

ASSIGNMENT-4
APPLIED DATA SCIENCE

Assignment date	6 November 2022
Student Name	Ningombam Chingkheinganba
Student Roll Number	7309730919104072
Maximum Marks	2 Marks

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localhost:8888/notebooks/anaconda3/anaconda/assignment4.ipynb#

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Download the dataset

```
In [5]: import pandas as pd
import numpy as np
```

Load the dataset

```
In [7]: df=pd.read_csv('Mall_Customers.csv')
df.head()
```

Out[7]:

	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

Perform Below Visualizations

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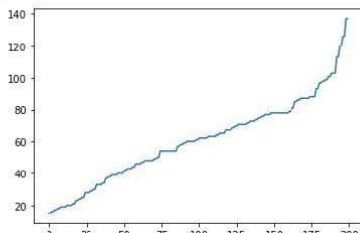
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Univariate Analysis

```
In [8]: import matplotlib.pyplot as plt
import seaborn as sns
matplotlib inline
```

```
In [11]: plt.plot(df['Annual Income (k$)'])
plt.show()
```



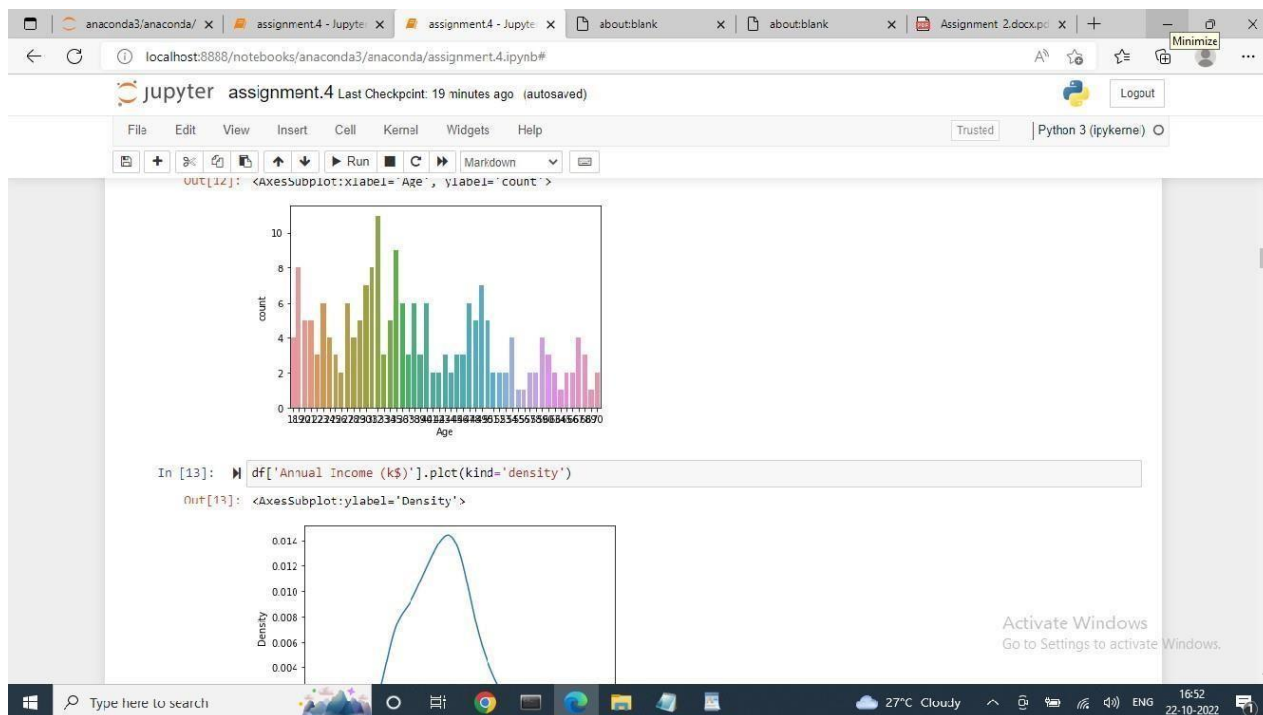
```
In [10]: data=np.array(df['Age'])
plt.plot(data,linestyle - 'cotted')
```

