Assignment 4

Assignment Date	**23-10-2022**
Team ID	**PNT2022TMID15904**
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Maximum Marks	**2 Marks**

1.Download the dataset

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

2. Load the dataset

```
data = pd.read_csv(r"Mall_Customers.csv")

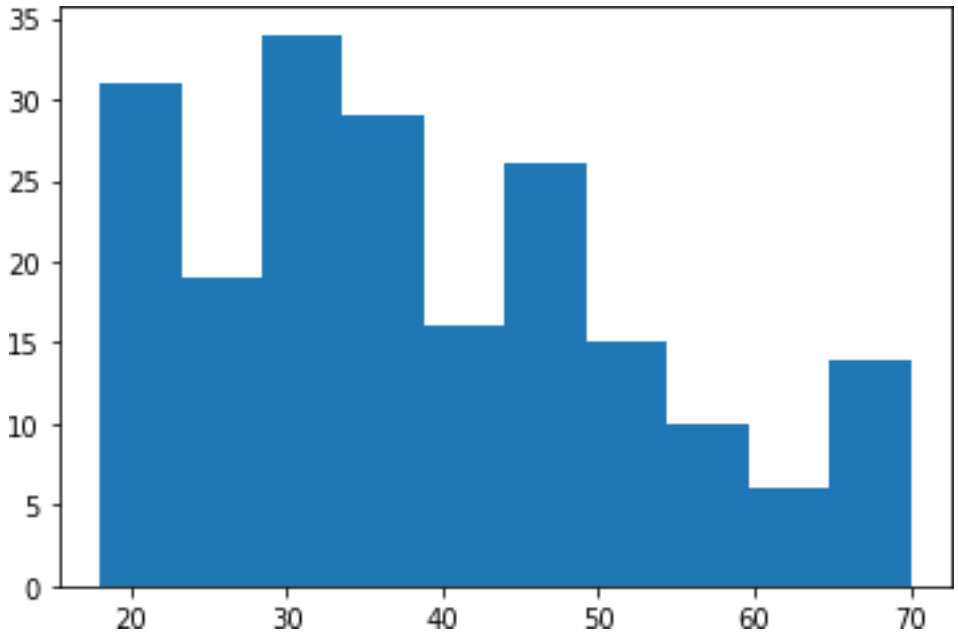
data.head();
```

3. Perform Below Visualizations.

• Univariate Analysis

```
plt.hist(data['Age'])
```

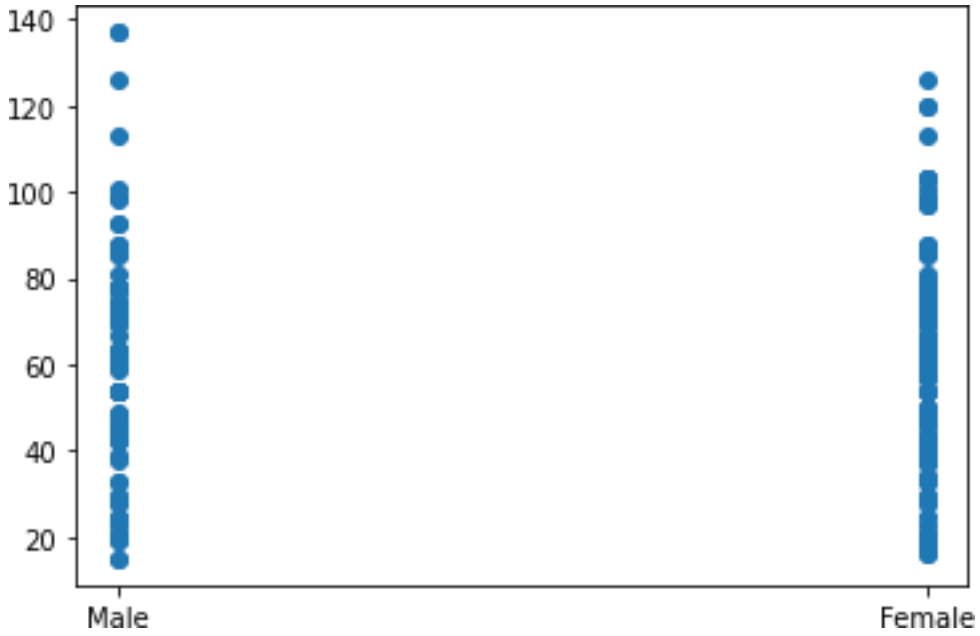
```
(array([31., 19., 34., 29., 16., 26., 15., 10.,  6., 14.]),
 array([18. , 23.2, 28.4, 33.6, 38.8, 44. , 49.2, 54.4, 59.6, 64.8,
70. ]),
 <BarContainer object of 10 artists>)
```


