```
In [1]: import pandas as pd
        import seaborn as sns
        import matplotlib.pyplot as plt
        import numpy as np
        from sklearn.preprocessing import LabelEncoder
        from sklearn.preprocessing import scale
        from sklearn.model_selection import train_test_split
        from sklearn.metrics import mean_squared_error
        import math

        from sklearn.cluster import KMeans
        from sklearn.preprocessing import StandardScaler
```

Dataset

```
In [2]: df = pd.read_csv("/content/Mall_Customers.csv")
        df.head()
```

Out[2]:

	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 [3]: label_encoder = LabelEncoder()

        df['Gender']= label_encoder.fit_transform(df['Gender'])

        df['Gender'].unique()
```

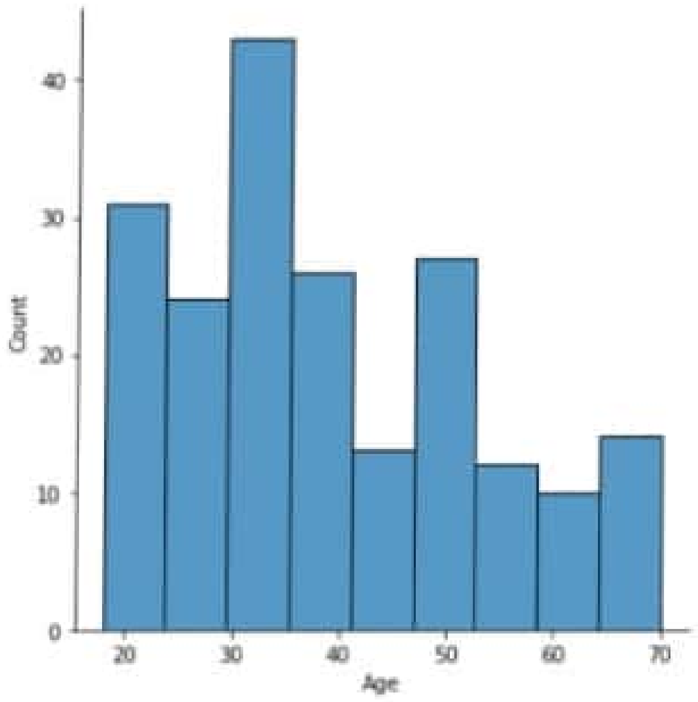
```
df['Gender'].unique()
```

Out[3]: array([1, 0])

Univariate Analysis

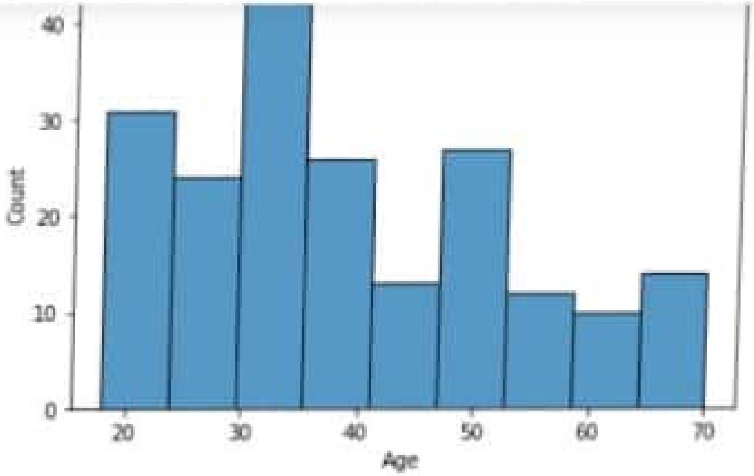
In [4]:
```
sns.displot(df["Age"])
```

Out[4]: <seaborn.axisgrid.FacetGrid at 0x7f356ad85a90>



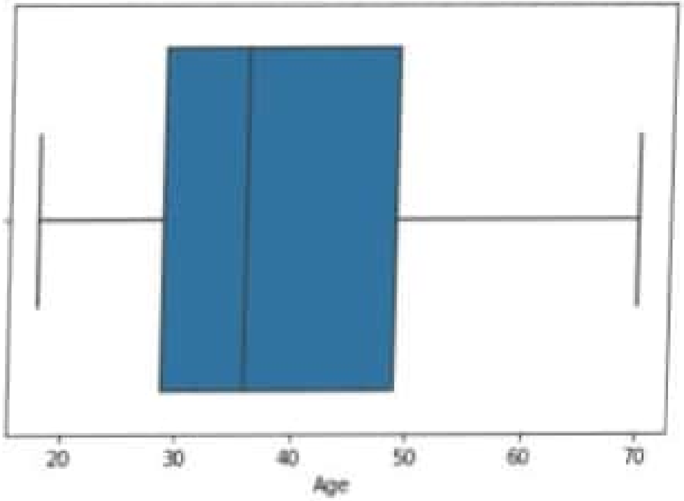
In [5]:
```
sns.histplot(x=df['Age'])
```

Out[5]: <matplotlib.axes._subplots.AxesSubplot at 0x7f35589bdfd0>



In [6]:
```
sns.boxplot(x=df['Age'])
```

Out[6]: <matplotlib.axes._subplots.AxesSubplot at 0x7f355847dcd0>

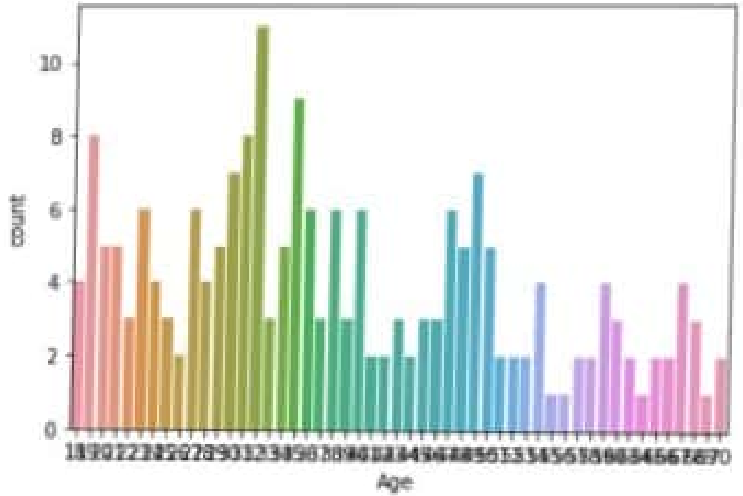


In [7]:
```
sns.countplot(x=df['Age'])
```

Out[7]: <matplotlib.axes._subplots.AxesSubplot at 0x7f355841b4d0>

