Assignment-4

Assignment Date	26 October 2022
Team ID	PNT2022TMID46353
Student Name	Priyadharshini.J
Student Roll Number	820319104029
Maximum Marks	2 Marks

Problem Statement: Customer Segmentation Analysis

Problem Statement:

You own the mall and want to understand the customers who can quickly converge [Target Customers] so that the insight can be given to the marketing team and plan the strategy accordingly.

Clustering the data and performing classification algorithms

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

1. **Download the dataset: Dataset**
2. **Load the dataset into the tool.**

[5]

```
from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

[6]

```
data =pd.read_csv('/content/drive/MyDrive/Mall_Customers.csv')
```

3. Perform Below Visualizations. · Univariate Analysis · Bi- Variate Analysis · Multi-Variate Analysis

[7]

data.head()

	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

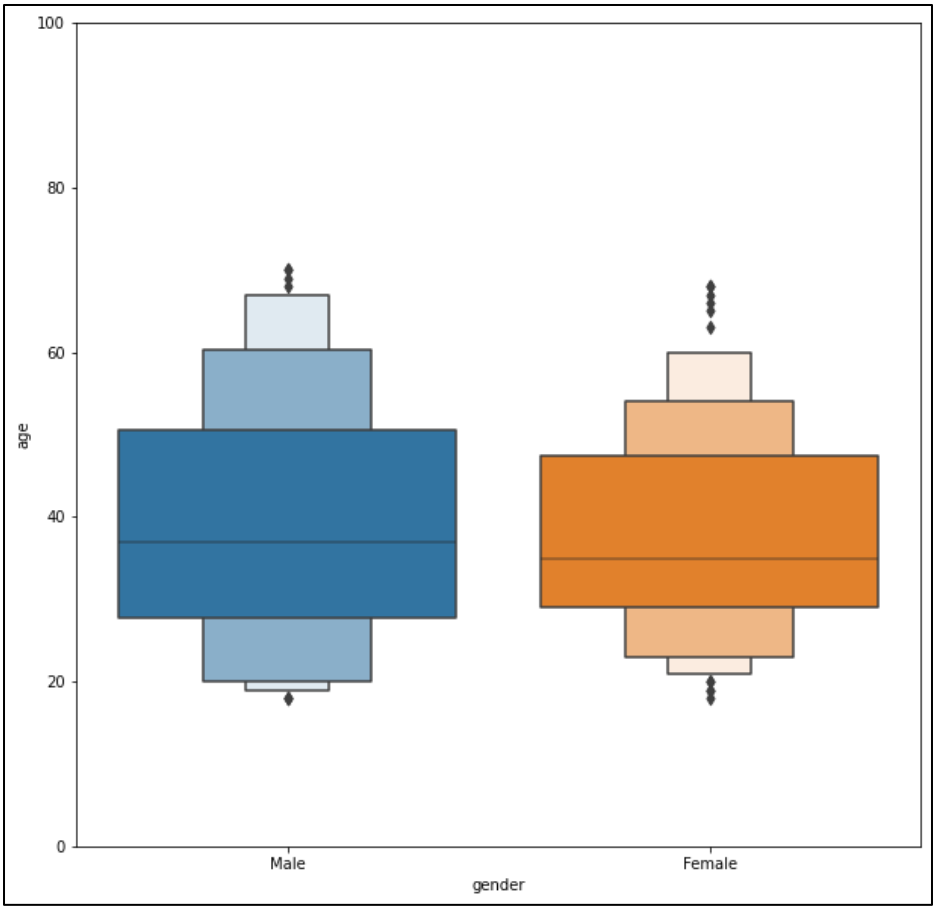
[8]

```
data.rename(columns={"CustomerID":"customer_id","Gender":"gender","Age":"a
ge","Annual Income (k$)":"annual_income",
                    "Spending Score (1-100)":"spending_scores"},inplace=True)
```

[9]

```
temp = pd.concat([data['age'], data['gender']], axis=1)

