In [20]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import math
from sklearn.preprocessing import scale
from sklearn.model_selection import train_test_split
from sklearn.cluster import KMeans
from sklearn.decomposition import PCA
import matplotlib.pyplot as plt
```

In [22]:
```
df = pd.read_csv("D:\csv\Mall_Customers.csv")
df.head()
```

Out[22]:

	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 [23]:
```
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: 7.1+ KB
```

In [24]:
```
df.shape
```

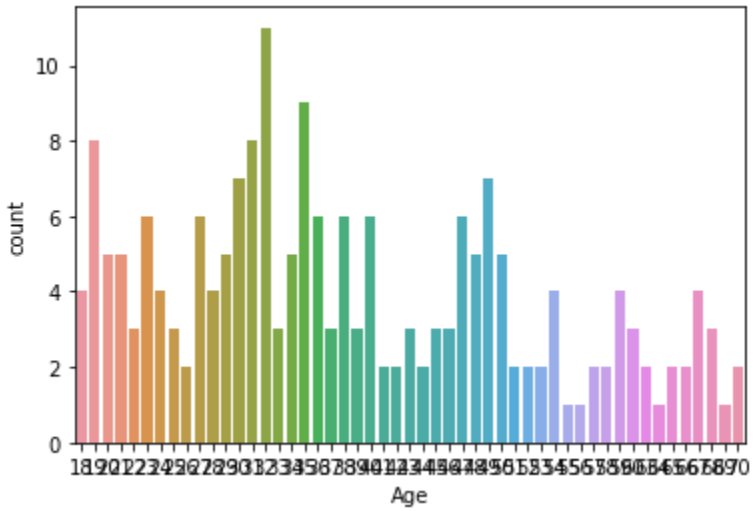
Out[24]:
```
(200, 5)
```

In [25]:
```
df.Gender.value_counts()
```

Out[25]:
```
Female    112
Male       88
Name: Gender, dtype: int64
```

In [26]:
```
sns.countplot(x=df['Age'])
```

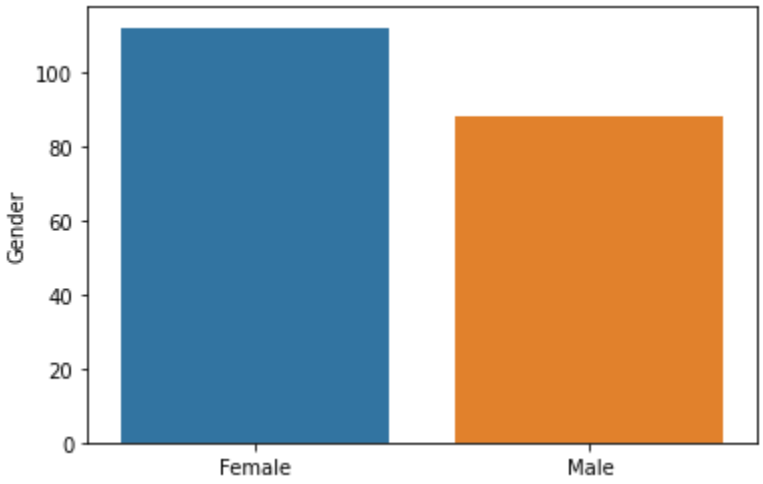
Out[26]:
```
<AxesSubplot:xlabel='Age', ylabel='count'>
```



In [27]:
```
sns.barplot(df.Gender.value_counts().index,df.Gender.value_counts())
```

```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variables as keyword args: x, y. From version 0.12, the only valid positio
nal argument will be `data`, and passing other arguments without an explicit keyword wil
l result in an error or misinterpretation.
