ASSIGNMENT-5

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[10]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

import warnings
warnings.filterwarnings("ignore")
```

Data Preprocessing and Understanding

[11]:
```
data = pd.read_csv(r"/content/Mall_Customers.csv")
data.head()
```

[11]:
```
   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
```

[12]:
```
data.shape
```

[12]:
```
(200, 5)
```

[13]:
```
data.isnull().sum()
```

[13] :
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

[14]:
```
data.describe()
```

[14]:

```
       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
```

[15]:

```
data.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
```

Data Visualization

[16]:

```
#dropping the customer id column
data.drop(columns = 'CustomerID',inplace = True)
```

[17]:

```
categorical_features = []
numerical_features = []
for i in data.columns:
    if data[i].dtype =='int' :
        numerical_features.append(i)
    else:
        categorical_features.append(i)
print('The Numerical Features are : ' ,numerical_features)

print('The Categorical Features are : ',categorical_features)
```

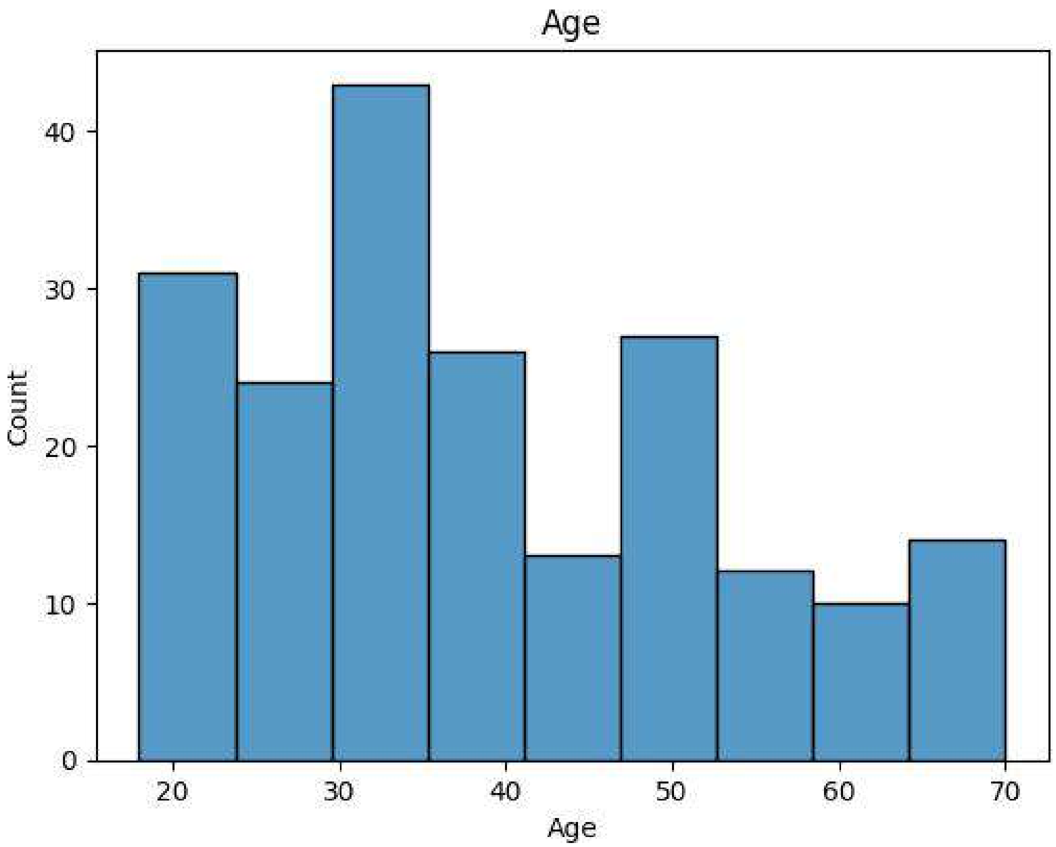
```
The Numerical Features are :  ['Age', 'Annual Income (k$)', 'Spending Score
(1-100)']
The Categorical Features are :  ['Gender']
```

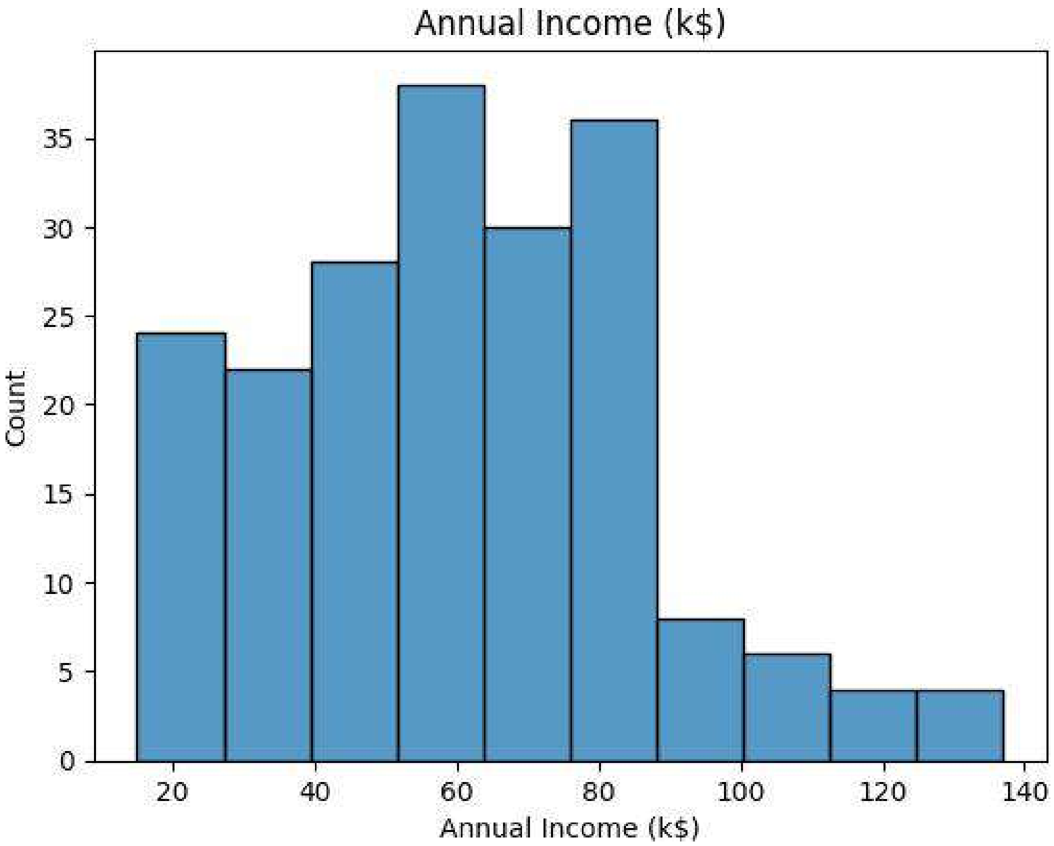
UniVariate Analysis

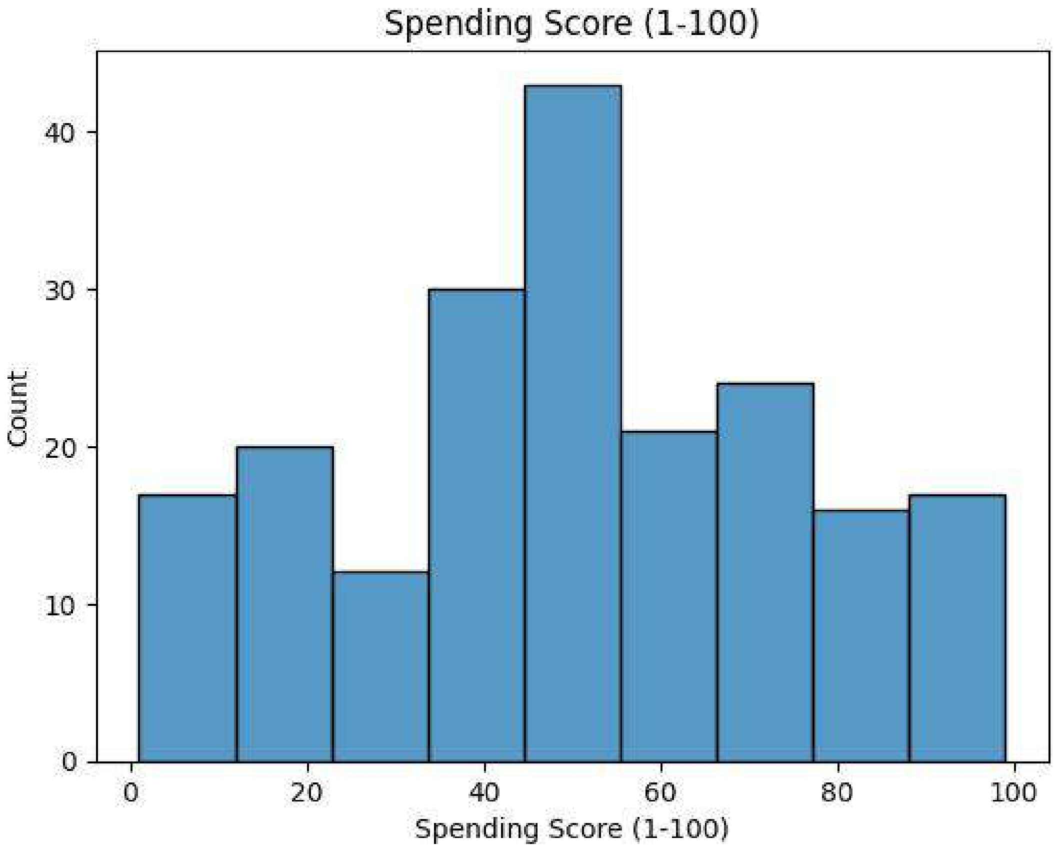
Histogram

[18]:

```
for i in numerical_features :
    sns.histplot(data[i])
    plt.title(i)
    plt.show()
```




Annual Income (k$)
Count
0
5
10
15
20
25
30
35
20
40
60
80
100
120
140
Annual Income (k$)

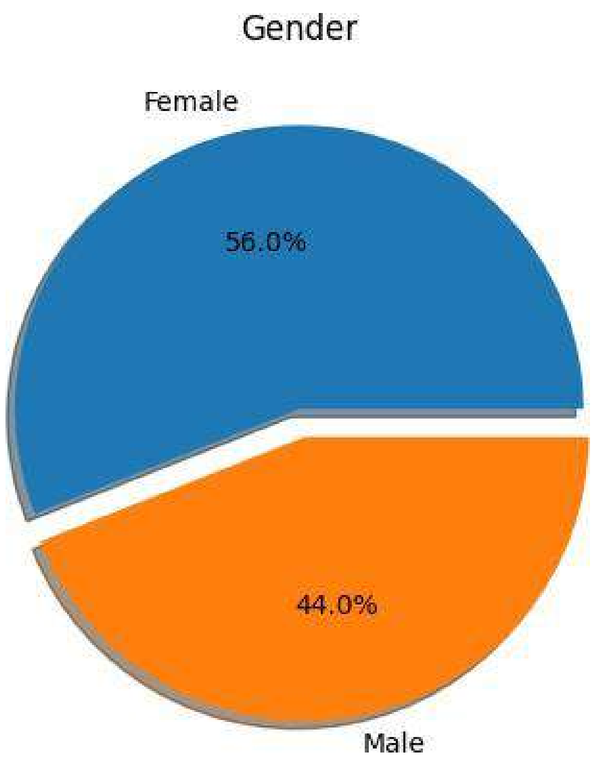


[19]:
```
data.Gender.value_counts()
```

[19]:
```
Female    112
Male       88
Name: Gender, dtype: int64
```

Pie chart

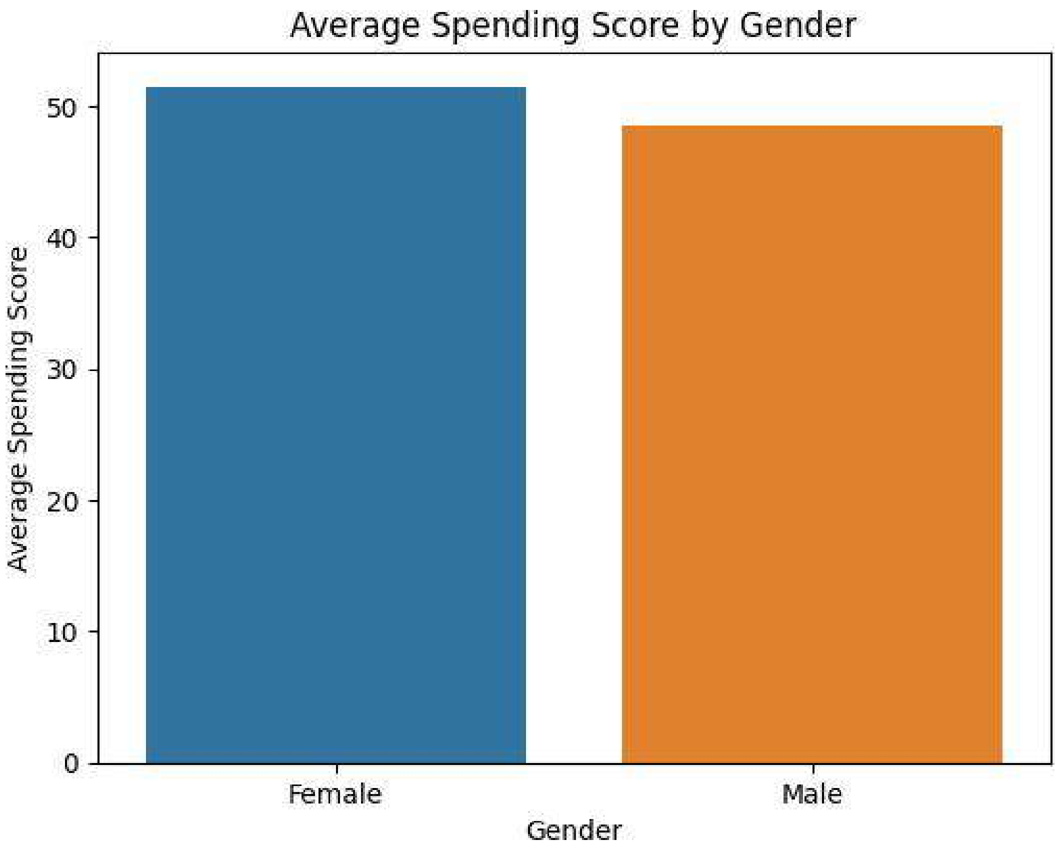
[20]:
```
plt.pie(data.Gender.value_counts(),[0,0.1],labels=['Female','Male'],autopct␣
↪='%1.1f%%',shadow = True)
plt.title('Gender')
plt.show()
```



BiVariate Analysis

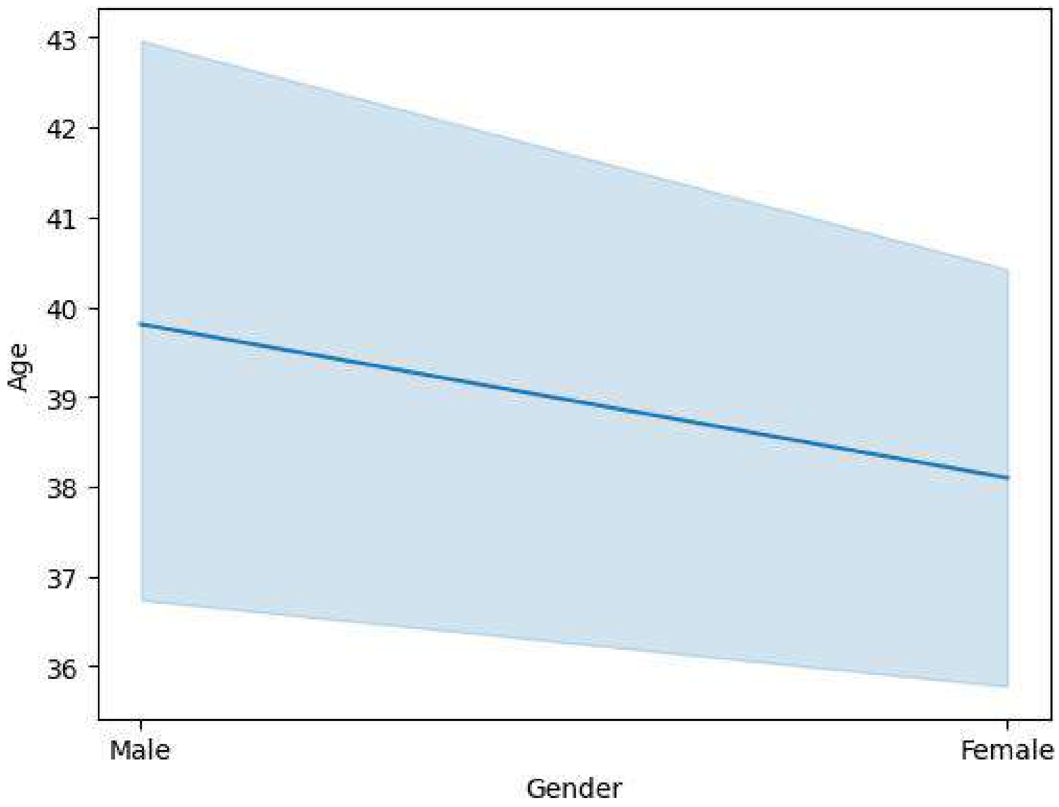
Bar Plot

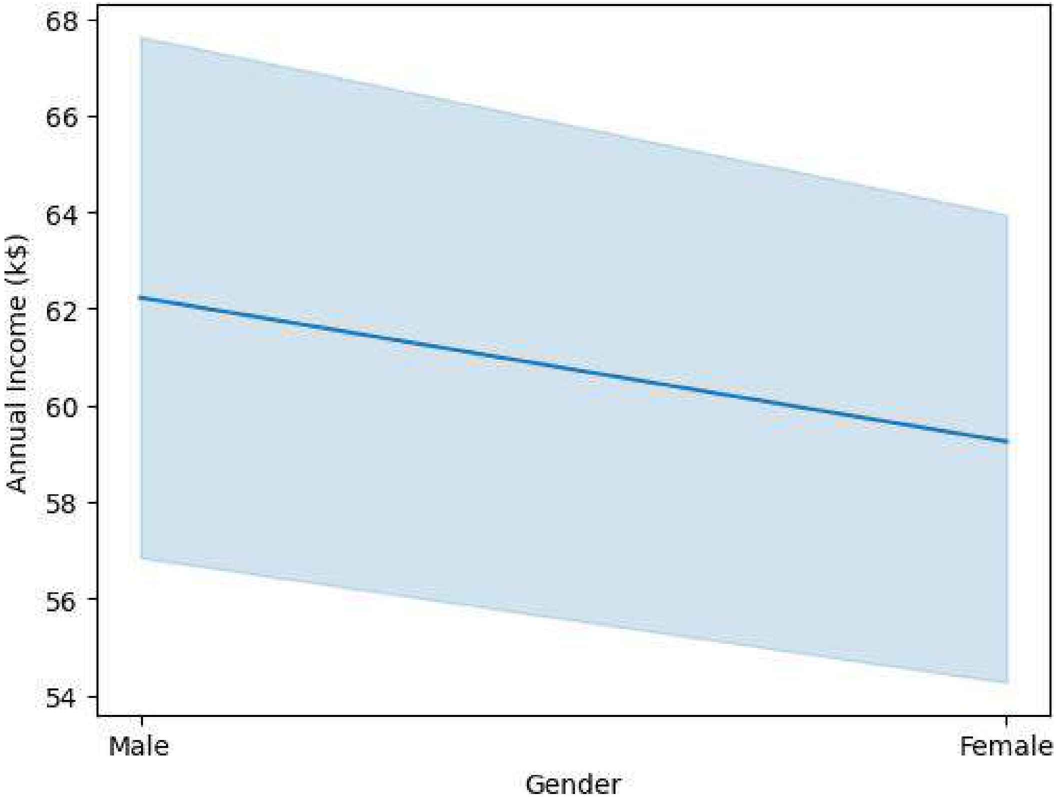
```
[21]: mean_scores = data.groupby("Gender")["Spending Score (1-100)"].mean()