f, ax = plt.subplots(figsize=(10,10))
fig = sns.boxenplot(x='gender', y="age", data=data)
fig.axis(ymin=0, ymax=100);
```



ANALYSIS

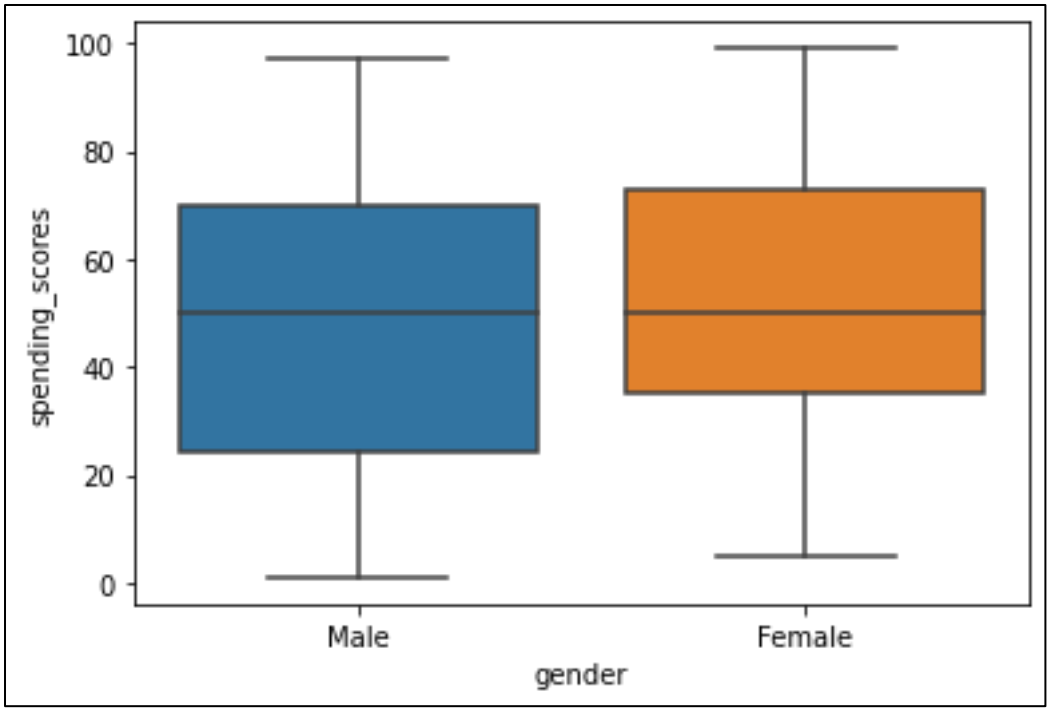
There is no difference in age of rings for male and female (18-70).

Count plot

[10]

sns.boxplot(x=data['gender'],y=data['spending_scores'])

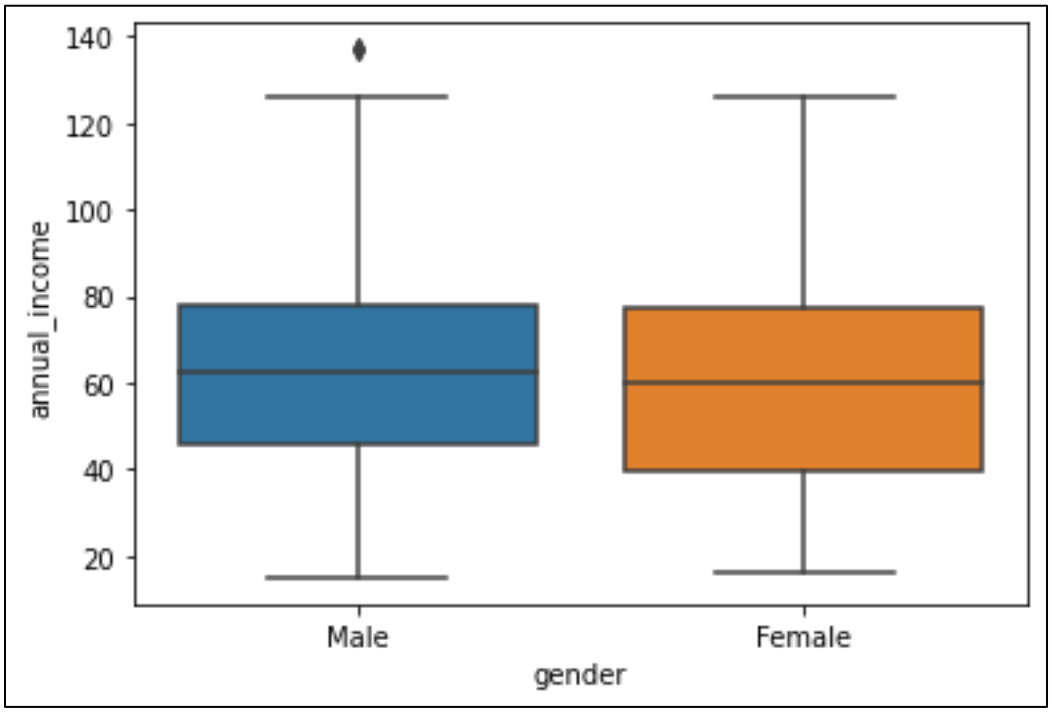
<matplotlib.axes._subplots.AxesSubplot at 0x7f801df52310>



[11]

sns.boxplot(x=data['gender'],y=data['annual_income'])

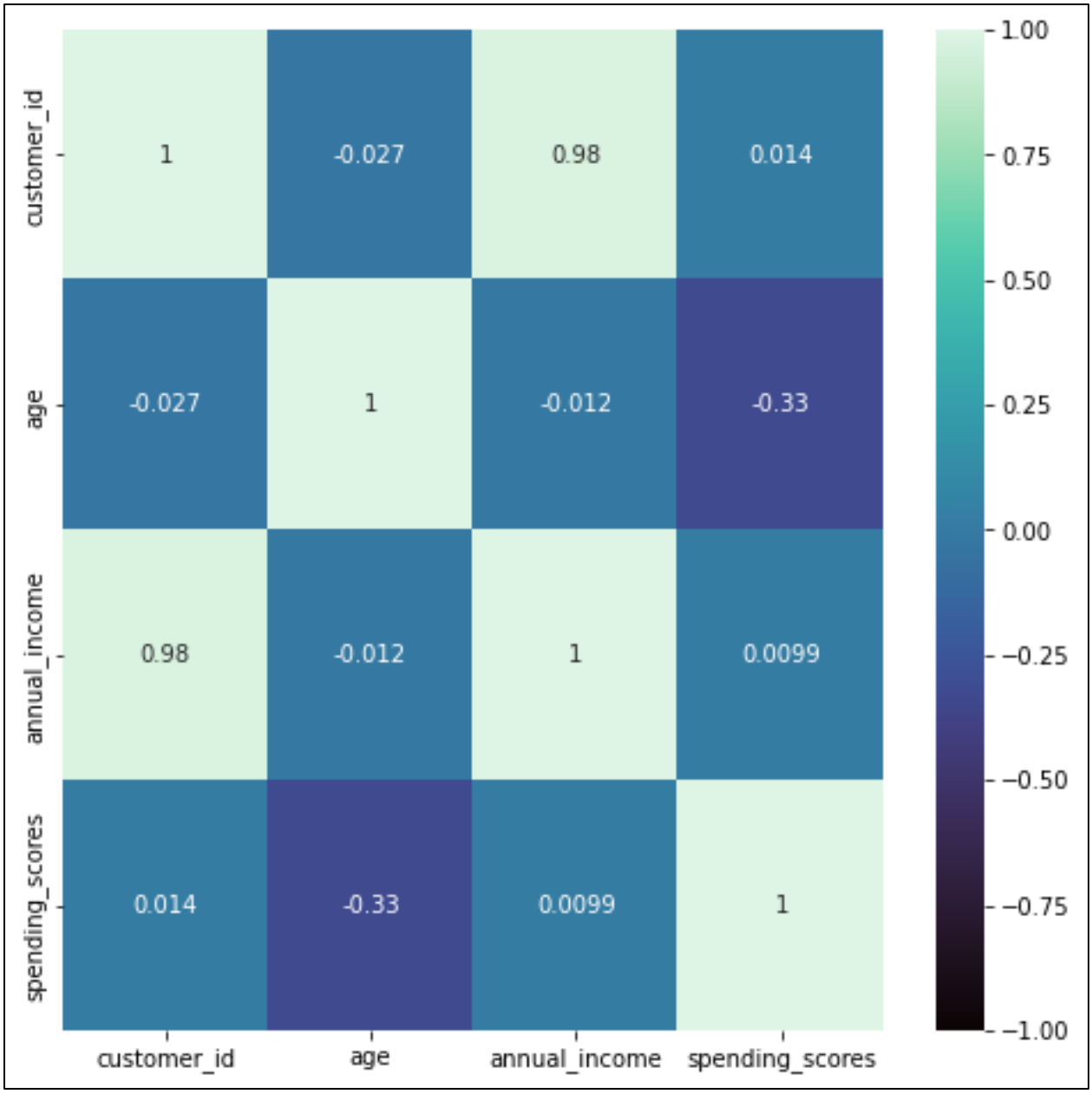
<matplotlib.axes._subplots.AxesSubplot at 0x7f801da98610>



Coorelation Plot

[12]

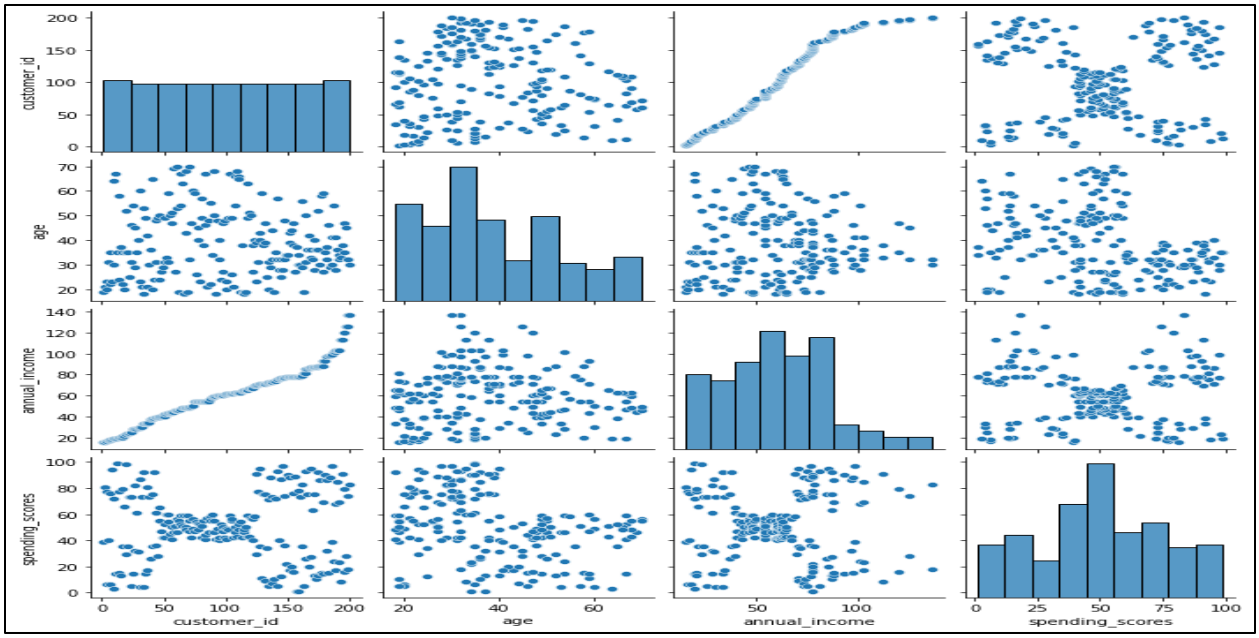
```
corr=data.corr()
plt.figure(figsize=(8,8))
sn=sns.heatmap(corr,vmin=-1,center=0, annot = True, cmap = 'mako')
```



[13]

