ASSIGNMENT 4

Customer Segmentation Analysis

1.Download the dataset

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

1. Load the dataset

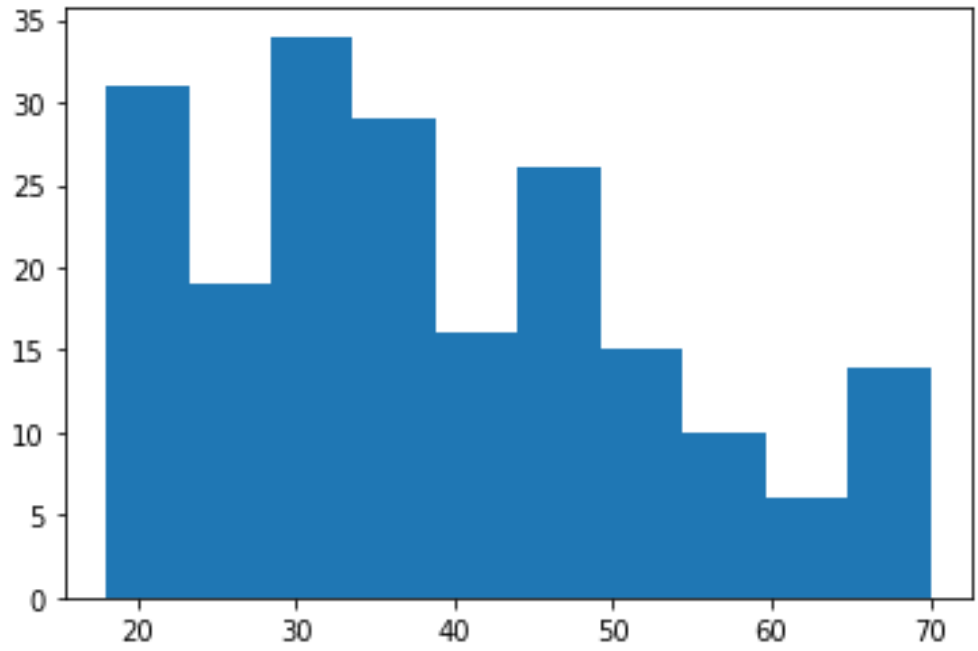
```
data = pd.read_csv(r"/content/Mall_Customers.csv")
data.head();
```

1. 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. ]),
 <a list of 10 Patch objects>)
```



· Bi- Variate Analysis

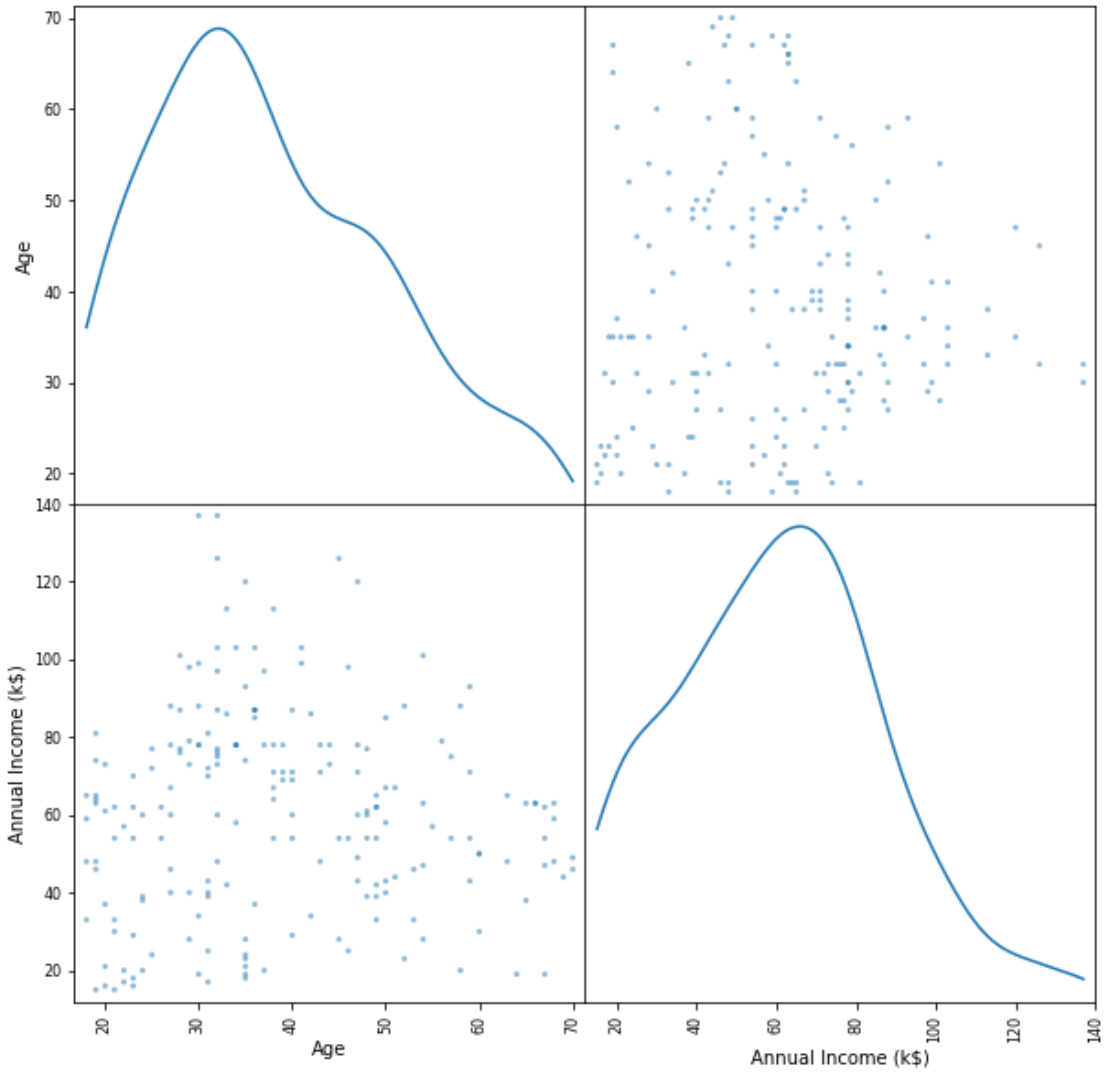
```
plt.scatter(data['Gender'],data['Annual Income (k$)'])
```

