```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans

customer_data = pd.read_csv(r"C:\Users\Sourab singha\Documents\
Mall_Customers.csv")

customer_data

     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
..          ...     ...  ...                 ...                    .
..
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]

customer_data.shape

(200, 5)

customer_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
```

```
customer_data.isna().sum()
```

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

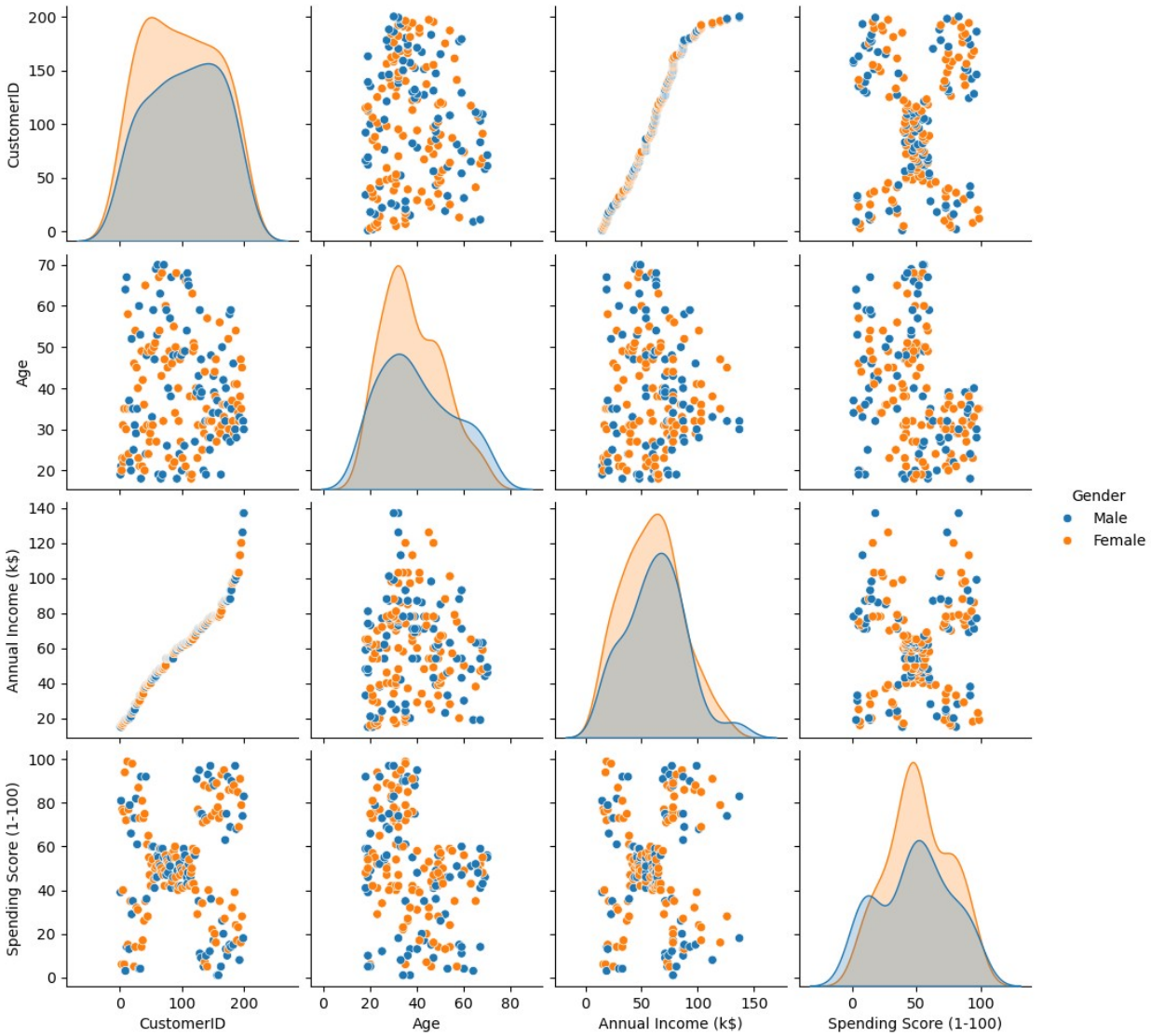
```
customer_data.duplicated().sum()
```

```
0
```