```
sns.pairplot(data)
```

<seaborn.axisgrid.PairGrid at 0x7f801d90d890>



4. Perform descriptive statistics on the dataset.

[14]

data.head(10)

	customer_id	gender	age	annual_income	spending_scores
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
5	6	Female	22	17	76
6	7	Female	35	18	6
7	8	Female	23	18	94
8	9	Male	64	19	3
9	10	Female	30	19	72

[15]

data.shape

(200, 5)

[16]

data.describe()

	customer_id	age	annual_income	spending_scores
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

[17]

data.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   customer_id     200 non-null    int64
 1   gender          200 non-null    object
 2   age             200 non-null    int64
 3   annual_income   200 non-null    int64
 4   spending_scores 200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

5. Check for Missing values and deal with them.

[18]

```
data[data.duplicated()]
```

[19]

```
data.isna().sum()
```

```
customer_id        0
gender             0
age                0
annual_income      0
spending_scores    0
dtype: int64
```

There is no missing values and duplicates in dataframe

6. Find the outliers and replace them outliers

[20]

```
for i in data:
    if data[i].dtype=='int64':
        q1=data[i].quantile(0.25)
        q3=data[i].quantile(0.75)
        iqr=q3-q1
        upper=q3+1.5*iqr
        lower=q1-1.5*iqr
        data[i]=np.where(data[i] >upper, upper, data[i])
        data[i]=np.where(data[i] <lower, lower, data[i])
```

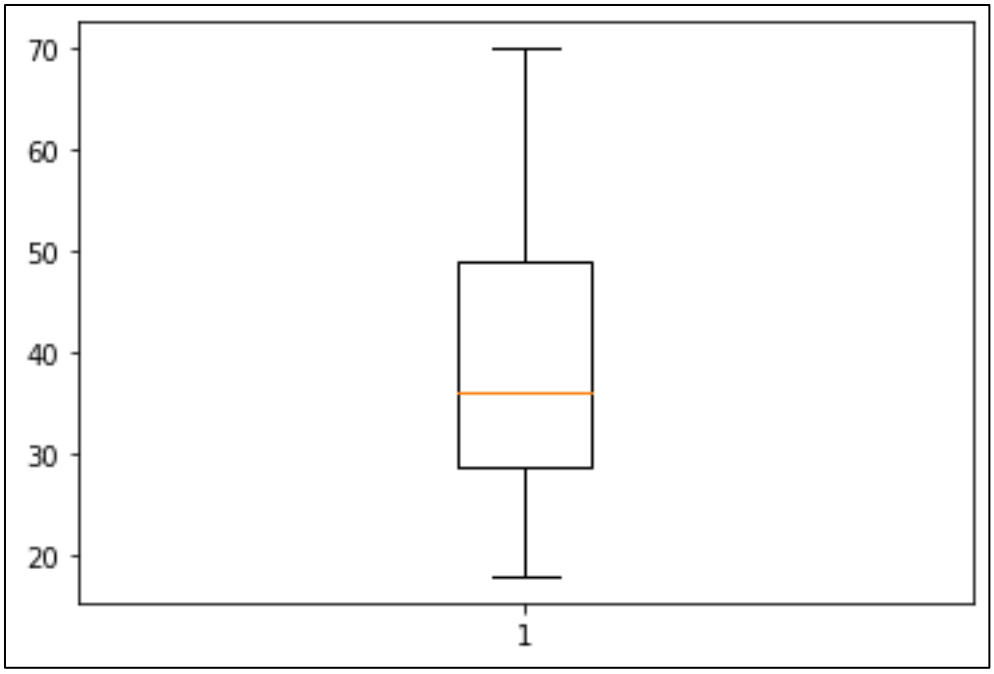
After removing outliers, boxplot will be like

[21]