Out[10]: [<matplotlib.lines.Line2D at 0x26f3e956f10>]

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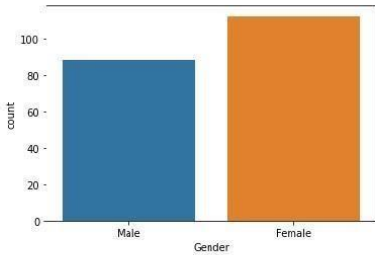
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Out[14]: <AxesSubplot: xlabel='Gender', ylabel='count'>



In [15]: `sns.boxplot(df['Annual Income (k$)'])`

C:\Users\admin\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 result in an error or misinterpretation.

Out[15]: <AxesSubplot: xlabel='Annual Income (k\$)'>

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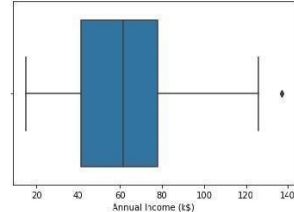
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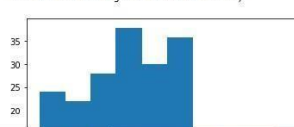
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In [16]: `plt.hist(df['Annual Income (k$)'])`

Out[16]: (array([24., 22., 28., 38., 30., 36., 8., 6., 4., 4.]),
array([15., 27.2, 39.4, 51.6, 63.8, 76., 88.2, 100.4, 112.6,
124.8, 137.]),
<BarContainer object of 10 artists>)



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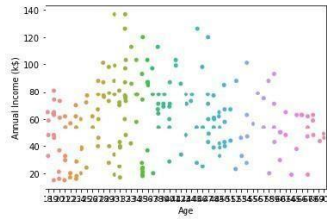
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Run

Bivariate Analysis

```
In [17]: sns.stripplot(x=df['Age'],y=df['Annual Income (k$)'])
Out[17]: <AxesSubplot: xlabel='Age', ylabel='Annual Income (k$)'
```



```
In [18]: sns.stripplot(x=df['Age'],y=df['Spending Score (1-100)'])
Out[18]: <AxesSubplot: xlabel='Age', ylabel='Spending Score (1-100)'
```



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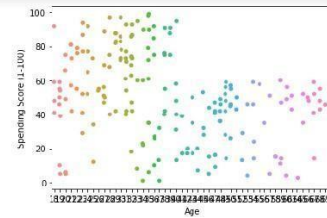
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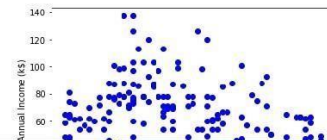
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Run

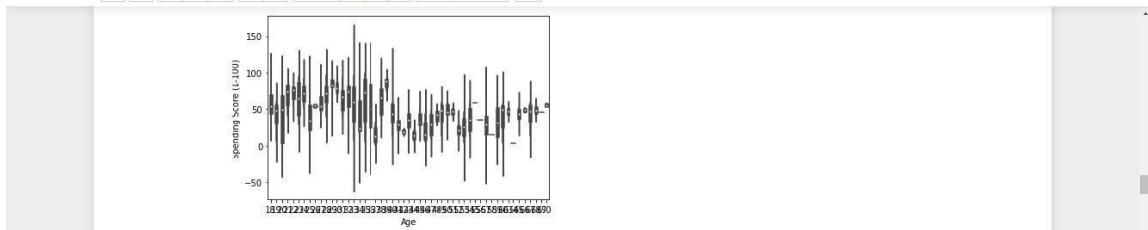


```
In [19]: plt.scatter(df['Age'],df['Annual Income (k$)'],color='blue')
plt.xlabel("Age")
plt.ylabel("Annual Income (k$)")
Out[19]: Text(0, 0.5, 'Annual Income (k$)')
```