```
In [7]: sns.countplot(x=df['Age'])
```

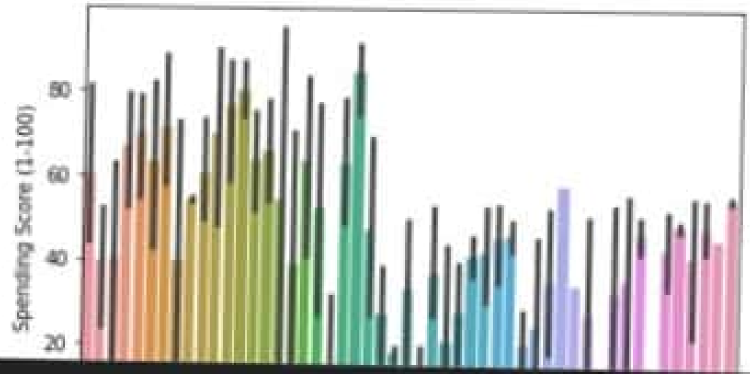
```
Out[7]: <matplotlib.axes._subplots.AxesSubplot at 0x7f355841b4d0>
```



Bivariate Analysis

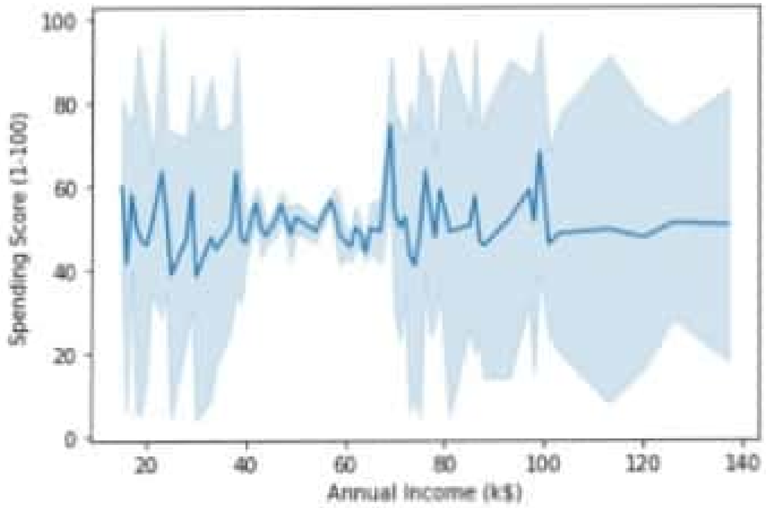
```
In [8]: sns.barplot(x=df['Age'],y=df['Spending Score (1-100)'])
```