```
plt.boxplot(data['age'])
```

```
{'whiskers': [<matplotlib.lines.Line2D at 0x7f801b8fc510>,
  <matplotlib.lines.Line2D at 0x7f801b8fca50>],
 'caps': [<matplotlib.lines.Line2D at 0x7f801b8fcf90>,
  <matplotlib.lines.Line2D at 0x7f801b901510>],
 'boxes': [<matplotlib.lines.Line2D at 0x7f801b8f6ed0>],
 'medians': [<matplotlib.lines.Line2D at 0x7f801b901a90>],
```

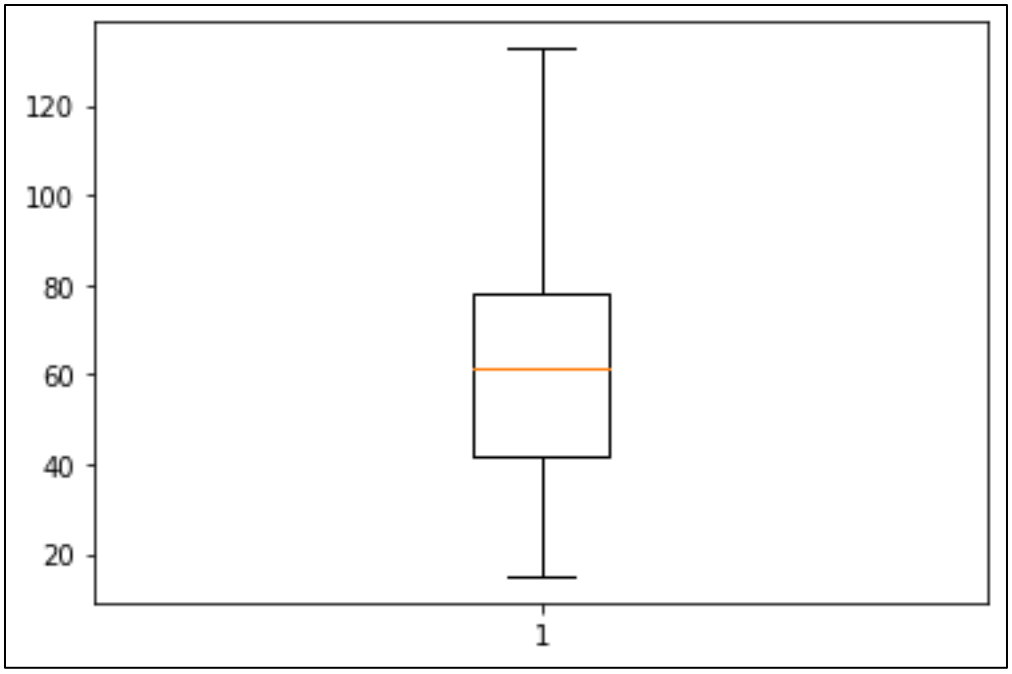
'fliers': [<matplotlib.lines.Line2D at 0x7f801b901fd0>],
'means': []}



[22]

plt.boxplot(data['annual_income'])

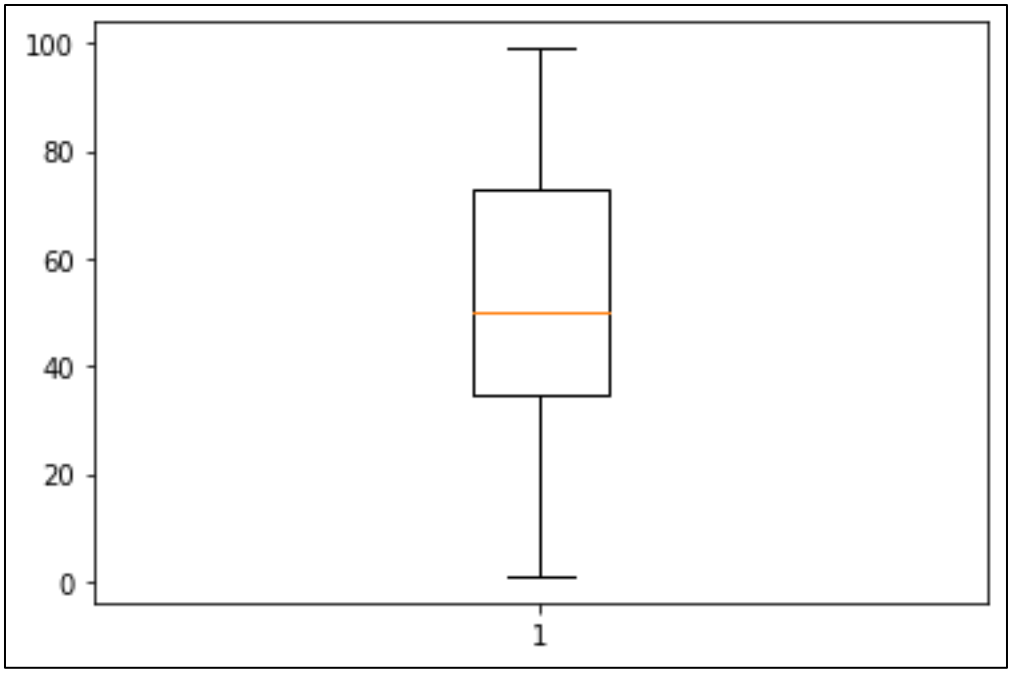
{'whiskers': [<matplotlib.lines.Line2D at 0x7f801b8a0510>,
<matplotlib.lines.Line2D at 0x7f801b8a0a50>],
'caps': [<matplotlib.lines.Line2D at 0x7f801b8a0f90>,
<matplotlib.lines.Line2D at 0x7f801b8a8510>],
'boxes': [<matplotlib.lines.Line2D at 0x7f801b898f50>],
'medians': [<matplotlib.lines.Line2D at 0x7f801b8a8a90>],
'fliers': [<matplotlib.lines.Line2D at 0x7f801b8a8fd0>],
'means': []}



[23]