  warnings.warn(
```

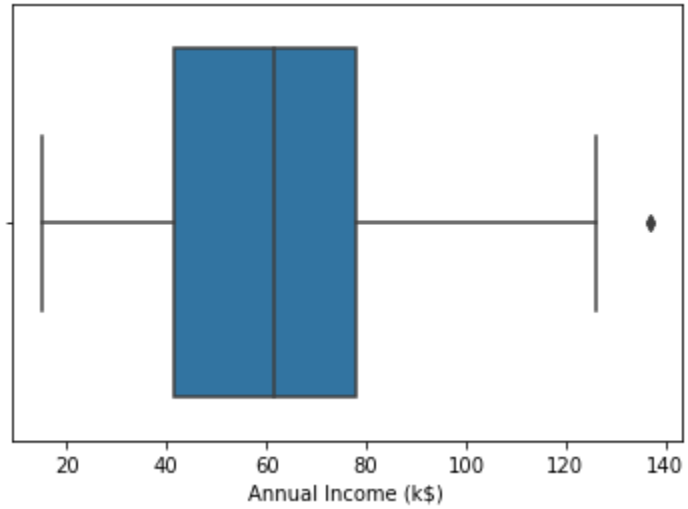
Out[27]: <AxesSubplot:ylabel='Gender'>



In [28]:
```
sns.boxplot(df['Annual Income (k$)'])
```

```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  warnings.warn(
```

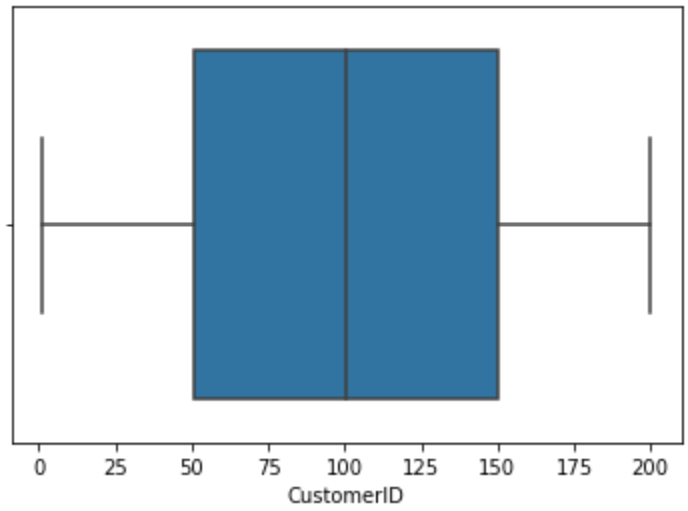
Out[28]: <AxesSubplot:xlabel='Annual Income (k$)'>



In [29]:
```
sns.boxplot(df['CustomerID'])
```

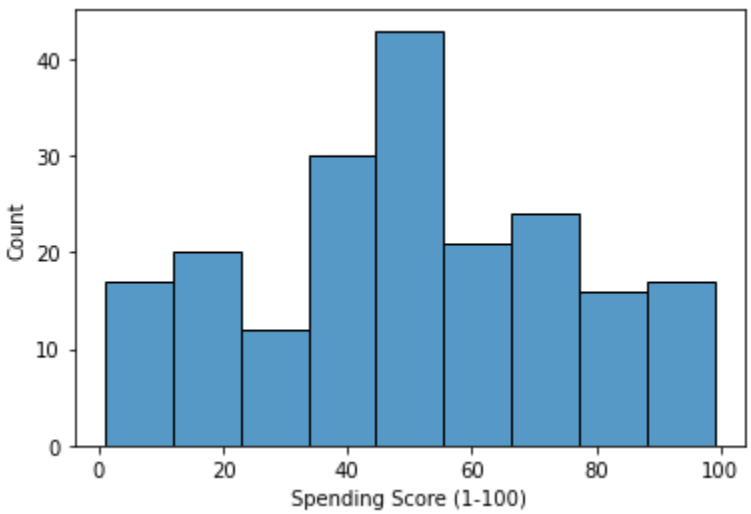
```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  warnings.warn(
```

Out[29]: <AxesSubplot:xlabel='CustomerID'>



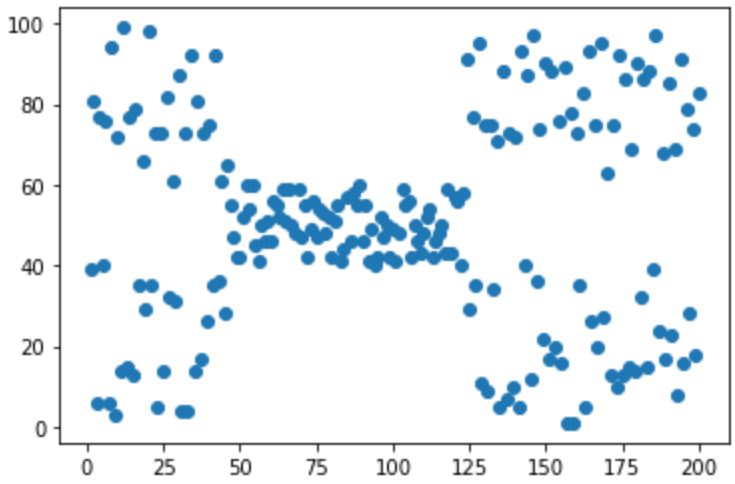
In [30]:
```
sns.histplot(df['Spending Score (1-100)'])
```

Out[30]: <AxesSubplot:xlabel='Spending Score (1-100)', ylabel='Count'>



In [31]:
```