sns.barplot(x=mean_scores.index, y=mean_scores.values)
plt.xlabel("Gender")
plt.ylabel("Average Spending Score")
plt.title("Average Spending Score by Gender")
plt.show()
```

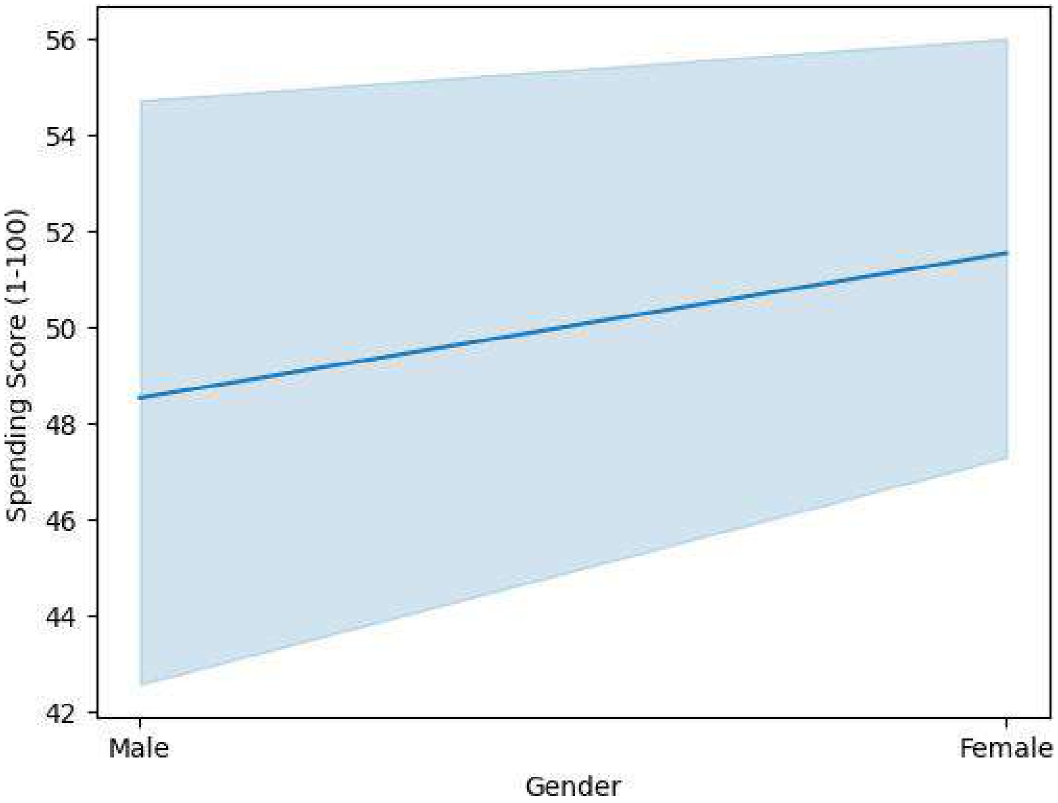


Line plot

[22]:
```
for i in numerical_features :