```
plt.boxplot(data['spending_scores'])
```

```
{'whiskers': [<matplotlib.lines.Line2D at 0x7f801b80ef10>,
  <matplotlib.lines.Line2D at 0x7f801b812490>],
 'caps': [<matplotlib.lines.Line2D at 0x7f801b8129d0>,
  <matplotlib.lines.Line2D at 0x7f801b812f10>],
 'boxes': [<matplotlib.lines.Line2D at 0x7f801b80e990>],
 'medians': [<matplotlib.lines.Line2D at 0x7f801b8184d0>],
 'fliers': [<matplotlib.lines.Line2D at 0x7f801b818a10>],
 'means': []}
```



7. Check for Categorical columns and perform encoding.

[24]

```
from sklearn.preprocessing import LabelEncoder
encoder=LabelEncoder()
data['gender']=encoder.fit_transform(data['gender'])
```

[25]

data.head()

	customer_id	gender	age	annual_income	spending_scores
0	1.0	1	19.0	15.0	39.0
1	2.0	1	21.0	15.0	81.0
2	3.0	0	20.0	16.0	6.0
3	4.0	0	23.0	16.0	77.0
4	5.0	0	31.0	17.0	40.0

8. Scaling the data

[26]

```
from sklearn.preprocessing import StandardScaler
df=StandardScaler()
data1=df.fit_transform(data)
```

[27]