plt.scatter(df.CustomerID,df['Spending Score (1-100)'])
```

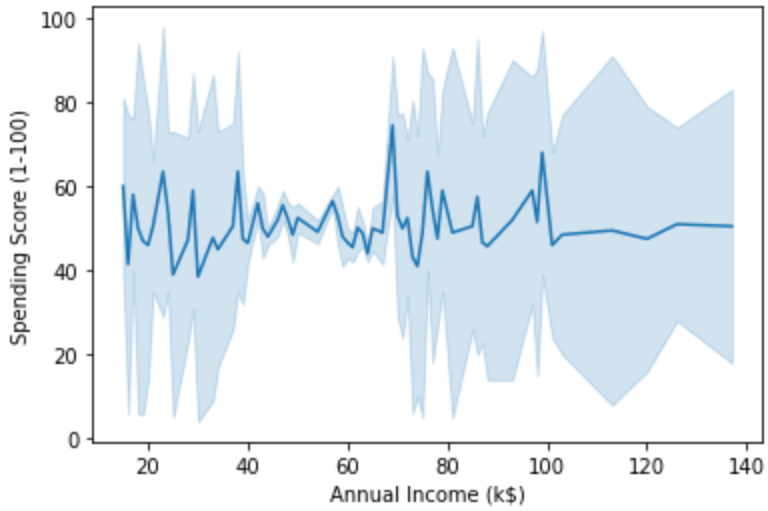
Out[31]:
```
<matplotlib.collections.PathCollection at 0xa134e98>
```



In [32]:
```
sns.lineplot(df['Annual Income (k$)'],df['Spending Score (1-100)'])
```

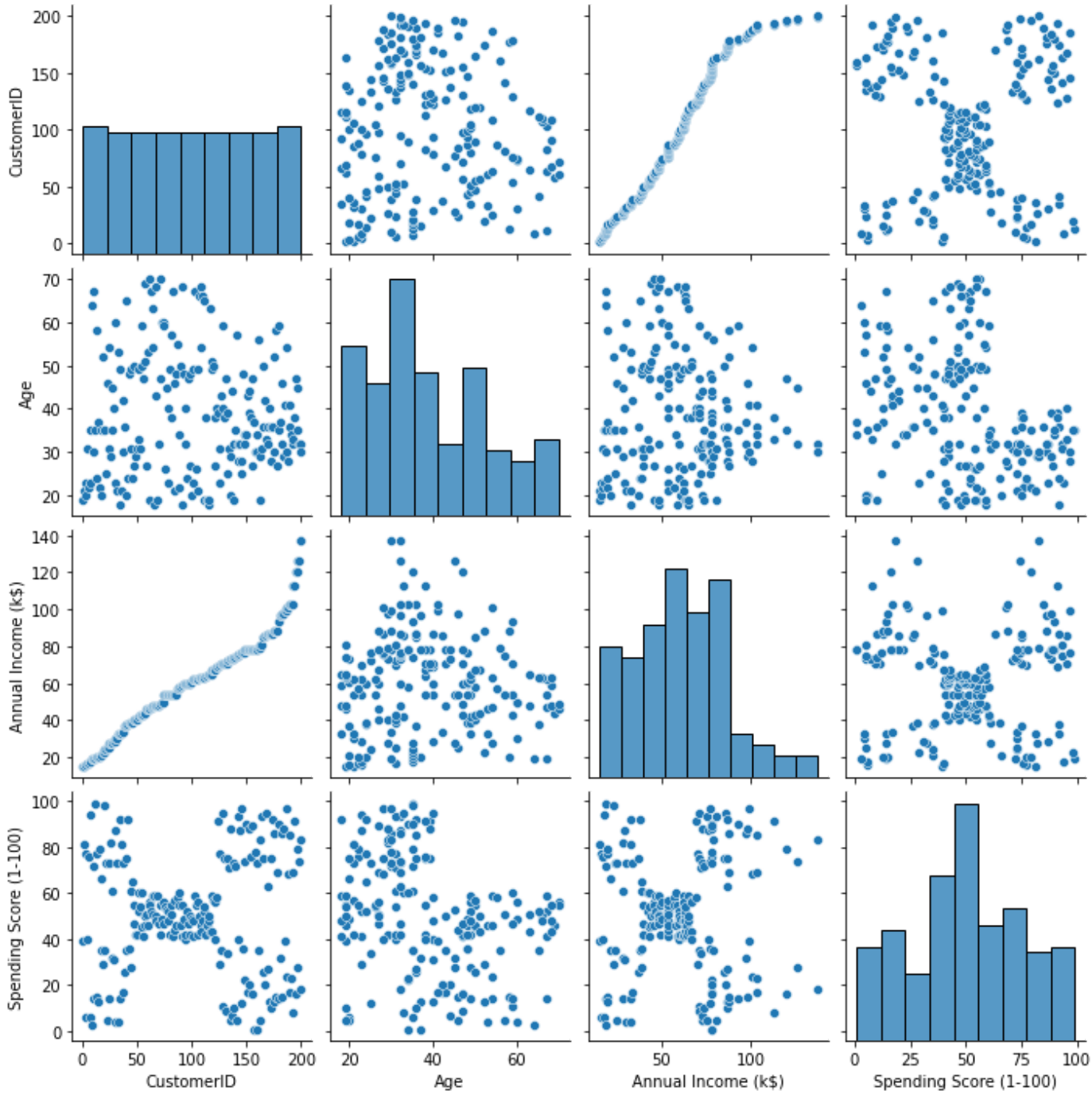
```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variables as keyword args: x, y. From version 0.12, the only valid positio
nal argument will be `data`, and passing other arguments without an explicit keyword wil
l result in an error or misinterpretation.
  warnings.warn(
```

Out[32]:
```
<AxesSubplot:xlabel='Annual Income (k$)', ylabel='Spending Score (1-100)'>
```



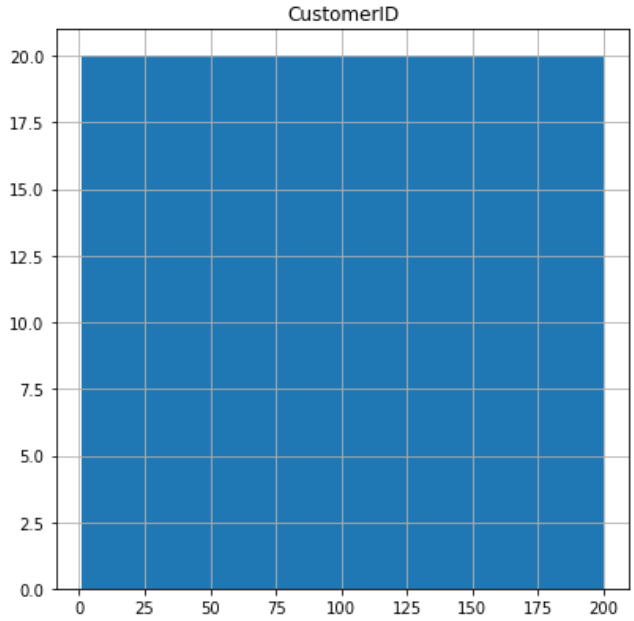
In [33]:
```
sns.pairplot(df)
```