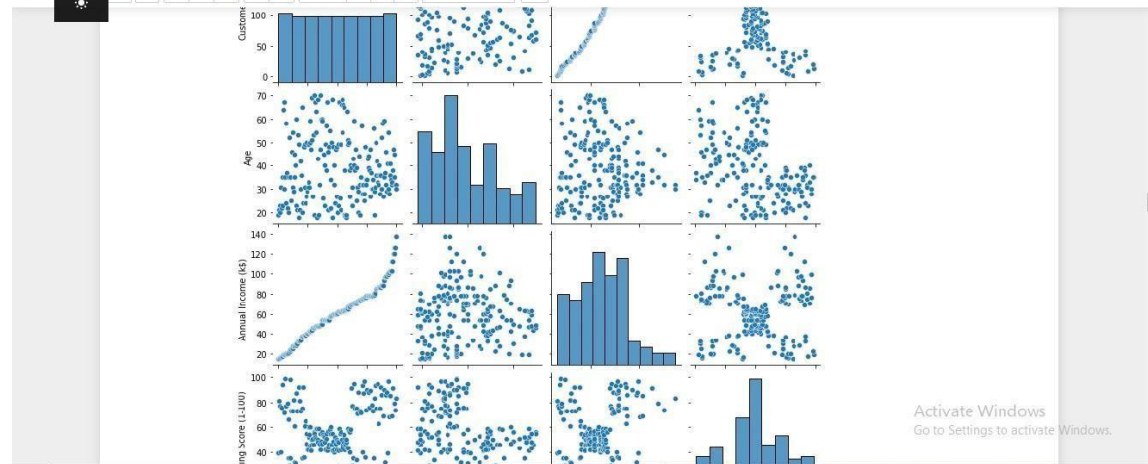
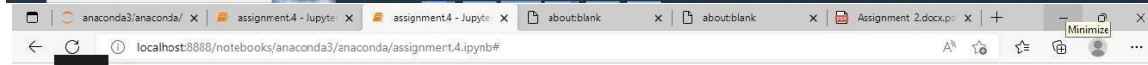
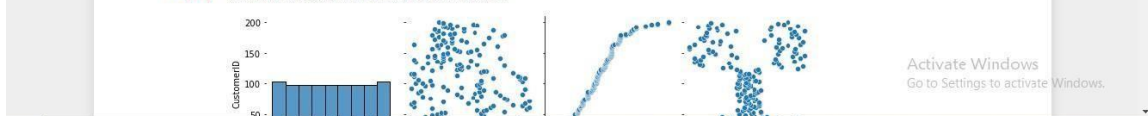
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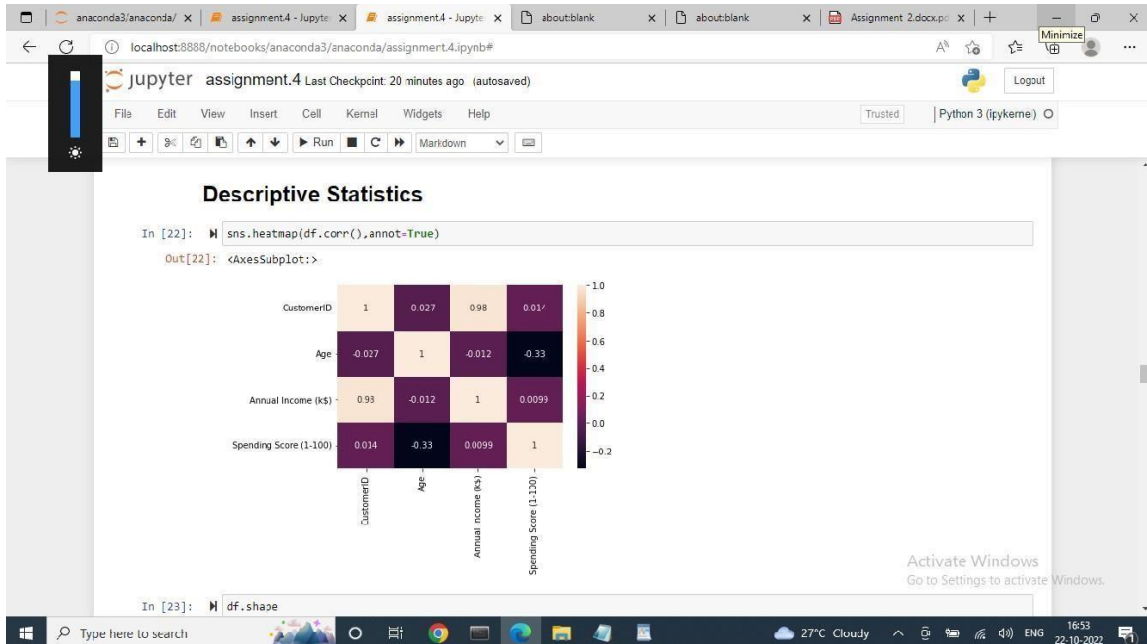
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Multivariate Analysis

```
In [21]: sns.pairplot(df)
Out[21]: <seaborn.axisgrid.PairGrid at 0x26f40038ae0>
```