  sns.lineplot(x = data.Gender,y=data[i])
  plt.show()
```

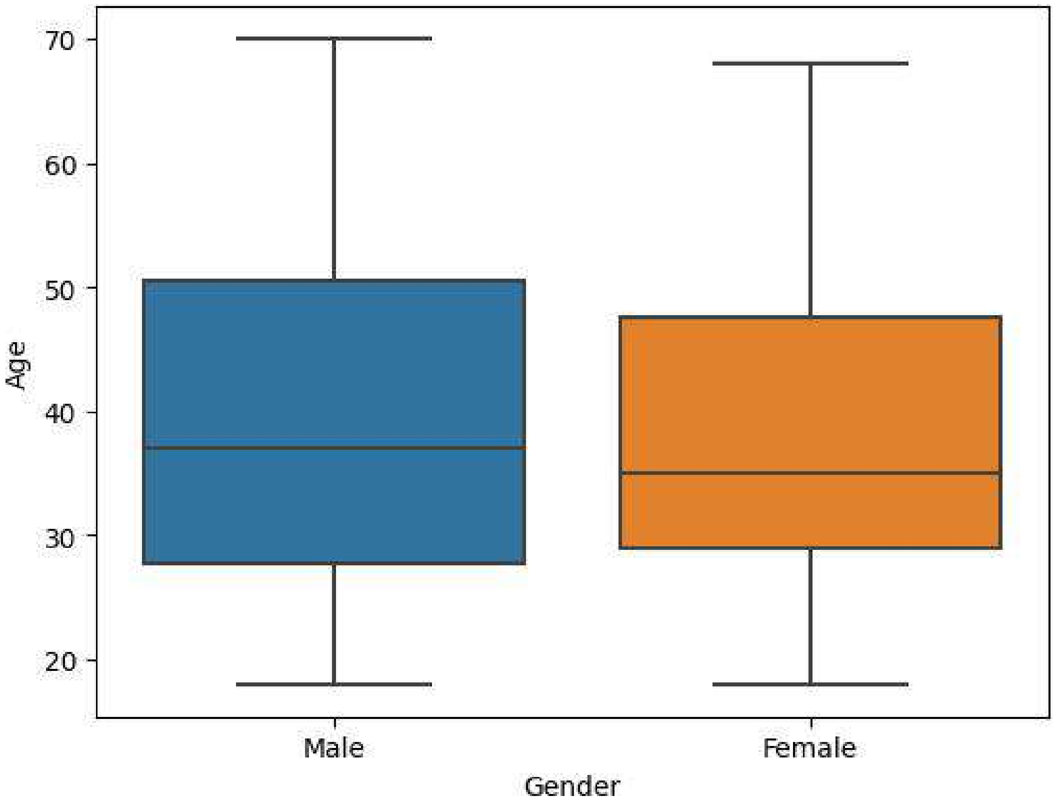

43
42
41
40
39
38
37
36
Age
Male
Female
Gender

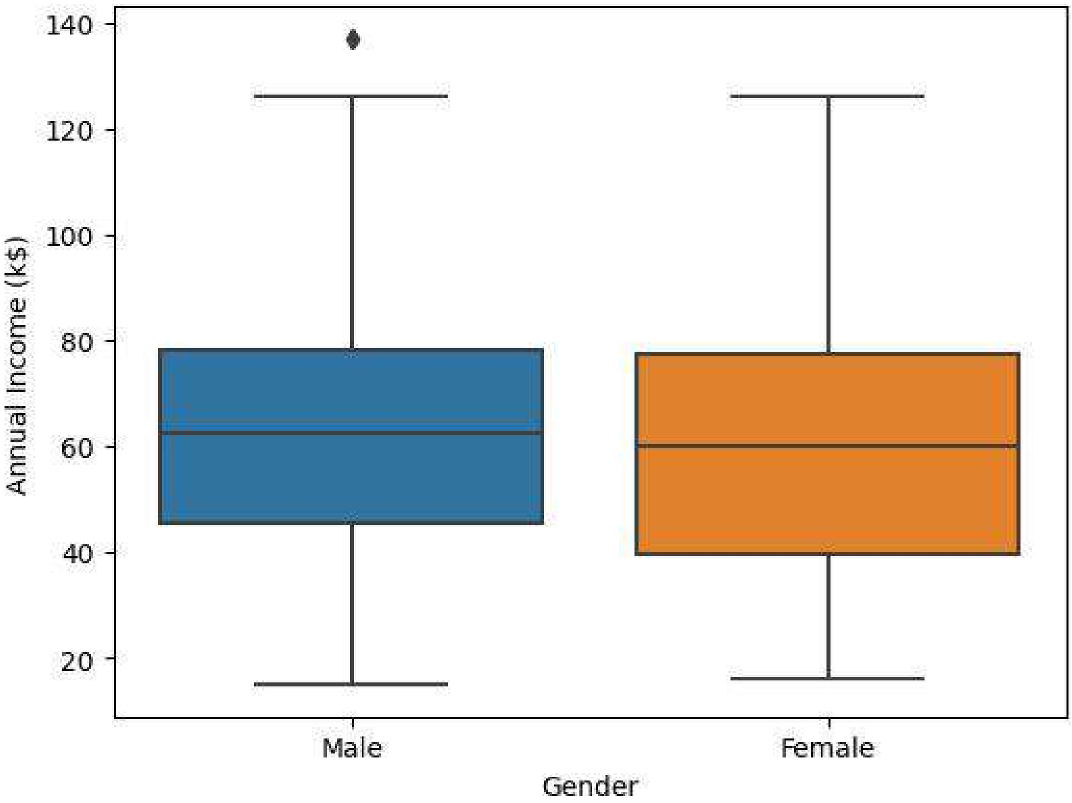

68
66
64
62
60
58
56
54
Annual Income (k$)
Male
Female
Gender

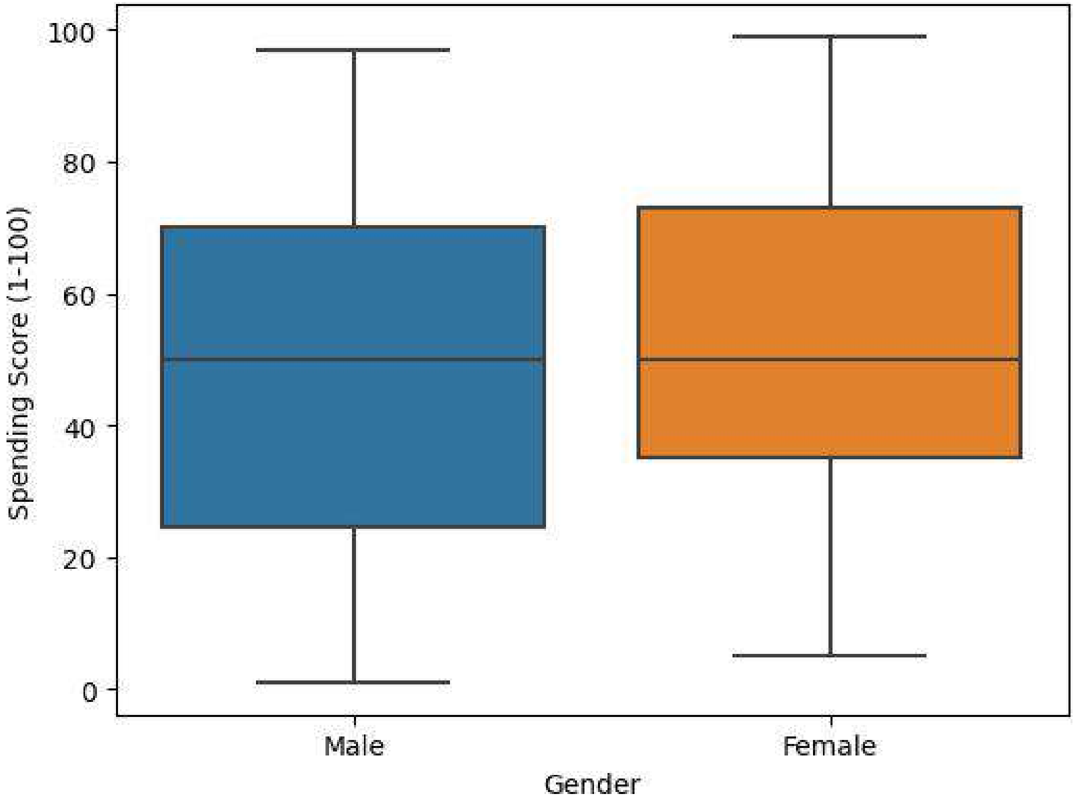


Box Plot