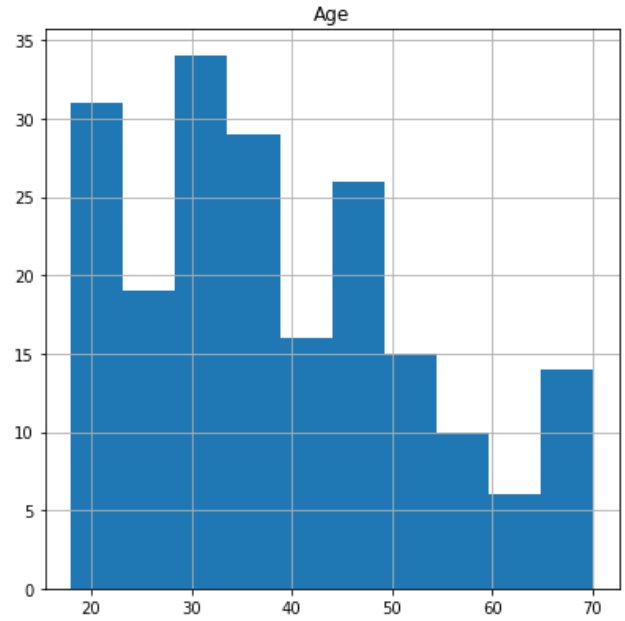
Out[33]:
```
<seaborn.axisgrid.PairGrid at 0x50e8e20>
```

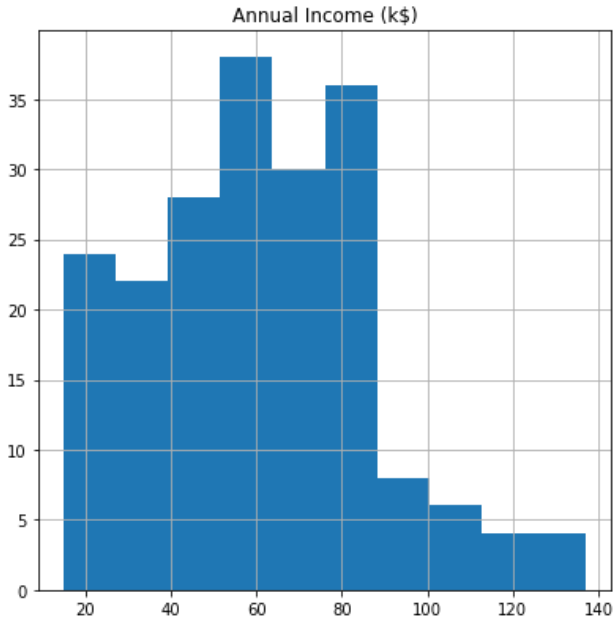


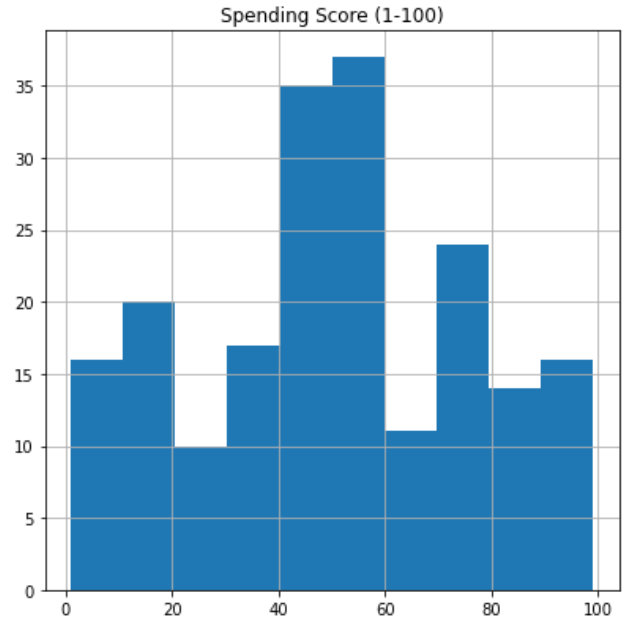
In [34]:

```
df.hist(figsize = (15,15))
plt.show()
```









In [35]:
```
df.describe()
```

Out[35]:

	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 [36]:
```
df.min()
```

Out[36]:
```
CustomerID                     1
Gender                    Female
Age                           18
Annual Income (k$)            15
Spending Score (1-100)         1
dtype: object
```

In [37]:
```
df.max()
```

Out[37]:
```
CustomerID                   200
Gender                      Male
Age                           70
Annual Income (k$)           137
Spending Score (1-100)        99