```
Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3558244e90>
```



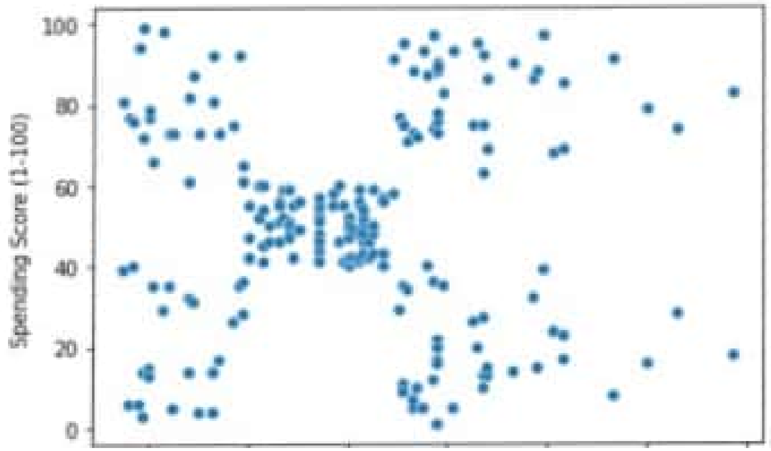
In [9]:
```
sns.lineplot(x=df['Annual Income (k$)'],y=df['Spending Score (1-100)'])
```

Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x7f355806f710>



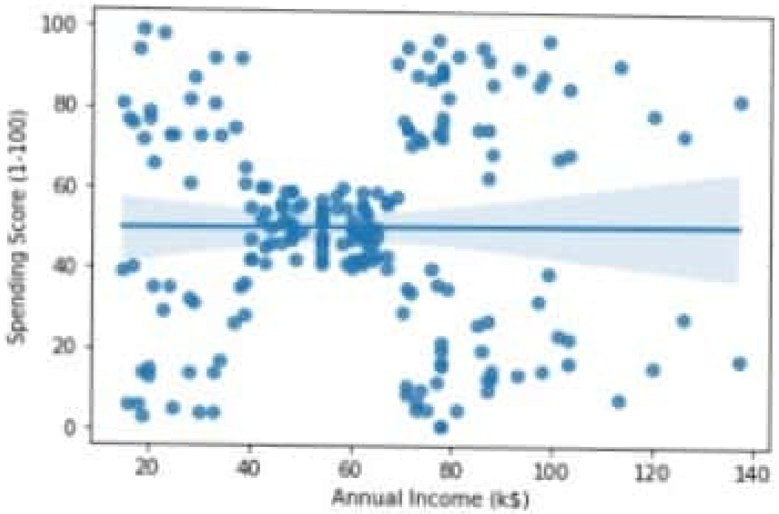
In [10]:
```
sns.scatterplot(x=df['Annual Income (k$)'],y=df['Spending Score (1-100)'])
```