```
[23]: for i in numerical_features :
        sns.boxplot(x = data.Gender,y=data[i])
        plt.show()
```


70
60
50
40
30
20
Age
Male
Female
Gender


140
120
100
80
60
40
20
Annual Income (k$)
Male
Female
Gender

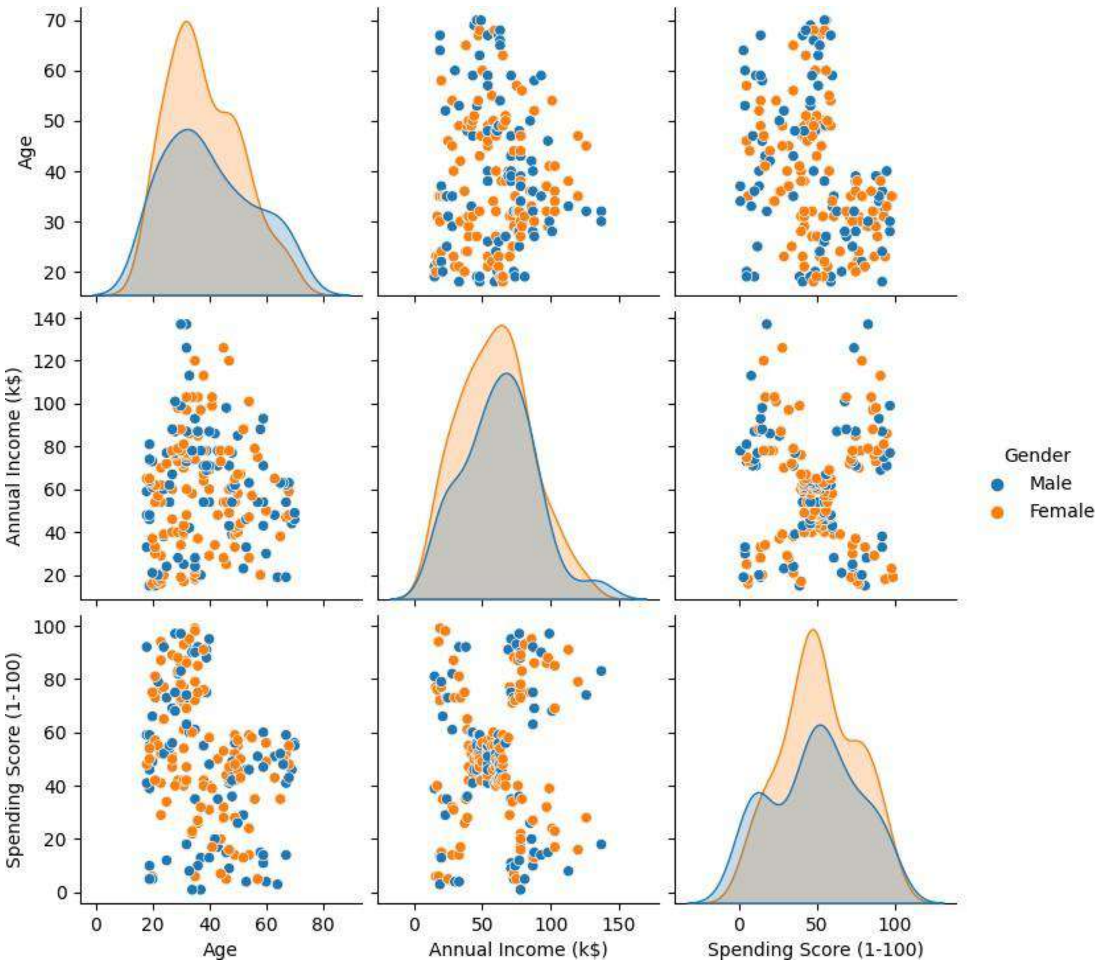


Multivariate Variate Analysis

Pairplot