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```
In [23]: df.shape
```

Out[23]: (200, 5)

```
In [24]: df.isnull().sum()
```

Out[24]:

CustomerID	0
Gender	0
Age	0
Annual Income (k\$)	0
Spending Score (1-100)	0

dtype: int64

```
In [25]: 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: 7.9+ KB

```
In [27]: df.describe()
```

Out[27]:

	CustomerID	Age	Annual Income (k\$)	Spending Score (1-100)
count	200	200	200	200
mean	100.5	33.8	60.1	48.5
std	85.4	11.2	25.3	12.7
min	1	18	1	1
max	200	70	160	100

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In [29]: `df.median()`

```
C:\Users\adnin\AppData\Local\Temp\ipykernel_7988\538851474.py:1: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError. Select only valid columns before calling the reduction.
df.median()

Out[29]: CustomerID      100.5
Age              36.0
Annual Income (k$)  61.5
Spending Score (1-100) 50.0
dtype: float64
```

In [30]: `df.mode()`

```
Out[30]:
```

	CustomerID	Gender	Age	Annual income (k\$)	Spending Score (1-100)
0	1	Female	32.0	54.0	42.0
1	2	NaN	NaN	78.0	NaN
2	3	NaN	NaN	NaN	NaN
3	4	NaN	NaN	NaN	NaN
4	5	NaN	NaN	NaN	NaN
...
195	196	NaN	NaN	NaN	NaN
196	197	NaN	NaN	NaN	NaN
197	198	NaN	NaN	NaN	NaN
...

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Check For Missing Values

In [33]: `df.isna().sum()`

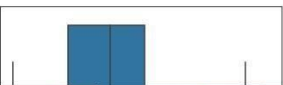
```
Out[33]: CustomerID      0
Gender              0
Age                0
Annual Income (k$)  0
Spending Score (1-100) 0
dtype: int64
```

Handling Outliers

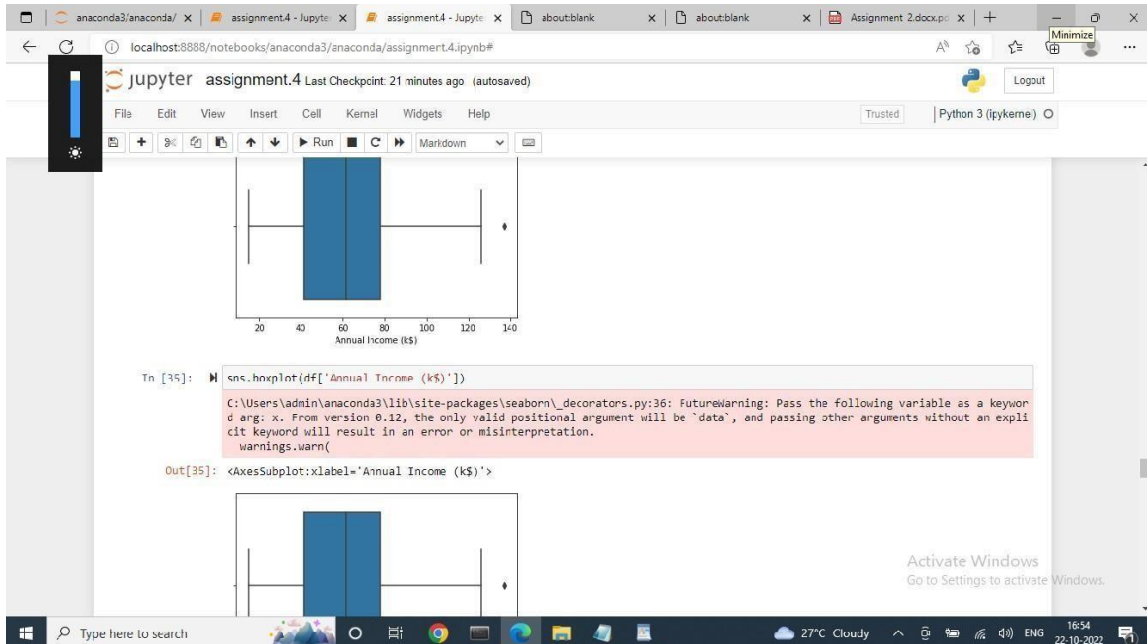
In [34]: `sns.boxplot(df['Annual Income (k$)'])`

```
C:\Users\adnin\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 result in an error or misinterpretation.
warnings.warn(

Out[34]: <AxesSubplot:xlabel='Annual Income (k$)'>
```