35
30
25
20
15
10
5
0
20
30
40
50
60
70

• Bi- Variate Analysis

```
plt.scatter(data['Gender'],data['Annual Income (k$)'])
```

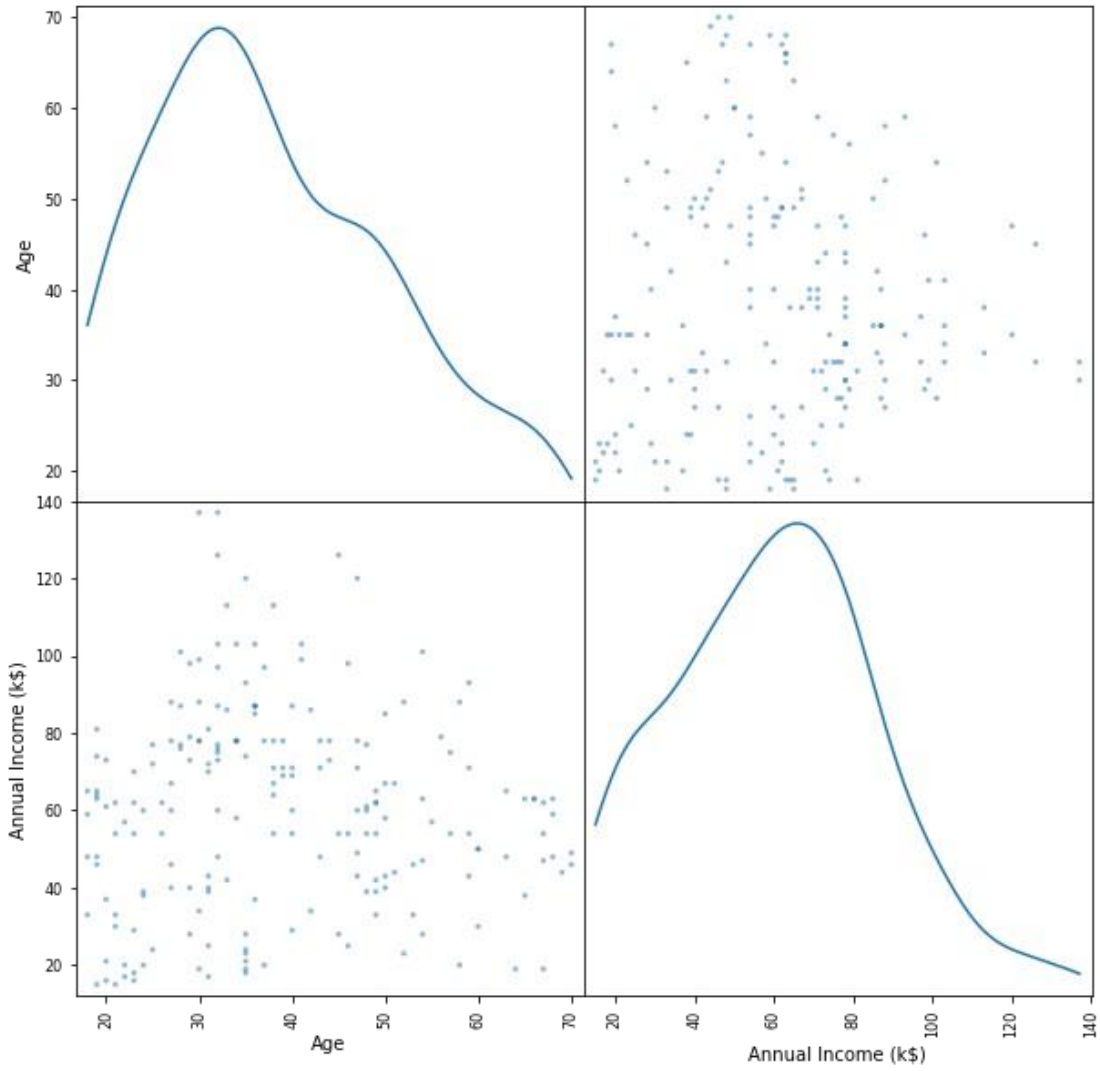
```
<matplotlib.collections.PathCollection at 0x233dba0ed90>
```