dtype: object
```

In [38]:
```
df.corr()
```

Out[38]:

	CustomerID	Age	Annual Income (k$)	Spending Score (1-100)
CustomerID	1.000000	-0.026763	0.977548	0.013835
Age	-0.026763	1.000000	-0.012398	-0.327227
Annual Income (k$)	0.977548	-0.012398	1.000000	0.009903
Spending Score (1-100)	0.013835	-0.327227	0.009903	1.000000

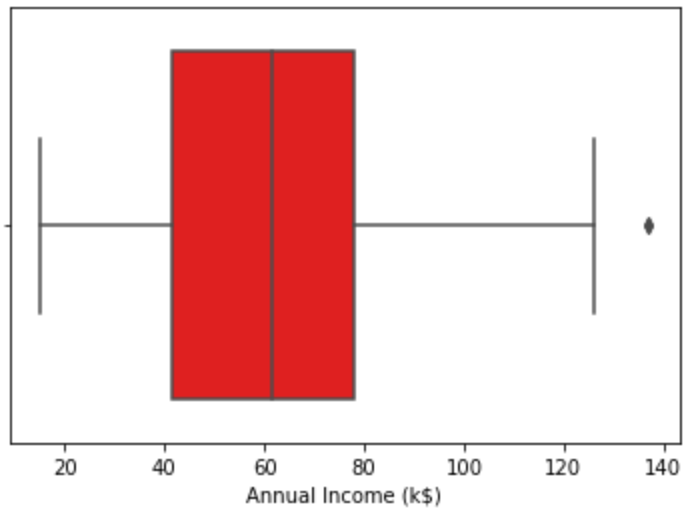
In [39]:
```
df.isnull().any()
```

Out[39]:
```
CustomerID                  False
Gender                      False
Age                         False
Annual Income (k$)          False
Spending Score (1-100)      False
dtype: bool
```

In [40]:
```
sns.boxplot(df['Annual Income (k$)'],color='red')
```

```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  warnings.warn(