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Encoding Categorical Values

In [37]:

```
numeric_data = df.select_dtypes(include=[np.number])
categorical_data = df.select_dtypes(exclude=[np.number])
print("Number of numerical variables: ", numeric_data.shape[1])
print("Number of categorical variables: ", categorical_data.shape[1])
```

Number of numerical variables: 4
Number of categorical variables: 1

In [38]:

```
print("Number of categorical variables: ", categorical_data.shape[1])
Categorical_variables = list(categorical_data.columns)
Categorical_variables
```

Number of categorical variables: 1

Out[38]: ['Gender']

In [39]:

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

Out[39]:

Female	112
Male	88

Name: Gender, dtype: int64

In [40]:

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
label = le.fit_transform(df['Gender'])
df['Gender'] = label
```

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Scaling The Data

```
In [42]: X = df.drop("Age",axis=1)
         y = df["Age"]

In [43]: from sklearn.preprocessing import StandardScaler
         object= StandardScaler()
         scale = object.fit_transform(X)
         print(scale)
```

```
[ 1.41163905 -0.88640526  1.390894  1.38581187]
[ 1.42895978  1.12815215  1.42906343 -1.36651894]
[ 1.4162805  -0.88640526  1.42906343  1.46745499]
[ 1.45360123 -0.88640526  1.46723286 -0.43480148]
[ 1.48092195  1.12815215  1.46723286  1.81684904]
[ 1.49824268 -0.88640526  1.54357172 -1.01712489]
[ 1.5155634  1.12815215  1.54357172  0.69102378]
[ 1.53288413 -0.88640526  1.61991057 -1.28887582]
[ 1.55020485 -0.88640526  1.61991057  1.35699031]
[ 1.56752558 -0.88640526  1.61991057 -1.05594645]
[ 1.5848463  -0.88640526  1.61991057  0.72584534]
[ 1.60216702  1.12815215  2.00160487 -1.63826986]
[ 1.61948775 -0.88640526  2.00160487  1.58391968]
[ 1.63680847 -0.88640526  2.26879087 -1.32769738]
[ 1.6541292  -0.88640526  2.26879087  1.11806095]
[ 1.67144992 -0.88640526  2.49780745 -0.86183865]
[ 1.68877065  1.12815215  2.49780745  0.92395314]
[ 1.70609137  1.12815215  2.91767117 -1.25805425]
[ 1.7234121  1.12815215  2.91767117  1.27334719]
```

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```
object= StandardScaler()
scale = object.fit_transform(X)
print(scale)
```

```
[ 1.41163905 -0.88640526  1.390894  1.38581187]
[ 1.42895978  1.12815215  1.42906343 -1.36651894]
[ 1.4162805  -0.88640526  1.42906343  1.46745499]
[ 1.45360123 -0.88640526  1.46723286 -0.43480148]
[ 1.48092195  1.12815215  1.46723286  1.81684904]
[ 1.49824268 -0.88640526  1.54357172 -1.01712489]
[ 1.5155634  1.12815215  1.54357172  0.69102378]
[ 1.53288413 -0.88640526  1.61991057 -1.28887582]
[ 1.55020485 -0.88640526  1.61991057  1.35699031]
[ 1.56752558 -0.88640526  1.61991057 -1.05594645]
[ 1.5848463  -0.88640526  1.61991057  0.72584534]
[ 1.60216702  1.12815215  2.00160487 -1.63826986]
[ 1.61948775 -0.88640526  2.00160487  1.58391968]
[ 1.63680847 -0.88640526  2.26879087 -1.32769738]
[ 1.6541292  -0.88640526  2.26879087  1.11806095]
[ 1.67144992 -0.88640526  2.49780745 -0.86183865]
[ 1.68877065  1.12815215  2.49780745  0.92395314]
[ 1.70609137  1.12815215  2.91767117 -1.25805425]
[ 1.7234121  1.12815215  2.91767117  1.27334719]
```

```
In [44]: X_scaled = pd.DataFrame(scale, columns = X.columns)
         X_scaled
```

```
Out[44]:
```