• Multi-Variate Analysis

```
pd.plotting.scatter_matrix(data.loc[:,"Age":"Annual Income (k$)"] ,
diagonal ="kde", figsize=(10,10))
```

```
array([[<AxesSubplot:xlabel='Age', ylabel='Age'>,
        <AxesSubplot:xlabel='Annual Income (k$)', ylabel='Age'>],
       [<AxesSubplot:xlabel='Age', ylabel='Annual Income (k$)'>,
        <AxesSubplot:xlabel='Annual Income (k$)', ylabel='Annual
Income (k$)'>]],
      dtype=object)
```



4. Perform descriptive statistics on the dataset.

```
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
```

```
data.describe().T
```

```
                          count    mean        std   min    25%    50%
75%  \
CustomerID                200.0  100.50  57.879185   1.0  50.75  100.5
150.25
Age                       200.0   38.85  13.969007  18.0  28.75   36.0
49.00
Annual Income (k$)        200.0   60.56  26.264721  15.0  41.50   61.5
78.00
Spending Score (1-100)    200.0   50.20  25.823522   1.0  34.75   50.0
73.00

                           max
CustomerID               200.0
Age                       70.0
Annual Income (k$)       137.0
Spending Score (1-100)    99.0
```

5. Check for Missing values and deal with them.

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

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

6. Find the outliers and replace them outliers

```
fig,ax=plt.subplots(figsize=(25,5))

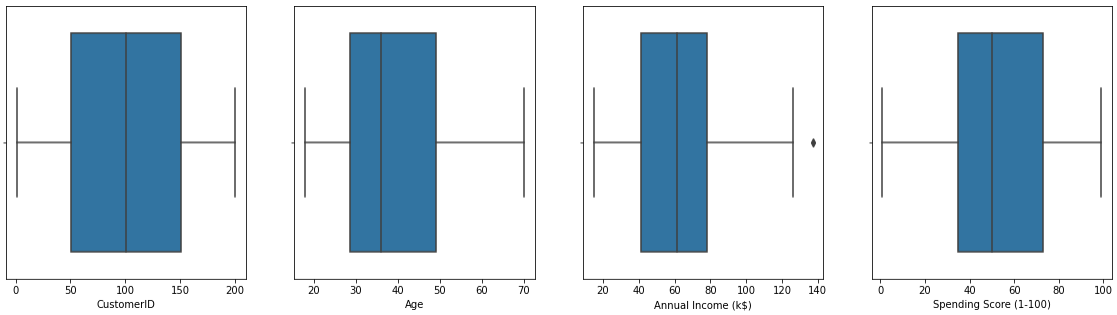
plt.subplot(1, 5, 2)
sns.boxplot(x=data['Age'])

plt.subplot(1, 5, 3)
sns.boxplot(x=data['Annual Income (k$)'])

plt.subplot(1, 5, 4)
sns.boxplot(x=data['Spending Score (1-100)'])
```

```
plt.subplot(1, 5, 1)
sns.boxplot(x=data['CustomerID'])
```

```
<AxesSubplot:xlabel='CustomerID'>
```



Handling outlier

```
quant=data.quantile(q=[0.25,0.75])
quant
```

```
      CustomerID    Age  Annual Income (k$)  Spending Score (1-100)
0.25       50.75  28.75                41.5                   34.75
0.75      150.25  49.00                78.0                   73.00
```

```
quant.loc[0.75]
```

```
CustomerID                150.25
Age                        49.00
Annual Income (k$)         78.00
Spending Score (1-100)     73.00
Name: 0.75, dtype: float64
```

```
quant.loc[0.25]
```

```
CustomerID                50.75
Age                       28.75
Annual Income (k$)        41.50
Spending Score (1-100)    34.75
Name: 0.25, dtype: float64
```

```
iqr=quant.loc[0.75]-quant.loc[0.25]
iqr
```

```
CustomerID                99.50
Age                       20.25
Annual Income (k$)        36.50
Spending Score (1-100)    38.25
dtype: float64
```

```
low=quant.loc[0.25]-(1.5 *iqr)
low
```

```
CustomerID                -98.500
Age                        -1.625
Annual Income (k$)        -13.250
Spending Score (1-100)    -22.625
dtype: float64
```