Out[10]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3558135cd0>



In [11]:
```
sns.regplot(x=df['Annual Income (k$)'],y=df['Spending Score (1-100)'])
```

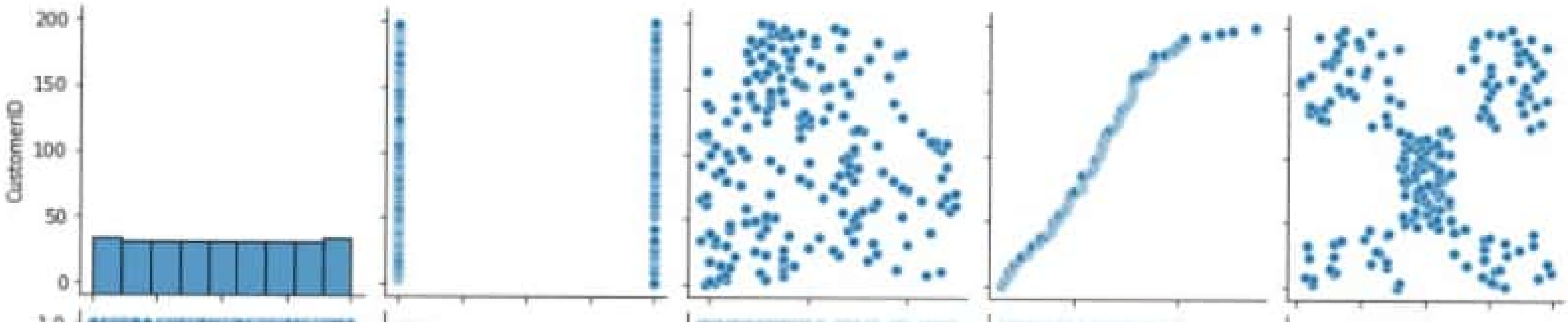
Out[11]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3557fea910>

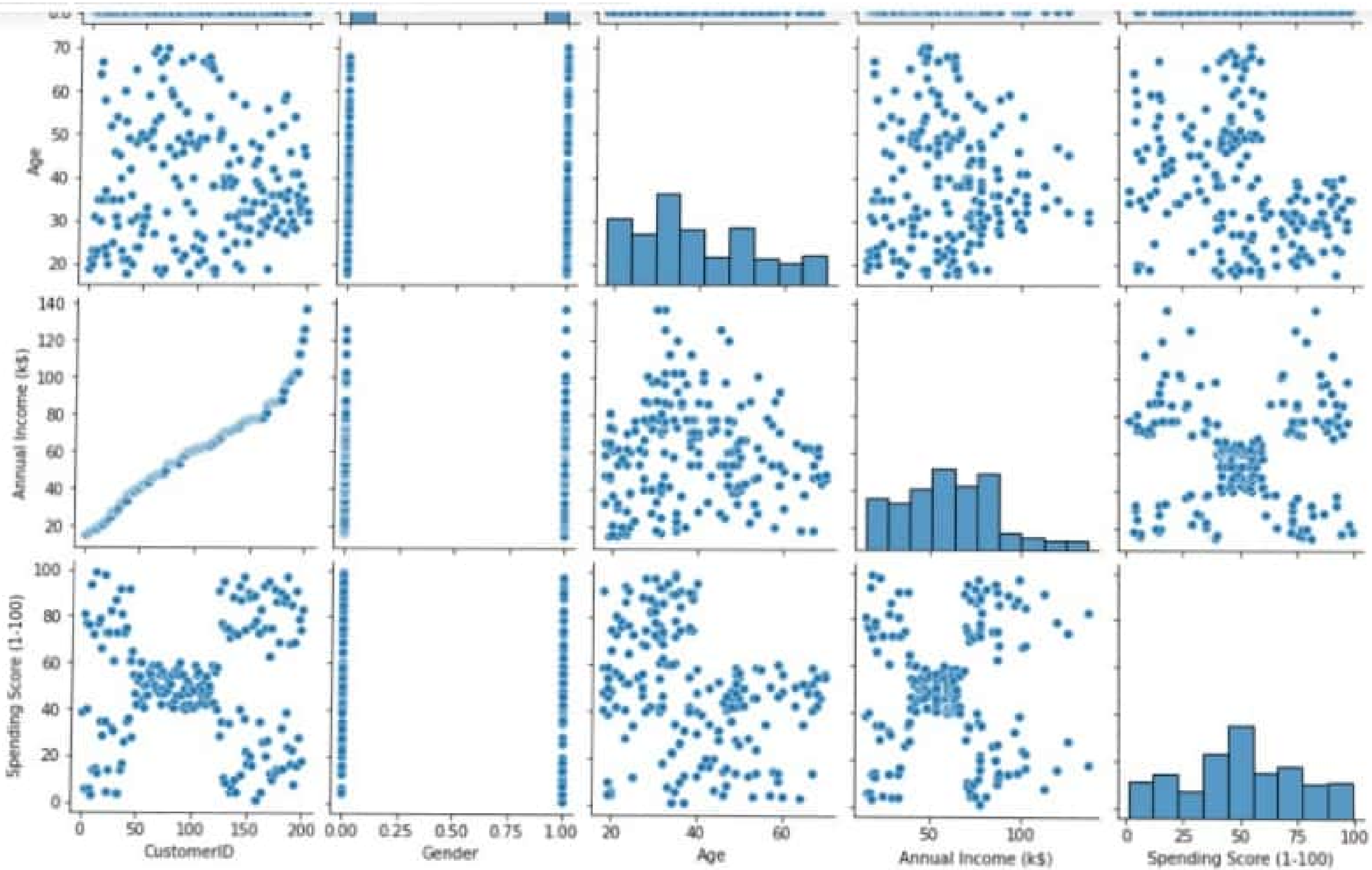


Multivariate Analysis

In [12]:
```
sns.pairplot(data=df)
```

Out[12]: <seaborn.axisgrid.PairGrid at 0x7f35581d9510>





Descriptive Statistics