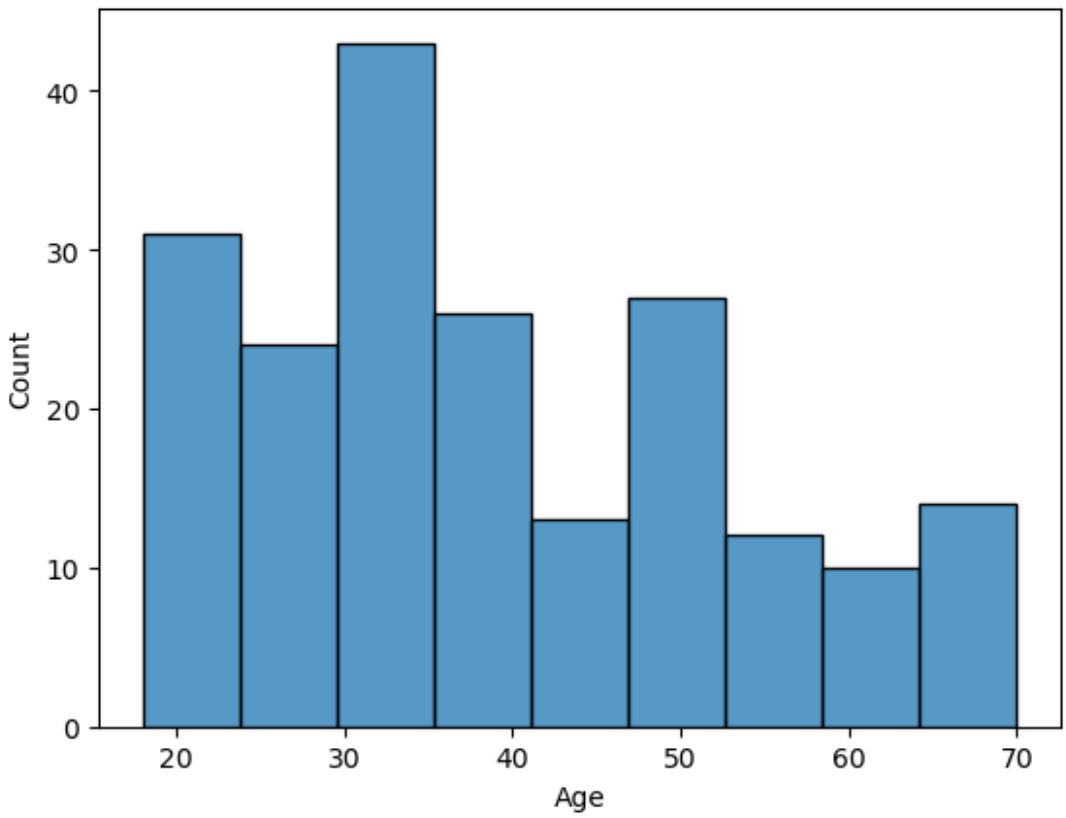
```
customer_data.describe()
```

```
       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
```

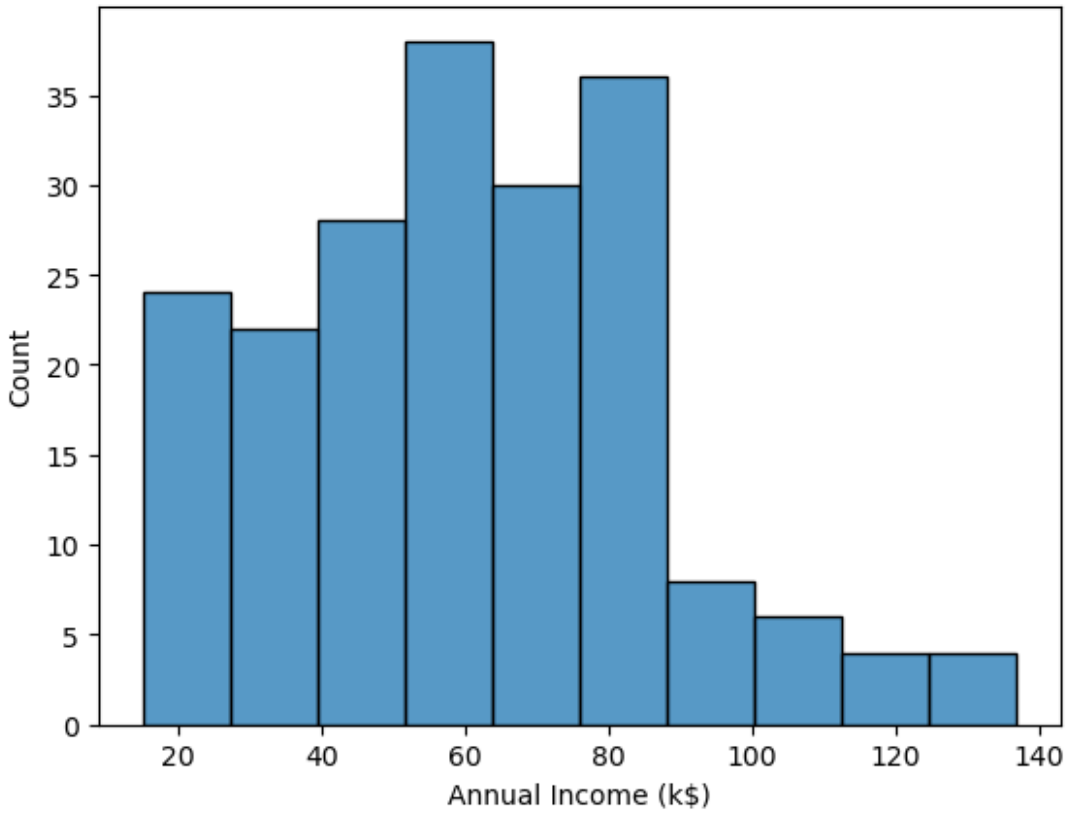
```
sns.pairplot(customer_data, hue='Gender')
plt.show()
```