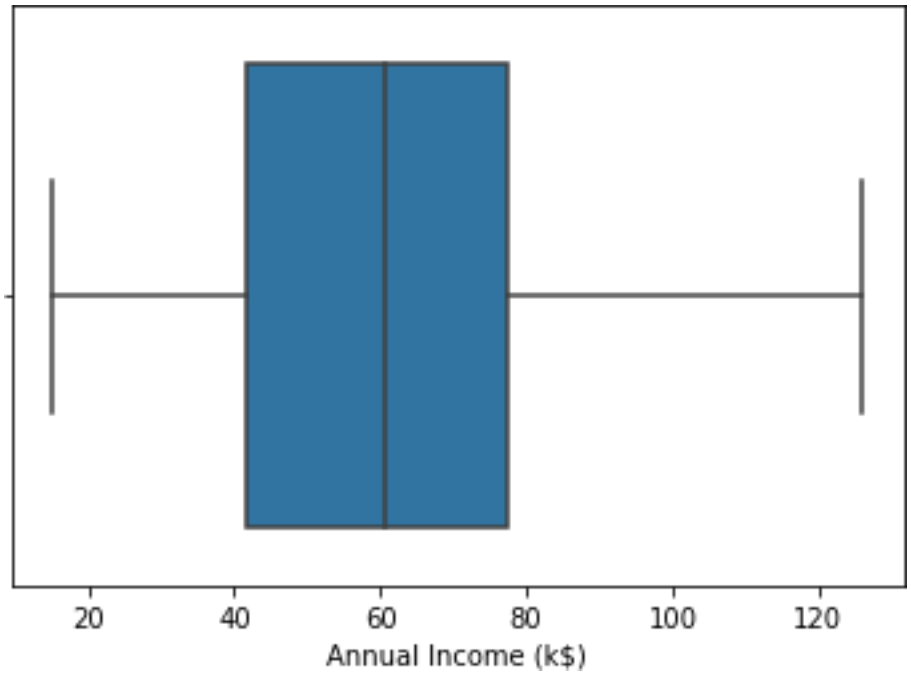
```
up=quant.loc[0.75]+(1.5 *iqr)
up
```

```
CustomerID                 299.500
Age                         79.375
Annual Income (k$)         132.750
Spending Score (1-100)     130.375
dtype: float64
```

```
data['Annual Income (k$)']= np.where(data['Annual Income
(k$)']>132,60,data['Annual Income (k$)'])
```

```
sns.boxplot(x=data['Annual Income (k$)'])
```

```
<AxesSubplot:xlabel='Annual Income (k$)'>
```



7. Check for Categorical columns and perform encoding.

```
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
```

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

```
array(['Male', 'Female'], dtype=object)
```

```
data['Gender'].replace({'Male':1,"Female":0},inplace=True)
```

```
data
```

```
     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
..          ...     ...  ...                 ...                    .
..
195         196       0   35                 120
79
196         197       0   45                 126
28
197         198       1   32                 126
74
198         199       1   32                  60
18
199         200       1   30                  60
83

[200 rows x 5 columns]
```