```
[24]: sns.pairplot(data,hue="Gender")
```

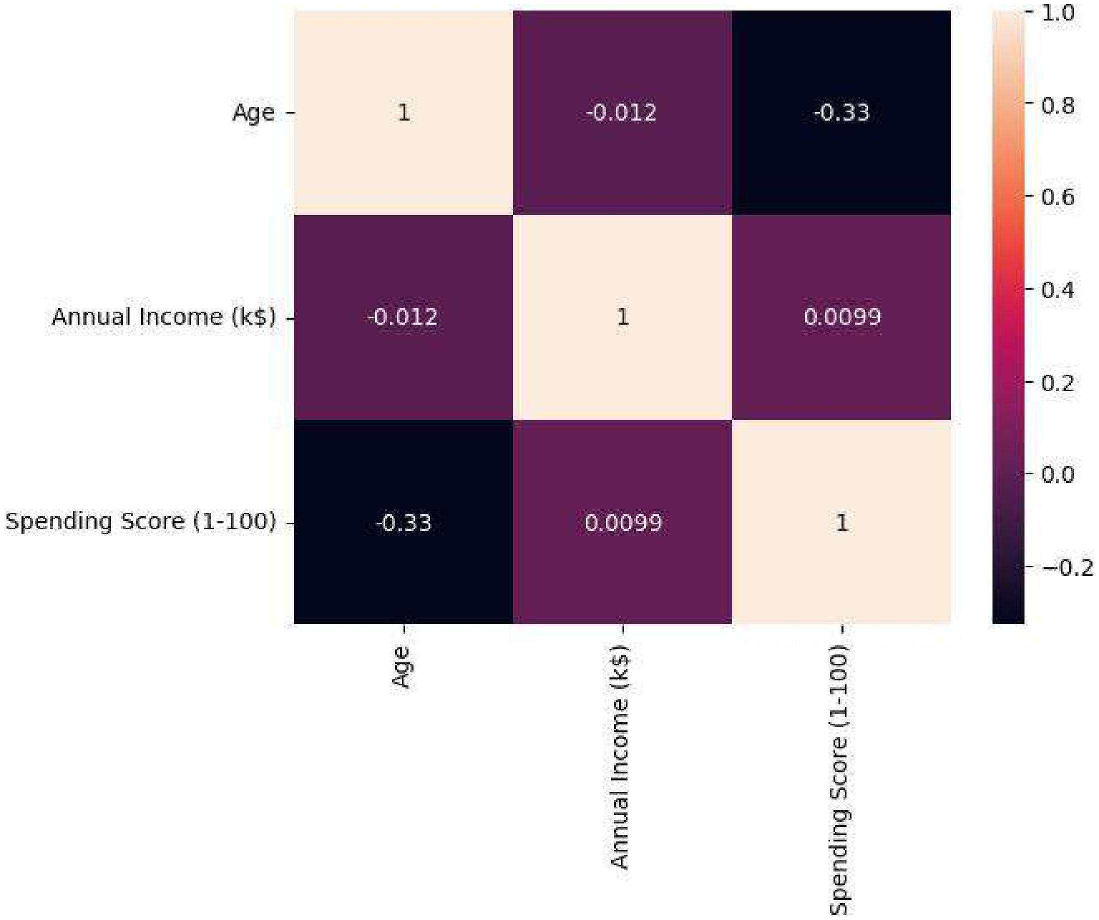
```
[24]: <seaborn.axisgrid.PairGrid at 0x7f3fee7ffee0>
```



Heat Map

[25]:
```
sns.heatmap(data.corr(),annot=True)
```

[25] :
```
<Axes: >
```



Machine Learning approach with clustering algorithm

Model Building

[26]:
```
from sklearn.cluster import KMeans
```

[27]:
```
# encoding the gender column
from sklearn.preprocessing import LabelEncoder