```

Out[40]:
```
<AxesSubplot:xlabel='Annual Income (k$)'>
```



In [41]:
```
#IQR
q1 = df['Annual Income (k$)'].quantile(0.25)
q3 = df['Annual Income (k$)'].quantile(0.75)
```

In [42]:
```
IQR = q3-q1
```

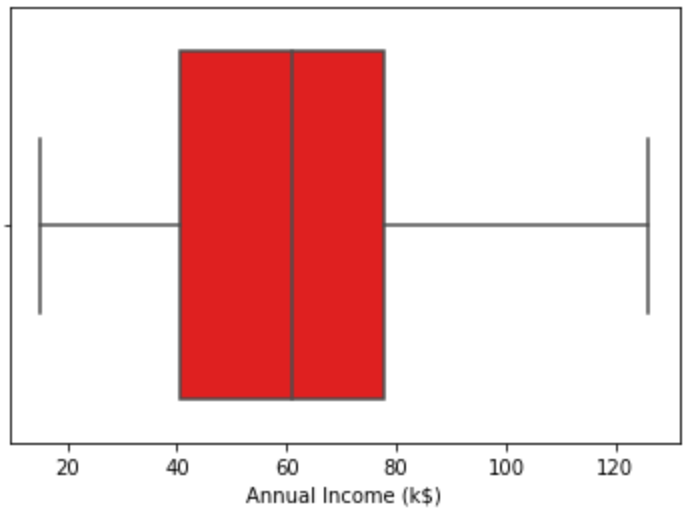
In [43]:
```
upper_limit = q3+1.5*IQR
lower_limit = q1-1.5*IQR
```

In [44]:
```
df = df[df['Annual Income (k$)'] < upper_limit]
```

In [45]:
```
sns.boxplot(df['Annual Income (k$)'],color='red')
```

```
C:\Users\sss\anaconda3\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass
the following variable as a keyword arg: x. From version 0.12, the only valid positional
argument will be `data`, and passing other arguments without an explicit keyword will re
sult in an error or misinterpretation.