8. Scaling the data

```
from sklearn.preprocessing import MinMaxScaler
sc=MinMaxScaler()
```

```
df=sc.fit_transform(data.iloc[:,1:])
```

```
df
```

```
array([[1.        , 0.01923077, 0.        , 0.3877551 ],
       [1.        , 0.05769231, 0.        , 0.81632653],
       [0.        , 0.03846154, 0.00900901, 0.05102041],
       [0.        , 0.09615385, 0.00900901, 0.7755102 ],
       [0.        , 0.25      , 0.01801802, 0.39795918],
       [0.        , 0.07692308, 0.01801802, 0.76530612],
       [0.        , 0.32692308, 0.02702703, 0.05102041],
       [0.        , 0.09615385, 0.02702703, 0.94897959],
       [1.        , 0.88461538, 0.03603604, 0.02040816],
       [0.        , 0.23076923, 0.03603604, 0.7244898 ],
       [1.        , 0.94230769, 0.03603604, 0.13265306],
       [0.        , 0.32692308, 0.03603604, 1.        ],
       [0.        , 0.76923077, 0.04504505, 0.14285714],
       [0.        , 0.11538462, 0.04504505, 0.7755102 ],
       [1.        , 0.36538462, 0.04504505, 0.12244898],
       [1.        , 0.07692308, 0.04504505, 0.79591837],
       [0.        , 0.32692308, 0.05405405, 0.34693878],
       [1.        , 0.03846154, 0.05405405, 0.66326531],
       [1.        , 0.65384615, 0.07207207, 0.28571429],
       [0.        , 0.32692308, 0.07207207, 0.98979592],
       [1.        , 0.32692308, 0.08108108, 0.34693878],
       [1.        , 0.13461538, 0.08108108, 0.73469388],
       [0.        , 0.53846154, 0.09009009, 0.04081633],
       [1.        , 0.25      , 0.09009009, 0.73469388],
       [0.        , 0.69230769, 0.11711712, 0.13265306],
       [1.        , 0.21153846, 0.11711712, 0.82653061],
       [0.        , 0.51923077, 0.11711712, 0.31632653],
       [1.        , 0.32692308, 0.11711712, 0.6122449 ],
       [0.        , 0.42307692, 0.12612613, 0.30612245],
       [0.        , 0.09615385, 0.12612613, 0.87755102],
       [1.        , 0.80769231, 0.13513514, 0.03061224],
       [0.        , 0.05769231, 0.13513514, 0.73469388],
       [1.        , 0.67307692, 0.16216216, 0.03061224],
       [1.        , 0.        , 0.16216216, 0.92857143],
       [0.        , 0.59615385, 0.16216216, 0.13265306],
       [0.        , 0.05769231, 0.16216216, 0.81632653],
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       [0.        , 0.23076923, 0.17117117, 0.73469388],
       [0.        , 0.34615385, 0.1981982 , 0.25510204],
       [0.        , 0.03846154, 0.1981982 , 0.75510204],
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       [0.        , 0.25      , 0.21621622, 0.6122449 ],
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       [0.        , 0.17307692, 0.22522523, 0.46938776],
```

```
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```

```
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```
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[1.        , 0.28846154, 0.88288288, 0.07142857],
[0.        , 0.38461538, 0.88288288, 0.91836735],
[0.        , 0.55769231, 0.94594595, 0.15306122],
[0.        , 0.32692308, 0.94594595, 0.79591837],
[0.        , 0.51923077, 1.        , 0.2755102 ],
[1.        , 0.26923077, 1.        , 0.74489796],
```

```
       [1.        , 0.26923077, 0.40540541, 0.17346939],
       [1.        , 0.23076923, 0.40540541, 0.83673469]])
```

9. Perform any of the clustering algorithms

Kmeans_clustering

```
from sklearn.cluster import KMeans

TWSS=[]
k=list(range(2,9))

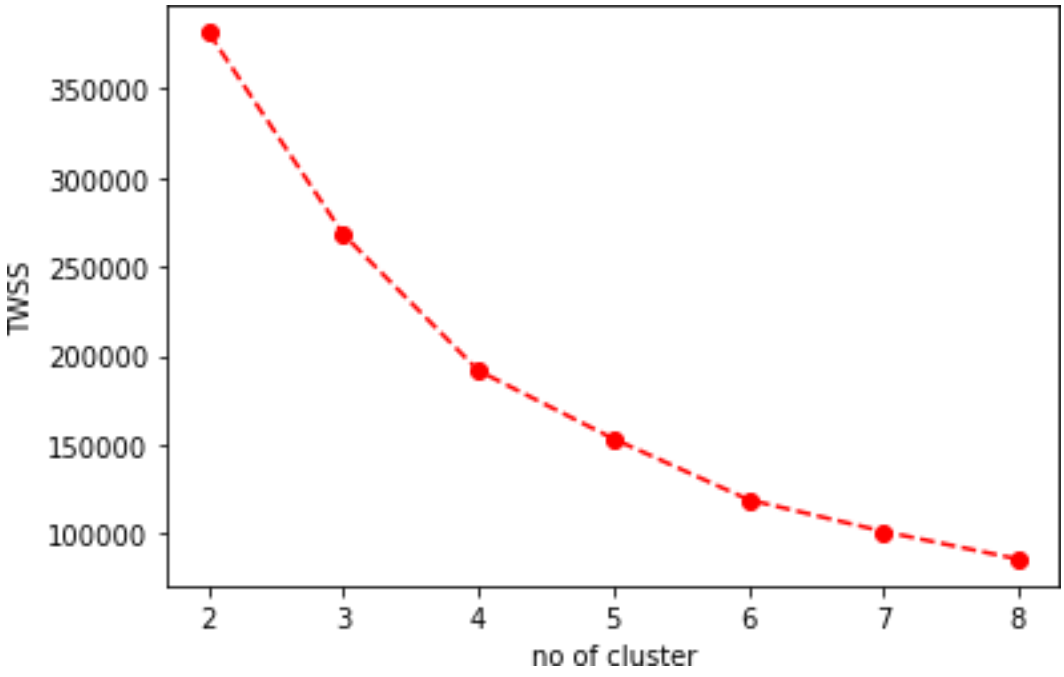
for i in k:
    kmeans=KMeans(n_clusters=i,init='k-means++')
    kmeans.fit(data)
    TWSS.append(kmeans.inertia_)