	CustomerID	Gender	Annual Income (k\$)	Spending Score (1-100)
0	-1.723412	1.128152	-1.738999	-0.434801
1	-1.706091	1.128152	-1.738999	1.195704

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In [44]: `X_scaled = pd.DataFrame(scale, columns = X.columns)`

Out[44]:

	CustomerID	Gender	Annual Income (K\$)	Spending Score (1-100)
0	-1.723412	1	128152	-1.738999
1	-1.706991	1	128152	-1.738999
2	-1.688771	-0.886405	-1.700830	-1.715913
3	-1.671450	-0.886405	-1.700830	1.040418
4	-1.654129	-0.886405	-1.662660	-0.395980
...
195	1.654129	-0.886405	2.268791	1.118061
196	1.671450	-0.886405	2.497807	-0.861839
197	1.688771	1	128152	2.497807
198	1.706991	1	128152	2.917671
199	1.723412	1	128152	2.917671

200 rows x 4 columns

In [45]: `#train test split
from sklearn.model_selection import train_test_split
split the dataset
X_train, X_test, Y_train, Y_test = train_test_split(X_scaled, Y, test_size=0.20, random_state=0)`

In [48]: `X_train.shape`

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`X_train, X_test, Y_train, Y_test = train_test_split(X_scaled, Y, test_size=0.20, random_state=0)`

In [40]: `X_train.shape`

Out[40]: (160, 4)

In [49]: `X_test.shape`

Out[49]: (40, 4)

In [50]: `Y_train.shape`

Out[50]: (160,)

In [51]: `Y_test.shape`

Out[51]: (40,)

#clustering algorithm

In [52]: `x = df.iloc[:, [3, 4]].values`

In [53]: `#finding optimal number of clusters using the elbow method
from sklearn.cluster import KMeans
wcss_list = [] #Initializing the list for the values of WCSS

#Using for loop for iterations from 1 to 10.
for i in range(1, 11):
 kmeans = KMeans(n_clusters=i, init='k-means++', random_state= 42)`

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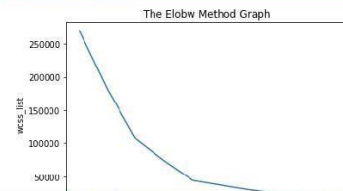
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```
from sklearn.cluster import KMeans
wcss_list= [] #Initializing the List for the values of WCSS

#Using for loop for iterations from 1 to 10.
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 Elbow Method Graph')
plt.xlabel('Number of clusters(k)')
plt.ylabel('wcss_list')
plt.show()
```

C:\Users\admin\anaconda3\lib\site-packages\sklearn\cluster_kmeans.py:1036: 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()



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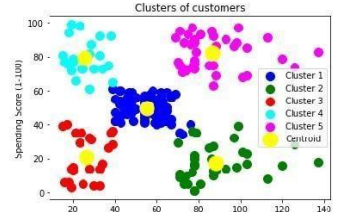
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```
kmeans = KMeans(n_clusters=5, init='k-means++', random_state= 42)
y_predict= kmeans.fit_predict(x)

In [56]: #visualizing the clusters
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, 0], kmeans.cluster_centers_[0, 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()
```



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