```
data1
```

```
array([[-1.7234121 ,  1.12815215, -1.42456879, -1.74542941, -0.43480148],
       [-1.70609137,  1.12815215, -1.28103541, -1.74542941,  1.19570407],
       [-1.68877065, -0.88640526, -1.3528021 , -1.70708307, -1.71591298],
       [-1.67144992, -0.88640526, -1.13750203, -1.70708307,  1.04041783],
       [-1.6541292 , -0.88640526, -0.56336851, -1.66873673, -0.39597992],
       [-1.63680847, -0.88640526, -1.20926872, -1.66873673,  1.00159627],
       [-1.61948775, -0.88640526, -0.27630176, -1.6303904 , -1.71591298],
       [-1.60216702, -0.88640526, -1.13750203, -1.6303904 ,  1.70038436],
       [-1.5848463 ,  1.12815215,  1.80493225, -1.59204406, -1.83237767],
       [-1.56752558, -0.88640526, -0.6351352 , -1.59204406,  0.84631002],
       [-1.55020485,  1.12815215,  2.02023231, -1.59204406, -1.4053405 ],
       [-1.53288413, -0.88640526, -0.27630176, -1.59204406,  1.89449216],
       [-1.5155634 , -0.88640526,  1.37433211, -1.55369772, -1.36651894],
       [-1.49824268, -0.88640526, -1.06573534, -1.55369772,  1.04041783],
       [-1.48092195,  1.12815215, -0.13276838, -1.55369772, -1.44416206],
       [-1.46360123,  1.12815215, -1.20926872, -1.55369772,  1.11806095],
       [-1.4462805 , -0.88640526, -0.27630176, -1.51535138, -0.59008772],
       [-1.42895978,  1.12815215, -1.3528021 , -1.51535138,  0.61338066],
       [-1.41163905,  1.12815215,  0.94373197, -1.43865871, -0.82301709],
       [-1.39431833, -0.88640526, -0.27630176, -1.43865871,  1.8556706 ],
       [-1.3769976 ,  1.12815215, -0.27630176, -1.40031237, -0.59008772],
       [-1.35967688,  1.12815215, -0.99396865, -1.40031237,  0.88513158],
       [-1.34235616, -0.88640526,  0.51313183, -1.36196603, -1.75473454],
       [-1.32503543,  1.12815215, -0.56336851, -1.36196603,  0.88513158],
       [-1.30771471, -0.88640526,  1.08726535, -1.24692702, -1.4053405 ],
       [-1.29039398,  1.12815215, -0.70690189, -1.24692702,  1.23452563],
       [-1.27307326, -0.88640526,  0.44136514, -1.24692702, -0.7065524 ],
       [-1.25575253,  1.12815215, -0.27630176, -1.24692702,  0.41927286],
```

[-1.23843181, -0.88640526, 0.08253169, -1.20858069, -0.74537397],
[-1.22111108, -0.88640526, -1.13750203, -1.20858069, 1.42863343],
[-1.20379036, 1.12815215, 1.51786549, -1.17023435, -1.7935561],
[-1.18646963, -0.88640526, -1.28103541, -1.17023435, 0.88513158],
[-1.16914891, 1.12815215, 1.01549866, -1.05519534, -1.7935561],
[-1.15182818, 1.12815215, -1.49633548, -1.05519534, 1.62274124],
[-1.13450746, -0.88640526, 0.7284319 , -1.05519534, -1.4053405],
[-1.11718674, -0.88640526, -1.28103541, -1.05519534, 1.19570407],
[-1.09986601, -0.88640526, 0.22606507, -1.016849 , -1.28887582],
[-1.08254529, -0.88640526, -0.6351352 , -1.016849 , 0.88513158],
[-1.06522456, -0.88640526, -0.20453507, -0.90180999, -0.93948177],
[-1.04790384, -0.88640526, -1.3528021 , -0.90180999, 0.96277471],
[-1.03058311, -0.88640526, 1.87669894, -0.86346365, -0.59008772],
[-1.01326239, 1.12815215, -1.06573534, -0.86346365, 1.62274124],
[-0.99594166, 1.12815215, 0.65666521, -0.82511731, -0.55126616],
[-0.97862094, -0.88640526, -0.56336851, -0.82511731, 0.41927286],
[-0.96130021, -0.88640526, 0.7284319 , -0.82511731, -0.86183865],
[-0.94397949, -0.88640526, -1.06573534, -0.82511731, 0.5745591],
[-0.92665877, -0.88640526, 0.80019859, -0.78677098, 0.18634349],
[-0.90933804, -0.88640526, -0.85043527, -0.78677098, -0.12422899],
[-0.89201732, -0.88640526, -0.70690189, -0.78677098, -0.3183368],
[-0.87469659, -0.88640526, -0.56336851, -0.78677098, -0.3183368],
[-0.85737587, -0.88640526, 0.7284319 , -0.7100783 , 0.06987881],
[-0.84005514, 1.12815215, -0.41983513, -0.7100783 , 0.38045129],
[-0.82273442, -0.88640526, -0.56336851, -0.67173196, 0.14752193],
[-0.80541369, 1.12815215, 1.4460988 , -0.67173196, 0.38045129],
[-0.78809297, -0.88640526, 0.80019859, -0.67173196, -0.20187212],
[-0.77077224, 1.12815215, 0.58489852, -0.67173196, -0.35715836],
[-0.75345152, -0.88640526, 0.87196528, -0.63338563, -0.00776431],
[-0.73613079, 1.12815215, 2.16376569, -0.63338563, -0.16305055],
[-0.71881007, -0.88640526, -0.85043527, -0.55669295, 0.03105725],
[-0.70148935, 1.12815215, 1.01549866, -0.55669295, -0.16305055],
[-0.68416862, 1.12815215, 2.23553238, -0.55669295, 0.22516505],
[-0.6668479 , 1.12815215, -1.42456879, -0.55669295, 0.18634349],
[-0.64952717, -0.88640526, 2.02023231, -0.51834661, 0.06987881],
[-0.63220645, -0.88640526, 1.08726535, -0.51834661, 0.34162973],
[-0.61488572, 1.12815215, 1.73316556, -0.48000028, 0.03105725],

[-0.597565 , 1.12815215, -1.49633548, -0.48000028, 0.34162973],
[-0.58024427, -0.88640526, 0.29783176, -0.48000028, -0.00776431],
[-0.56292355, -0.88640526, 2.091999 , -0.48000028, -0.08540743],
[-0.54560282, 1.12815215, -1.42456879, -0.48000028, 0.34162973],
[-0.5282821 , -0.88640526, -0.49160182, -0.48000028, -0.12422899],
[-0.51096138, 1.12815215, 2.23553238, -0.44165394, 0.18634349],
[-0.49364065, -0.88640526, 0.58489852, -0.44165394, -0.3183368],
[-0.47631993, -0.88640526, 1.51786549, -0.4033076 , -0.04658587],
[-0.4589992 , -0.88640526, 1.51786549, -0.4033076 , 0.22516505],
[-0.44167848, 1.12815215, 1.4460988 , -0.24992225, -0.12422899],
[-0.42435775, 1.12815215, -0.92220196, -0.24992225, 0.14752193],
[-0.40703703, -0.88640526, 0.44136514, -0.24992225, 0.10870037],
[-0.3897163 , 1.12815215, 0.08253169, -0.24992225, -0.08540743],
[-0.37239558, -0.88640526, -1.13750203, -0.24992225, 0.06987881],
[-0.35507485, -0.88640526, 0.7284319 , -0.24992225, -0.3183368],
[-0.33775413, 1.12815215, 1.30256542, -0.24992225, 0.03105725],
[-0.3204334 , 1.12815215, -0.06100169, -0.24992225, 0.18634349],
[-0.30311268, 1.12815215, 2.02023231, -0.24992225, -0.35715836],
[-0.28579196, -0.88640526, 0.51313183, -0.24992225, -0.24069368],
[-0.26847123, -0.88640526, -1.28103541, -0.24992225, 0.26398661],
[-0.25115051, 1.12815215, 0.65666521, -0.24992225, -0.16305055],
[-0.23382978, -0.88640526, 1.15903204, -0.13488324, 0.30280817],
[-0.21650906, -0.88640526, -1.20926872, -0.13488324, 0.18634349],
[-0.19918833, -0.88640526, -0.34806844, -0.0965369 , 0.38045129],
[-0.18186761, -0.88640526, 0.80019859, -0.0965369 , -0.16305055],
[-0.16454688, -0.88640526, 2.091999 , -0.05819057, 0.18634349],
[-0.14722616, 1.12815215, -1.49633548, -0.05819057, -0.35715836],
[-0.12990543, 1.12815215, 0.65666521, -0.01984423, -0.04658587],
[-0.11258471, -0.88640526, 0.08253169, -0.01984423, -0.39597992],
[-0.09526399, -0.88640526, -0.49160182, -0.01984423, -0.3183368],
[-0.07794326, 1.12815215, -1.06573534, -0.01984423, 0.06987881],
[-0.06062254, -0.88640526, 0.58489852, -0.01984423, -0.12422899],
[-0.04330181, -0.88640526, -0.85043527, -0.01984423, -0.00776431],
[-0.02598109, 1.12815215, 0.65666521, 0.01850211, -0.3183368],
[-0.00866036, 1.12815215, -1.3528021 , 0.01850211, -0.04658587],
[0.00866036, -0.88640526, -1.13750203, 0.05684845, -0.35715836],
[0.02598109, -0.88640526, 0.7284319 , 0.05684845, -0.08540743],

[0.04330181, 1.12815215, 2.02023231, 0.05684845, 0.34162973],
[0.06062254, 1.12815215, -0.92220196, 0.05684845, 0.18634349],
[0.07794326, 1.12815215, 0.7284319 , 0.05684845, 0.22516505],
[0.09526399, -0.88640526, -1.28103541, 0.05684845, -0.3183368],
[0.11258471, -0.88640526, 1.94846562, 0.09519478, -0.00776431],
[0.12990543, 1.12815215, 1.08726535, 0.09519478, -0.16305055],
[0.14722616, 1.12815215, 2.091999 , 0.09519478, -0.27951524],
[0.16454688, 1.12815215, 1.94846562, 0.09519478, -0.08540743],
[0.18186761, 1.12815215, 1.87669894, 0.09519478, 0.06987881],
[0.19918833, -0.88640526, -1.42456879, 0.09519478, 0.14752193],
[0.21650906, -0.88640526, -0.06100169, 0.13354112, -0.3183368],
[0.23382978, 1.12815215, -1.42456879, 0.13354112, -0.16305055],
[0.25115051, -0.88640526, -1.49633548, 0.17188746, -0.08540743],
[0.26847123, -0.88640526, -1.42456879, 0.17188746, -0.00776431],
[0.28579196, -0.88640526, 1.73316556, 0.17188746, -0.27951524],
[0.30311268, -0.88640526, 0.7284319 , 0.17188746, 0.34162973],
[0.3204334 , -0.88640526, 0.87196528, 0.24858013, -0.27951524],
[0.33775413, -0.88640526, 0.80019859, 0.24858013, 0.26398661],
[0.35507485, 1.12815215, -0.85043527, 0.24858013, 0.22516505],
[0.37239558, -0.88640526, -0.06100169, 0.24858013, -0.39597992],
[0.3897163 , -0.88640526, 0.08253169, 0.32527281, 0.30280817],
[0.40703703, 1.12815215, 0.010765 , 0.32527281, 1.58391968],
[0.42435775, -0.88640526, -1.13750203, 0.36361914, -0.82301709],
[0.44167848, -0.88640526, -0.56336851, 0.36361914, 1.04041783],
[0.4589992 , 1.12815215, 0.29783176, 0.40196548, -0.59008772],
[0.47631993, 1.12815215, 0.08253169, 0.40196548, 1.73920592],
[0.49364065, 1.12815215, 1.4460988 , 0.40196548, -1.52180518],
[0.51096138, 1.12815215, -0.06100169, 0.40196548, 0.96277471],
[0.5282821 , 1.12815215, 0.58489852, 0.40196548, -1.5994483],
[0.54560282, 1.12815215, 0.010765 , 0.40196548, 0.96277471],
[0.56292355, -0.88640526, -0.99396865, 0.44031182, -0.62890928],
[0.58024427, -0.88640526, -0.56336851, 0.44031182, 0.80748846],
[0.597565 , 1.12815215, -1.3528021 , 0.47865816, -1.75473454],
[0.61488572, -0.88640526, -0.70690189, 0.47865816, 1.46745499],
[0.63220645, -0.88640526, 0.36959845, 0.47865816, -1.67709142],
[0.64952717, 1.12815215, -0.49160182, 0.47865816, 0.88513158],
[0.6668479 , 1.12815215, -1.42456879, 0.51700449, -1.56062674],

[0.68416862, -0.88640526, -0.27630176, 0.51700449, 0.84631002],
[0.70148935, -0.88640526, 1.30256542, 0.55535083, -1.75473454],
[0.71881007, 1.12815215, -0.49160182, 0.55535083, 1.6615628],
[0.73613079, -0.88640526, -0.77866858, 0.59369717, -0.39597992],
[0.75345152, -0.88640526, -0.49160182, 0.59369717, 1.42863343],
[0.77077224, 1.12815215, -0.99396865, 0.6320435 , -1.48298362],
[0.78809297, 1.12815215, -0.77866858, 0.6320435 , 1.81684904],
[0.80541369, 1.12815215, 0.65666521, 0.6320435 , -0.55126616],
[0.82273442, -0.88640526, -0.49160182, 0.6320435 , 0.92395314],
[0.84005514, -0.88640526, -0.34806844, 0.67038984, -1.09476801],
[0.85737587, 1.12815215, -0.34806844, 0.67038984, 1.54509812],
[0.87469659, 1.12815215, 0.29783176, 0.67038984, -1.28887582],
[0.89201732, 1.12815215, 0.010765 , 0.67038984, 1.46745499],
[0.90933804, -0.88640526, 0.36959845, 0.67038984, -1.17241113],
[0.92665877, -0.88640526, -0.06100169, 0.67038984, 1.00159627],
[0.94397949, -0.88640526, 0.58489852, 0.67038984, -1.32769738],
[0.96130021, -0.88640526, -0.85043527, 0.67038984, 1.50627656],
[0.97862094, 1.12815215, -0.13276838, 0.67038984, -1.91002079],
[0.99594166, -0.88640526, -0.6351352 , 0.67038984, 1.07923939],
[1.01326239, 1.12815215, -0.34806844, 0.67038984, -1.91002079],
[1.03058311, -0.88640526, -0.6351352 , 0.67038984, 0.88513158],
[1.04790384, -0.88640526, 1.23079873, 0.70873618, -0.59008772],
[1.06522456, -0.88640526, -0.70690189, 0.70873618, 1.27334719],
[1.08254529, 1.12815215, -1.42456879, 0.78542885, -1.75473454],
[1.09986601, -0.88640526, -0.56336851, 0.78542885, 1.6615628],
[1.11718674, 1.12815215, 0.80019859, 0.9388142 , -0.93948177],
[1.13450746, -0.88640526, -0.20453507, 0.9388142 , 0.96277471],
[1.15182818, 1.12815215, 0.22606507, 0.97716054, -1.17241113],
[1.16914891, -0.88640526, -0.41983513, 0.97716054, 1.73920592],
[1.18646963, -0.88640526, -0.20453507, 1.01550688, -0.90066021],
[1.20379036, 1.12815215, -0.49160182, 1.01550688, 0.49691598],
[1.22111108, 1.12815215, 0.08253169, 1.01550688, -1.44416206],
[1.23843181, 1.12815215, -0.77866858, 1.01550688, 0.96277471],
[1.25575253, 1.12815215, -0.20453507, 1.01550688, -1.56062674],
[1.27307326, 1.12815215, -0.20453507, 1.01550688, 1.62274124],
[1.29039398, -0.88640526, 0.94373197, 1.05385321, -1.44416206],
[1.30771471, -0.88640526, -0.6351352 , 1.05385321, 1.38981187],