TWSS
```

```
[381550.6840684068,
 268082.56760639744,
 191612.56821803437,
 153394.66603206735,
 119223.63779954854,
 101364.2432178932,
 85819.89345888031]
```

```
plt.plot(k,TWSS,'ro--')
plt.xlabel('no of cluster')
plt.ylabel('TWSS')
```

```
Text(0, 0.5, 'TWSS')
```




```
#selecting  4 clusters

model=KMeans(n_clusters=4)

model.fit(data)

KMeans(n_clusters=4)

model.labels_

array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 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, 3, 0, 3, 0, 3, 2, 3, 2,
3,
       2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2,
3,
       2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2,
3,
       2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2, 3, 2,
3,
       2, 3])
```

```
mb=pd.Series(model.labels_)

data.head(3)
```

```
   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
```

10. Add the cluster data with the primary dataset

```
data['clust']=mb

data.head()
```

```
   CustomerID Gender Age  Annual Income (k$)  Spending Score (1-100)
clust
0           1       1   19                  15                      39
1
1           2       1   21                  15                      81
1
2           3       0   20                  16                       6
1
3           4       0   23                  16                      77
1
4           5       0   31                  17                      40
1

data.tail()
```

```
     CustomerID  Gender  Age  Annual Income (k$)  Spending Score (1-
100)  \
195         196       0   35                 120
79
196         197       0   45                 126
28
197         198       1   32                 126
74
198         199       1   32                  60
18
199         200       1   30                  60
83

     clust
195      3
196      2
197      3
198      2
199      3
```

11. Split the data into dependent and independent variables

```
#dependent
y= data['clust']
y
```

```
0      1
1      1
2      1
3      1
4      1
      ..
195    3
196    2
197    3
198    2
199    3
Name: clust, Length: 200, dtype: int32
```

```
#independent
x= data.drop(columns=['CustomerID','clust'],axis=1)
x.head()
```

```
   Gender  Age  Annual Income (k$)  Spending Score (1-100)
0       1   19                  15                      39
1       1   21                  15                      81
2       0   20                  16                       6
3       0   23                  16                      77
4       0   31                  17                      40
```

```
x.tail()
```

```
     Gender Age Annual Income (k$)  Spending Score (1-100)
195       0   35                 120                      79
196       0   45                 126                      28
197       1   32                 126                      74
198       1   32                  60                      18
199       1   30                  60                      83
```

12. Split the data into training and testing

```
from sklearn.model_selection import train_test_split

x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,rando
m_state=0)
```

13. Build the Model

```
from sklearn.ensemble import RandomForestClassifier

rf=RandomForestClassifier()
```

14. Train the Model

```
rf.fit(x_train,y_train)
```

```
RandomForestClassifier()
```

15. Test the Model

```
#prediction
pred=rf.predict(x_test)
```

16. Measure the performance using Evaluvation Metrics

```
# Accuracy of DI model
from sklearn.metrics import accuracy_score
accuracy_score(y_test,pred)
```

```
0.975
```

```
#confusion matrix
from sklearn import metrics
metrics.confusion_matrix(y_test,pred)
```

```
array([[13,  0,  0,  0],
       [ 0, 10,  0,  0],
       [ 1,  0,  8,  0],
       [ 0,  0,  0,  8]], dtype=int64)
```