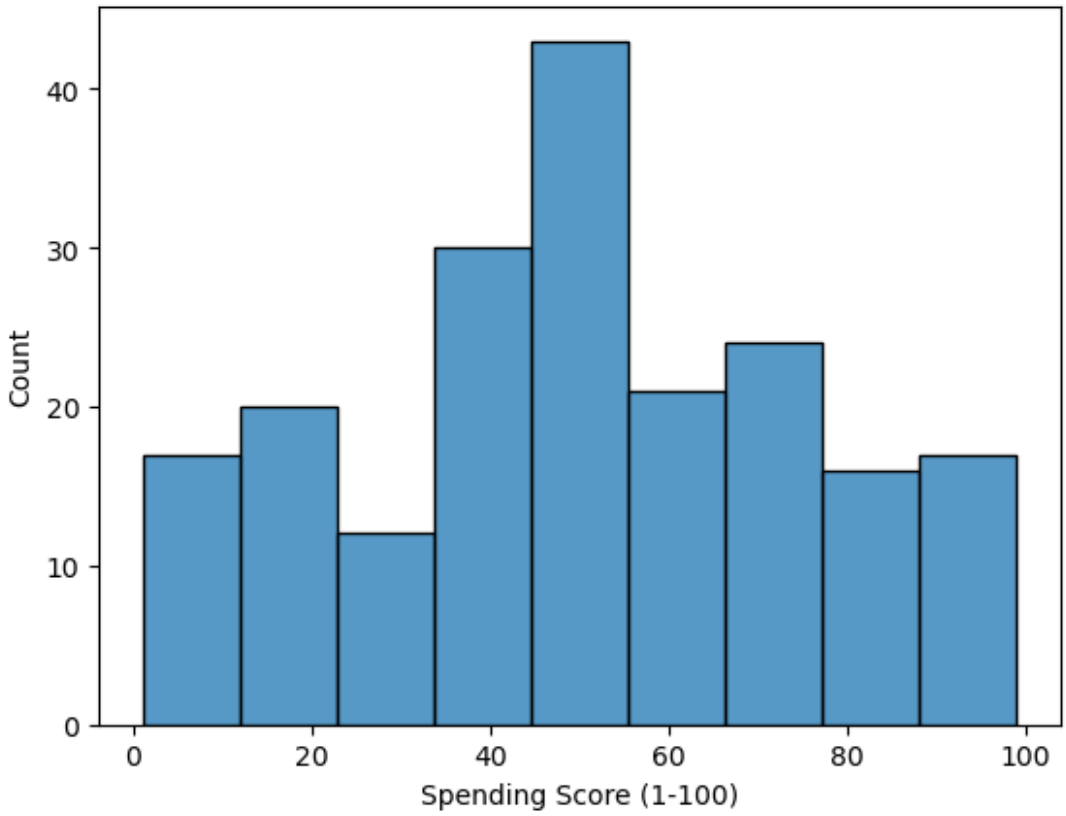

```
sns.histplot(customer_data['Age'])
plt.show()
```




```
sns.histplot(customer_data['Annual Income (k$)'])
plt.show()
```




```
sns.histplot(customer_data ['Spending Score (1-100)'])
plt.show()
```




```
X = customer_data.iloc[:, [3,4]].values

print(X[0])

[15 39]

print(X)

[[ 15  39]
 [ 15  81]
 [ 16   6]
 [ 16  77]
 [ 17  40]
 [ 17  76]
 [ 18   6]
 [ 18  94]
 [ 19   3]
 [ 19  72]
 [ 19  14]
 [ 19  99]
 [ 20  15]
 [ 20  77]
 [ 20  13]
 [ 20  79]
 [ 21  35]
```