encoder = LabelEncoder()
data['Gender'] = encoder.fit_transform(data['Gender'])
```

[28]:
```
data.head()
```

[28] :
```
   Gender  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
```

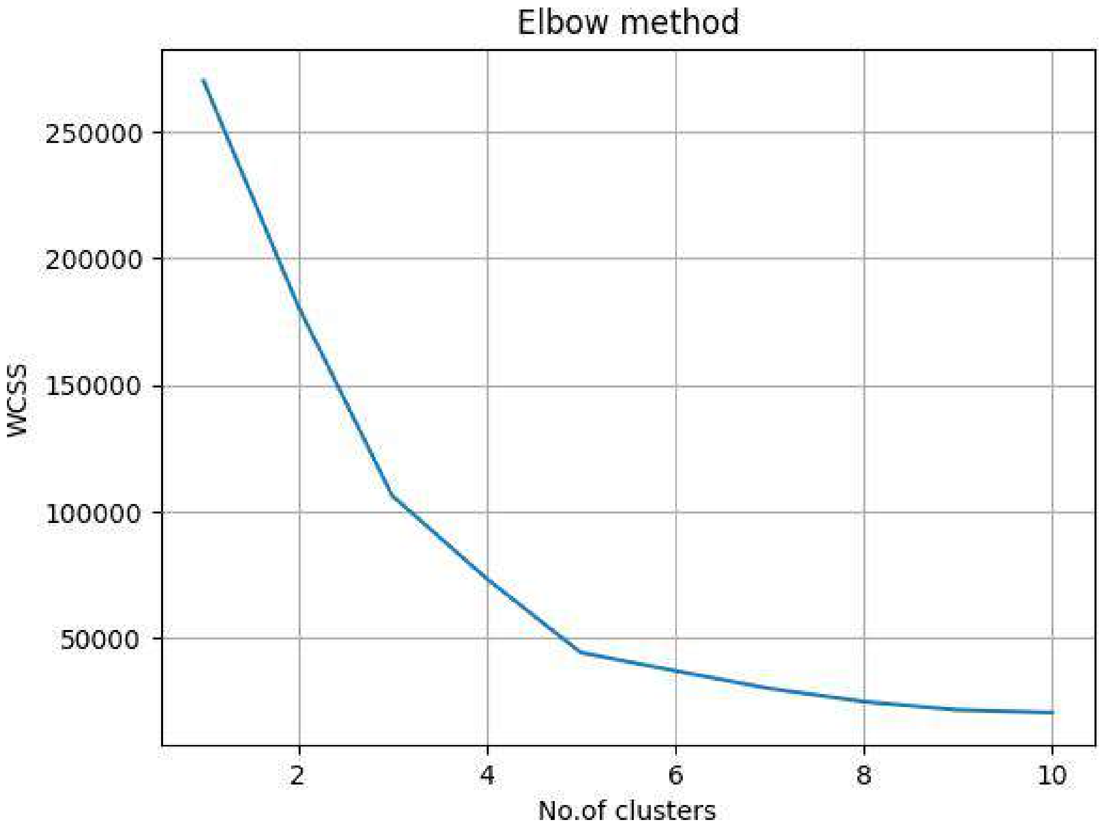
```
4         0    31                       17                             40
```

[29]:
```
new_data = data.iloc[:,[2,3]]
new_data.tail()
```

[29] :
```
      Annual Income (k$)  Spending Score (1-100)
195                  120                      79
196                  126                      28
197                  126                      74
198                  137                      18
199                  137                      83
```

[30]:
```
wcss=[]
for i in range(1,11):
   kmeans = KMeans(n_clusters=i,init = "k-means++",random_state=0)
   kmeans.fit(new_data)
   wcss.append(kmeans.inertia_)
```

[31]:
```
plt.plot(range(1,11),wcss)
plt.grid(True)
plt.title("Elbow method")
plt.xlabel("No.of clusters")
plt.ylabel("WCSS")
plt.show()
```