```
[ 1.32503543,  1.12815215,  1.37433211,  1.05385321, -1.36651894],
[ 1.34235616,  1.12815215, -0.85043527,  1.05385321,  0.72984534],
[ 1.35967688,  1.12815215,  1.4460988 ,  1.2455849 , -1.4053405 ],
[ 1.3769976 ,  1.12815215, -0.27630176,  1.2455849 ,  1.54509812],
[ 1.39431833, -0.88640526, -0.13276838,  1.39897025, -0.7065524 ],
[ 1.41163905, -0.88640526, -0.49160182,  1.39897025,  1.38981187],
[ 1.42895978,  1.12815215,  0.51313183,  1.43731659, -1.36651894],
[ 1.4462805 , -0.88640526, -0.70690189,  1.43731659,  1.46745499],
[ 1.46360123, -0.88640526,  0.15429838,  1.47566292, -0.43480148],
[ 1.48092195,  1.12815215, -0.6351352 ,  1.47566292,  1.81684904],
[ 1.49824268, -0.88640526,  1.08726535,  1.5523556 , -1.01712489],
[ 1.5155634 ,  1.12815215, -0.77866858,  1.5523556 ,  0.69102378],
[ 1.53288413, -0.88640526,  0.15429838,  1.62904827, -1.28887582],
[ 1.55020485, -0.88640526, -0.20453507,  1.62904827,  1.35099031],
[ 1.56752558, -0.88640526, -0.34806844,  1.62904827, -1.05594645],
[ 1.5848463 , -0.88640526, -0.49160182,  1.62904827,  0.72984534],
[ 1.60216702,  1.12815215, -0.41983513,  2.01251165, -1.63826986],
[ 1.61948775, -0.88640526, -0.06100169,  2.01251165,  1.58391968],
[ 1.63680847, -0.88640526,  0.58489852,  2.28093601, -1.32769738],
[ 1.6541292 , -0.88640526, -0.27630176,  2.28093601,  1.11806095],
[ 1.67144992, -0.88640526,  0.44136514,  2.51101403, -0.86183865],
[ 1.68877065,  1.12815215, -0.49160182,  2.51101403,  0.92395314],
[ 1.70609137,  1.12815215, -0.49160182,  2.76985181, -1.25005425],
[ 1.7234121 ,  1.12815215, -0.6351352 ,  2.76985181,  1.27334719]])
```

9. Perform any of the clustering algorithms

[28]