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[ 21  66]
[ 23  29]
[ 23  98]
[ 24  35]
[ 24  73]
[ 25   5]
[ 25  73]
[ 28  14]
[ 28  82]
[ 28  32]
[ 28  61]
[ 29  31]
[ 29  87]
[ 30   4]
[ 30  73]
[ 33   4]
[ 33  92]
[ 33  14]
[ 33  81]
[ 34  17]
[ 34  73]
[ 37  26]
[ 37  75]
[ 38  35]
[ 38  92]
[ 39  36]
[ 39  61]
[ 39  28]
[ 39  65]
[ 40  55]
[ 40  47]
[ 40  42]
[ 40  42]
[ 42  52]
[ 42  60]
[ 43  54]
[ 43  60]
[ 43  45]
[ 43  41]
[ 44  50]
[ 44  46]
[ 46  51]
[ 46  46]
[ 46  56]
[ 46  55]
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[ 47  59]
[ 48  51]
[ 48  59]
```

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[ 48  50]
[ 48  48]
[ 48  59]
[ 48  47]
[ 49  55]
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[ 63  50]
[ 63  46]
[ 63  43]
[ 63  48]
[ 63  52]
[ 63  54]
[ 64  42]
[ 64  46]
[ 65  48]
```

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[ 65  50]
[ 65  43]
[ 65  59]
[ 67  43]
[ 67  57]
[ 67  56]
[ 67  40]
[ 69  58]
[ 69  91]
[ 70  29]
[ 70  77]
[ 71  35]
[ 71  95]
[ 71  11]
[ 71  75]
[ 71   9]
[ 71  75]
[ 72  34]
[ 72  71]
[ 73   5]
[ 73  88]
[ 73   7]
[ 73  73]
[ 74  10]
[ 74  72]
[ 75   5]
[ 75  93]
[ 76  40]
[ 76  87]
[ 77  12]
[ 77  97]
[ 77  36]
[ 77  74]
[ 78  22]
[ 78  90]
[ 78  17]
[ 78  88]
[ 78  20]
[ 78  76]
[ 78  16]
[ 78  89]
[ 78   1]
[ 78  78]
[ 78   1]
[ 78  73]
[ 79  35]
[ 79  83]
[ 81   5]
[ 81  93]
```

```
 [ 85  26]
 [ 85  75]
 [ 86  20]
 [ 86  95]
 [ 87  27]
 [ 87  63]
 [ 87  13]
 [ 87  75]
 [ 87  10]
 [ 87  92]
 [ 88  13]
 [ 88  86]
 [ 88  15]
 [ 88  69]
 [ 93  14]
 [ 93  90]
 [ 97  32]
 [ 97  86]
 [ 98  15]
 [ 98  88]
 [ 99  39]
 [ 99  97]
 [101  24]
 [101  68]
 [103  17]
 [103  85]
 [103  23]
 [103  69]
 [113   8]
 [113  91]
 [120  16]
 [120  79]
 [126  28]
 [126  74]
 [137  18]
 [137  83]]
```

```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state=0)

Y = kmeans.fit_predict(X)