```
[32]: knn_model = KMeans(n_clusters=5,init = 'k-means++',random_state=0)
```

```
[33]: knn_model.fit(new_data)
```

```
[33]: KMeans(n_clusters=5, random_state=0)
```

```
[34]: #predicting the output
      model_pred = knn_model.fit_predict(new_data)
      model_pred
```

```
[34]: array([4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3,
             4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 3, 4, 1,
             4, 3, 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, 1, 2, 0, 2, 0, 2,
             1, 2, 0, 2, 0, 2, 0, 2, 0, 2, 1, 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, 0, 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, 0, 2, 0, 2,
             0, 2], dtype=int32)
```

[35]:

```
# Test the model with random observation

knn_model.predict([[17,40]])
```

[35]:

```
array([4], dtype=int32)
```

[36]:

```
knn_model.predict([[137,83]])
```

[36]:

```
array([2], dtype=int32)
```

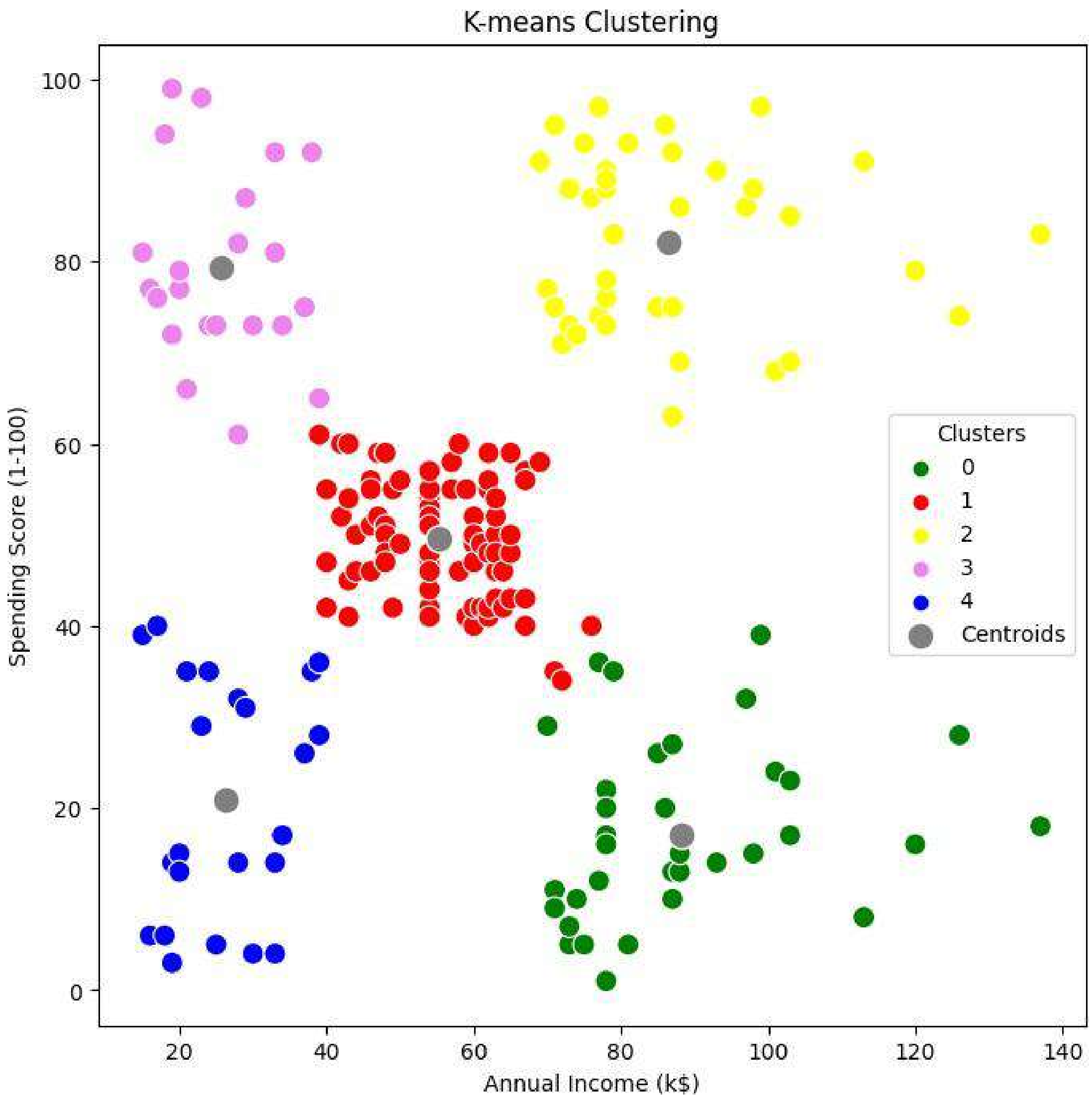
[37]:

```
new_data["model_pred"]  = model_pred
```

plotting the clusters

[39]:

```
plt.figure(figsize=(8, 8))
colors = ["green", "red", "yellow", "violet", "blue"]
centroids = knn_model.cluster_centers_
sns.scatterplot(x="Annual Income (k$)", y="Spending Score (1-100)",s=100, hue=␣
  ↪"model_pred",
                palette=colors, data=new_data)
sns.scatterplot(x=centroids[:, 0], y=centroids[:, 1], color="grey",␣
  ↪s=150,label="Centroids")
plt.title("K-means Clustering")
plt.xlabel("Annual Income (k$)")
plt.ylabel("Spending Score (1-100)")
plt.legend(title="Clusters")
plt.show()
```


K-means Clustering
Spending Score (1-100)
Annual Income (k$)
0
20
40
60
80
100
20
40
60
80
100
120
140
Clusters
0
1
2
3
4
Centroids