  warnings.warn(
```

Out[45]:
```
<AxesSubplot:xlabel='Annual Income (k$)'>
```



In [46]:
```
from sklearn.preprocessing import LabelEncoder
```

In [47]:
```
encoder=LabelEncoder()
df['Gender'] = encoder.fit_transform(df['Gender'])
df.head()
```

```
<ipython-input-47-05ffcf40ce91>:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_
guide/indexing.html#returning-a-view-versus-a-copy
  df['Gender'] = encoder.fit_transform(df['Gender'])
```

Out[47]:

	CustomerID	Gender	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 [48]:
```
from sklearn.preprocessing import MinMaxScaler
scaler=MinMaxScaler()
x=scaler.fit_transform(df)
x[0:5]
```

Out[48]:
```
array([[0.        , 1.        , 0.01923077, 0.        , 0.3877551 ],
       [0.00507614, 1.        , 0.05769231, 0.        , 0.81632653],
       [0.01015228, 0.        , 0.03846154, 0.00900901, 0.05102041],
       [0.01522843, 0.        , 0.09615385, 0.00900901, 0.7755102 ],
       [0.02030457, 0.        , 0.25      , 0.01801802, 0.39795918]])
```

In [49]:
```
x = df.iloc[:, [3, 4]].values
```

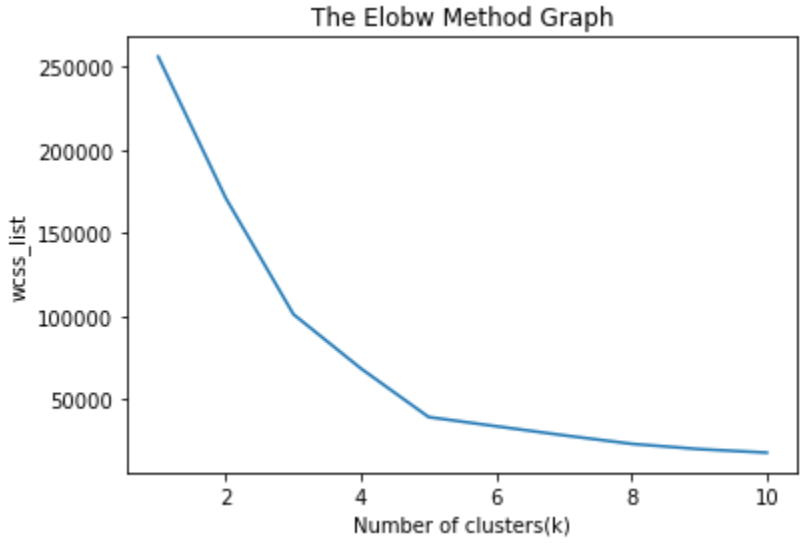
In [50]:
```
kmeans = KMeans(3)
kmeans.fit(x)
```

Out[50]:
```
KMeans(n_clusters=3)
```

In [51]:
```
KMeans(n_clusters=3)
```

Out[51]:
```
KMeans(n_clusters=3)
```

In [52]:
```
from sklearn.cluster import KMeans
wcss_list= []
for i in range(1, 11):
    kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)
    kmeans.fit(x)
    wcss_list.append(kmeans.inertia_)
plt.plot(range(1, 11), wcss_list)
plt.title('The Elobw Method Graph')
plt.xlabel('Number of clusters(k)')
plt.ylabel('wcss_list')
plt.show()
```



In [53]:
```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)
y_predict= kmeans.fit_predict(x)
```

In [55]:
```
plt.scatter(x[y_predict == 0, 0], x[y_predict == 0, 1], s = 100, c = 'blue', label = 'Cl
plt.scatter(x[y_predict == 1, 0], x[y_predict == 1, 1], s = 100, c = 'green', label = 'C
plt.scatter(x[y_predict== 2, 0], x[y_predict == 2, 1], s = 100, c = 'red', label = 'Clus
plt.scatter(x[y_predict == 3, 0], x[y_predict == 3, 1], s = 100, c = 'cyan', label = 'Cl
plt.scatter(x[y_predict == 4, 0], x[y_predict == 4, 1], s = 100, c = 'magenta', label =
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c =
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: