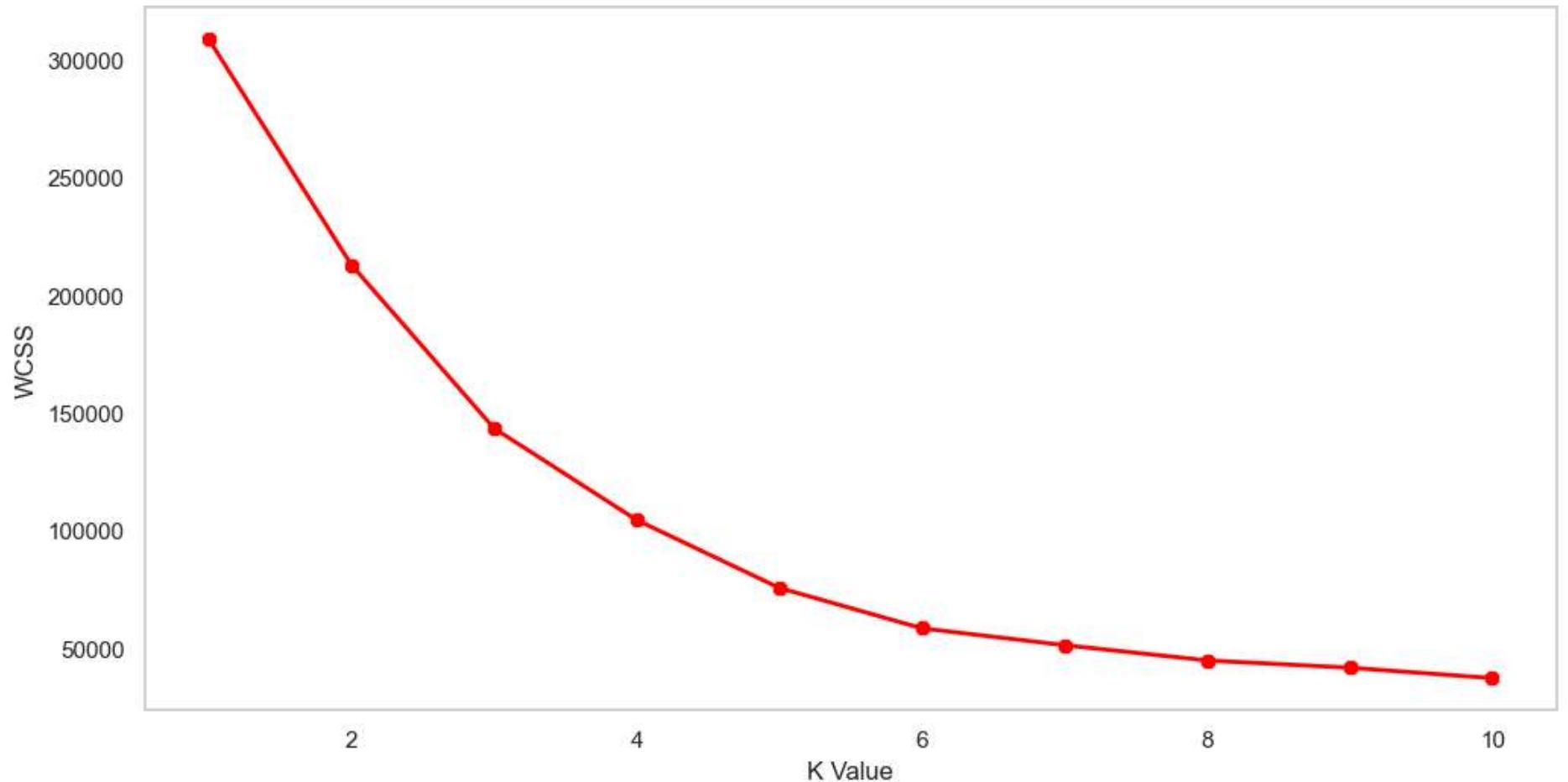
```
In [115...  
plt.scatter(X2[:,0],X1[:,1],c=kmeans.labels_, cmap='rainbow')  
plt.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],color='black')  
plt.title('Cluster of Customer')  
plt.xlabel('Annual Income (k$)')  
plt.ylabel('Spending Score(1-100)')  
plt.show()
```



```
In [116...  
X3 = df.iloc[:,1:]  
  
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()
```

```
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
    super().__check_params_vs_input(X, default_n_init=10)
C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster\_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
    super().__check_params_vs_input(X, default_n_init=10)
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    super().__check_params_vs_input(X, default_n_init=10)
```



In [117...]

```
kmeans = KMeans(n_clusters =5)
```

```
label = kmeans.fit_predict(X3)
```

```
print(label)
```

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

C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
super().__check_params_vs_input(X, default_n_init=10)

```
In [118...]: print(kmeans.cluster_centers_)

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

```
In [119...]: 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()
```

C:\Users\kumar\AppData\Local\Programs\Python\Python311\Lib\site-packages\sklearn\cluster_kmeans.py:1412: FutureWarning: The default value of `n_init` will change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly to suppress the warning
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