print(Y)
```

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

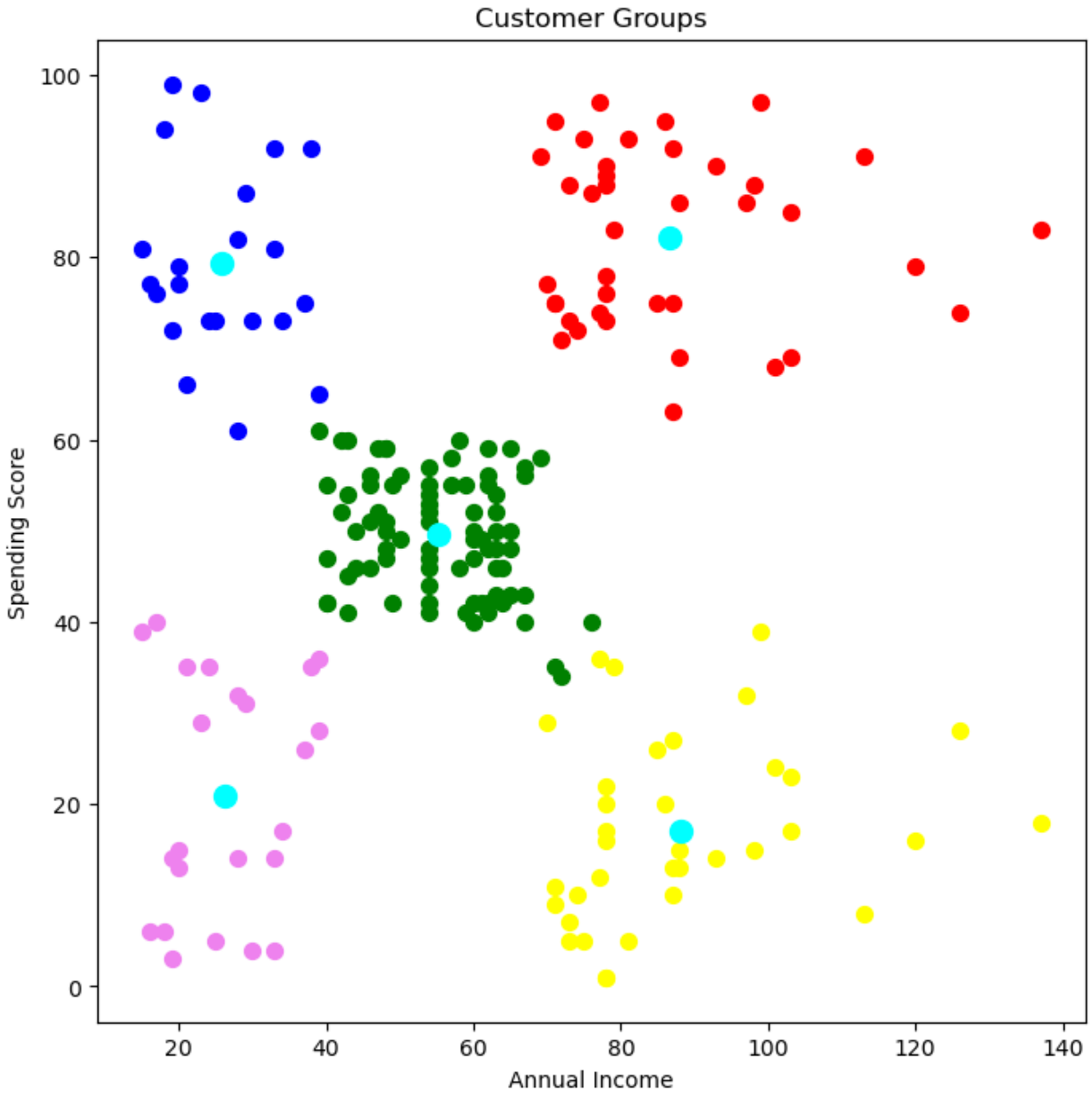
C:\Users\Sourab singha\anaconda3\Lib\site-packages\sklearn\cluster\
_kmeans.py:1429: UserWarning: KMeans is known to have a memory leak on
Windows with MKL, when there are less chunks than available threads.
You can avoid it by setting the environment variable
OMP_NUM_THREADS=1.
  warnings.warn(



plt.figure(figsize=(8,8))
plt.scatter(X[Y==0,0], X[Y==0,1], s=50, c='green', label='Cluster 1')
plt.scatter(X[Y==1,0], X[Y==1,1], s=50, c='red', label='Cluster 2')
plt.scatter(X[Y==2,0], X[Y==2,1], s=50, c='yellow', label='Cluster 3')
plt.scatter(X[Y==3,0], X[Y==3,1], s=50, c='violet', label='Cluster 4')
plt.scatter(X[Y==4,0], X[Y==4,1], s=50, c='blue', label='Cluster 5')

plt.scatter(kmeans.cluster_centers_[:,0],
kmeans.cluster_centers_[:,1], s=100, c='cyan', label='Centroids')

plt.title('Customer Groups')
plt.xlabel('Annual Income')
plt.ylabel('Spending Score')
plt.show()
```


Customer Groups
Spending Score
Annual Income
100
80
60
40
20
0
20
40
60
80
100
120
140