```
from sklearn.cluster import KMeans
```

[29]

```
data.drop('customer_id',axis=1,inplace=True)
```

[30]

```
km = KMeans(n_clusters=3, random_state=0)
```

[31]

```
data['Group or Cluster'] = km.fit_predict(data)
```

[32]

data.head()

	gender	age	annual_income	spending_scores	Group or Cluster
0	1	19.0	15.0	39.0	2
1	1	21.0	15.0	81.0	2
2	0	20.0	16.0	6.0	2
3	0	23.0	16.0	77.0	2
4	0	31.0	17.0	40.0	2

[33]

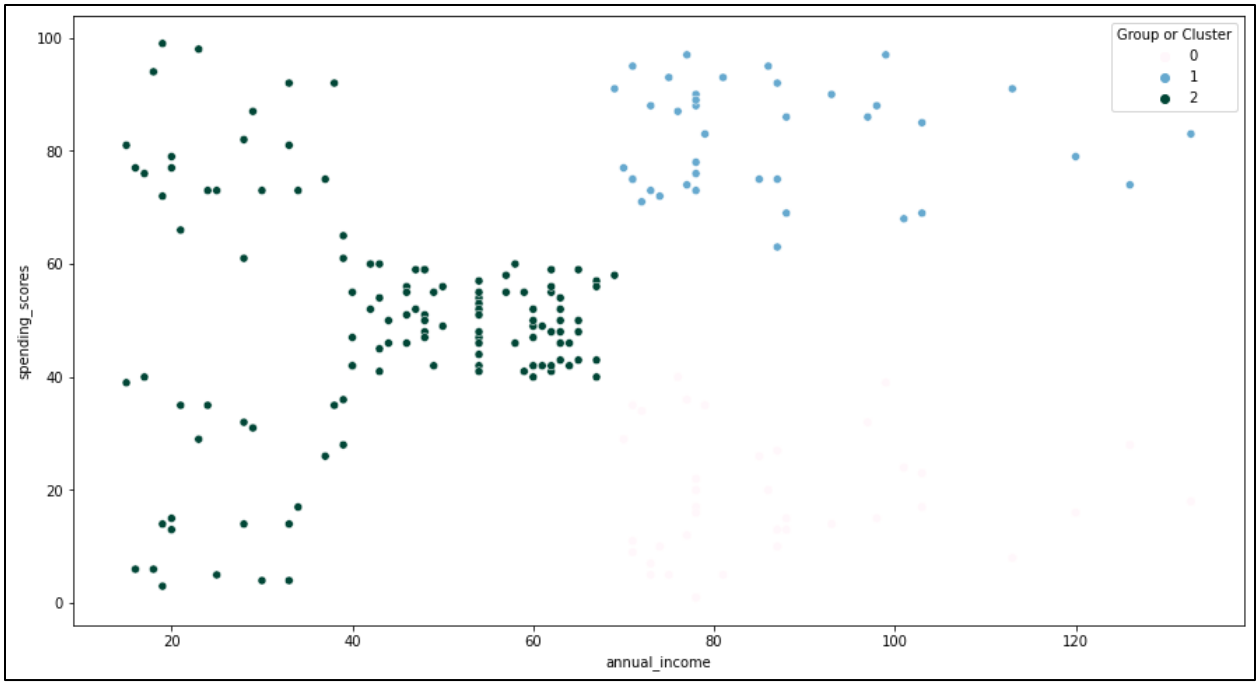
data['Group or Cluster'].value_counts()

2 123
1 39
0 38
Name: Group or Cluster, dtype: int64

[34]

```
import matplotlib.pyplot as plt

fig,ax = plt.subplots(figsize=(15,8))
sns.scatterplot(x=data['annual_income'],
                y=data['spending_scores'],
                hue=data['Group or Cluster'],
                palette='PuBuGn')
plt.show()
```



[35]

```
from sklearn.metrics import silhouette_score, silhouette_samples
score = silhouette_score(data,
                         km.labels_,
                         metric='euclidean')
score
```

0.3842057644019546

[36]

```
import matplotlib.pyplot as plt
from yellowbrick.cluster import SilhouetteVisualizer

fig, ax = plt.subplots(2, 2, figsize=(20,20))
for i in [2, 3, 4, 5]:
    '''
    Create KMeans instance for different number of clusters
    '''
    km = KMeans(n_clusters=i,
                init='k-means++',
                n_init=10,
                max_iter=100,
```

```
            random_state=0)
    q, mod = divmod(i, 2)
    '''
    Create SilhouetteVisualizer instance with KMeans instance
    Fit the visualizer
    '''
    visualizer = SilhouetteVisualizer(km,
                                      colors='yellowbrick',
                                      ax=ax[q-1][mod])
    visualizer.fit(data)
```