```
In [13]: df.describe()
```

Descriptive Statistics

In [13]:
```
df.describe()
```

Out[13]:

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
count	200.000000	200.000000	200.000000	200.000000	200.000000
mean	100.500000	0.440000	38.850000	60.560000	50.200000
std	57.879185	0.497633	13.969007	26.264721	25.823522
min	1.000000	0.000000	18.000000	15.000000	1.000000
25%	50.750000	0.000000	28.750000	41.500000	34.750000
50%	100.500000	0.000000	36.000000	61.500000	50.000000
75%	150.250000	1.000000	49.000000	78.000000	73.000000
max	200.000000	1.000000	70.000000	137.000000	99.000000

Check Missing Values

In [14]:
```
df.isnull().sum()
```

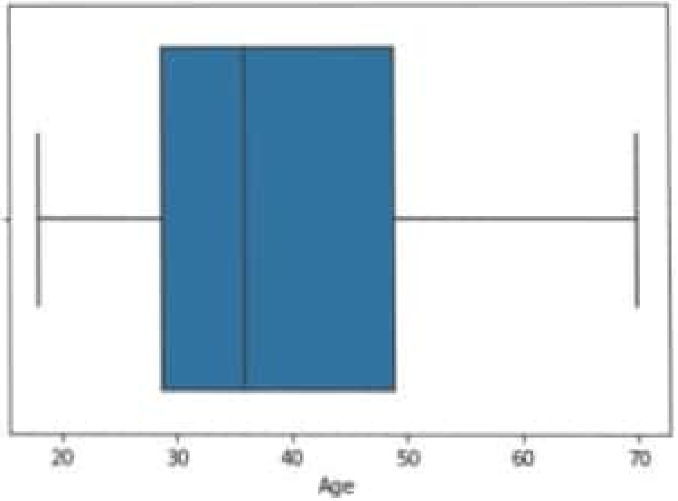
Out[14]:
```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

In [15]:
```
df.isna().any()
```

Out[15]:
```
CustomerID                False
Gender                    False
Age                       False
Annual Income (k$)        False
```

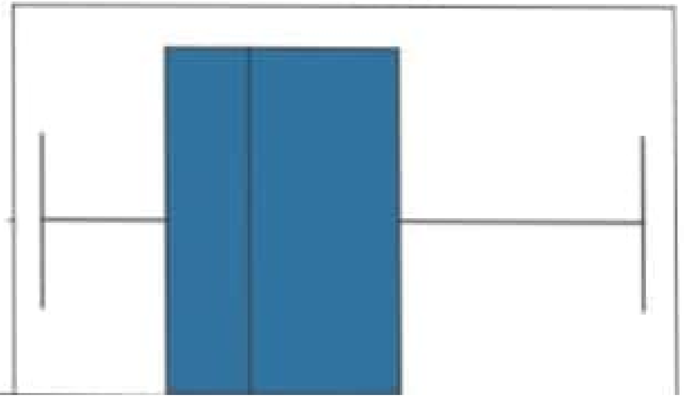
In [16]:
```
x = sns.boxplot(x=df["Age"])
x
```

Out[16]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3557449710>



In [17]:
```
x = df.Age
sns.boxplot(x=x)
```

Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3555b9f650>

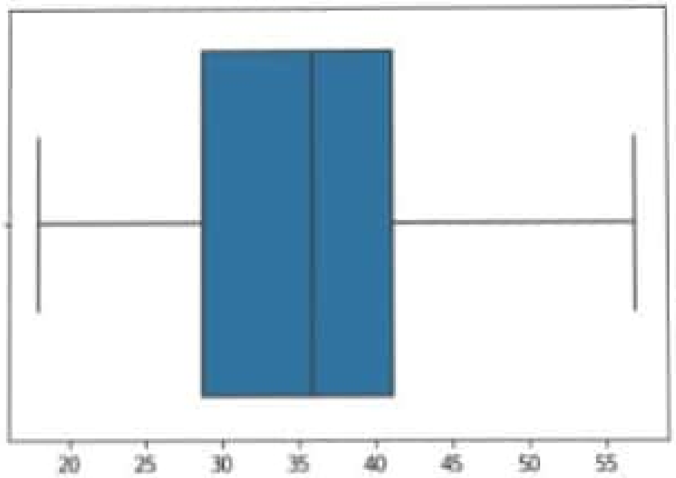


In [18]:
```
x = np.where(df['Age']>57,39, df['Age'])
x
```

Out[18]:
```
array([19, 21, 20, 23, 31, 22, 35, 23, 39, 30, 39, 35, 39, 24, 37, 22, 35,
       20, 52, 35, 35, 25, 46, 31, 54, 29, 45, 35, 40, 23, 39, 21, 53, 18,
       49, 21, 42, 30, 36, 20, 39, 24, 48, 31, 49, 24, 50, 27, 29, 31, 49,
       33, 31, 39, 50, 47, 51, 39, 27, 53, 39, 19, 39, 54, 39, 18, 43, 39,
       19, 32, 39, 47, 39, 39, 39, 26, 45, 40, 23, 49, 57, 38, 39, 46, 21,
       48, 55, 22, 34, 50, 39, 18, 48, 40, 32, 24, 47, 27, 48, 20, 23, 49,
       39, 26, 49, 21, 39, 54, 39, 39, 39, 19, 38, 19, 18, 19, 39, 49, 51,
       50, 27, 38, 40, 39, 23, 31, 43, 40, 39, 38, 47, 39, 25, 31, 20, 29,
       44, 32, 19, 35, 57, 32, 28, 32, 25, 28, 48, 32, 34, 34, 43, 39, 44,
       38, 47, 27, 37, 30, 34, 30, 56, 29, 19, 31, 50, 36, 42, 33, 36, 32,
       40, 28, 36, 36, 52, 30, 39, 27, 39, 35, 37, 32, 46, 29, 41, 30, 54,
       28, 41, 36, 34, 32, 33, 38, 47, 35, 45, 32, 32, 30])
```

In [19]:
```
sns.boxplot(x=x)
```

Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x7f3555b0cf10>



Build Model

Build Model

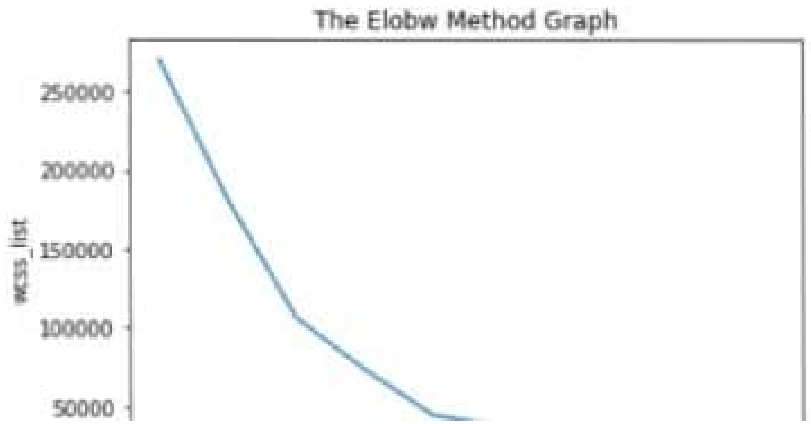
In [20]:
```
x = df.iloc[:, [3, 4]].values
```

Clustering

In [21]:
```
kmeans = KMeans(3)
kmeans.fit(x)
```

Out[21]: KMeans(n_clusters=3)

In [22]:
```
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 [23]:
```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)
y_predict= kmeans.fit_predict(x)
```

In [24]:
```
plt.scatter(x[y_predict == 0, 0], x[y_predict == 0, 1], s = 100, c = 'blue', label = 'Cluster 1') #for first cluster
plt.scatter(x[y_predict == 1, 0], x[y_predict == 1, 1], s = 100, c = 'green', label = 'Cluster 2') #for second cluster
plt.scatter(x[y_predict== 2, 0], x[y_predict == 2, 1], s = 100, c = 'red', label = 'Cluster 3') #for third cluster
plt.scatter(x[y_predict == 3, 0], x[y_predict == 3, 1], s = 100, c = 'cyan', label = 'Cluster 4') #for fourth cluster
plt.scatter(x[y_predict == 4, 0], x[y_predict == 4, 1], s = 100, c = 'magenta', label = 'Cluster 5') #for fifth cluster
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s = 300, c = 'yellow', label = 'Centroid')
plt.title('Clusters of customers')
plt.xlabel('Annual Income (k$)')
plt.ylabel('Spending Score (1-100)')
plt.legend()
plt.show()
```