```
<matplotlib.collections.PathCollection at 0x7f1c28b49610>
```

· Multi-Variate Analysis

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

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f1c28a611d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f1c28a14710>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f1c28a4bd10>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f1c28a11350>]],
      dtype=object)
```



1. 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
```

1. Check for Missing values and deal with them.

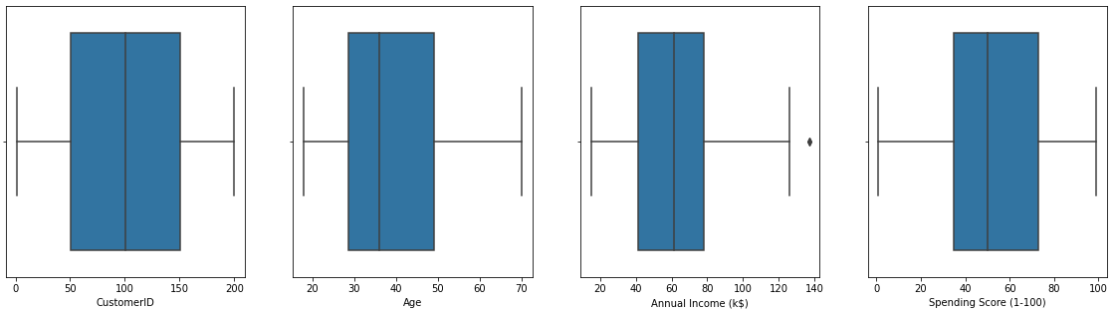
```
data.isna().sum()
```

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

1. 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'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f1c287cb510>
```



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
```

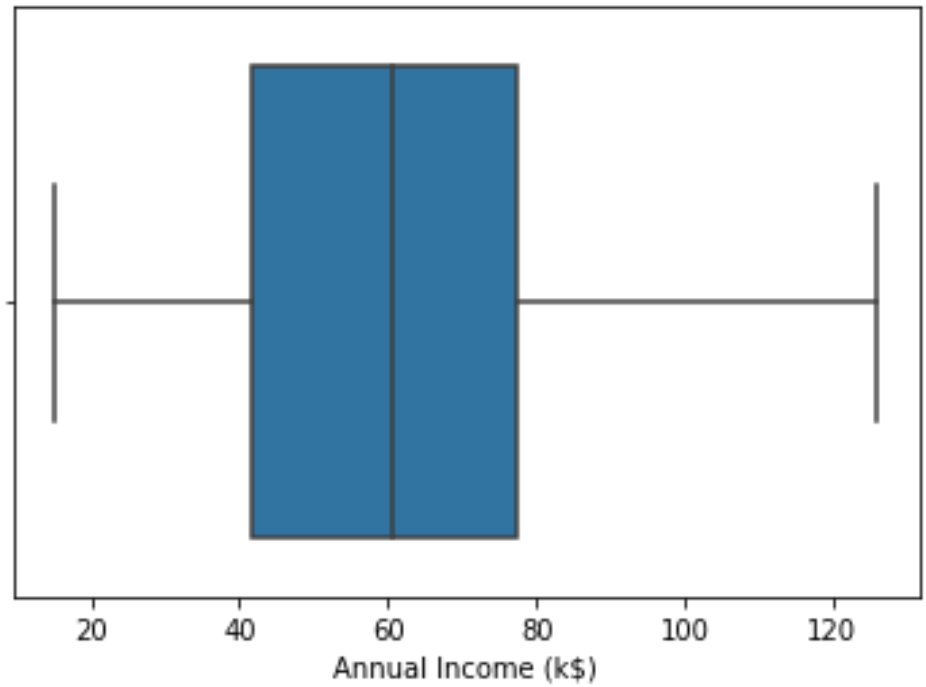
```
CustomerID               -98.500
Age                       -1.625
Annual Income (k$)       -13.250
Spending Score (1-100)   -22.625
dtype: float64
```

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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f1c288ca350>
```



1. 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]
```

1. 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],
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```

```
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```

```
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[1.        , 0.78846154, 0.7027027 , 0.13265306],
```

```
       [1.        , 0.32692308, 0.7027027 , 0.90816327],
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       [1.        , 0.26923077, 0.40540541, 0.17346939],
       [1.        , 0.23076923, 0.40540541, 0.83673469]])
```

1. Perform any of the clustering algorithms

Kmeans_clustering

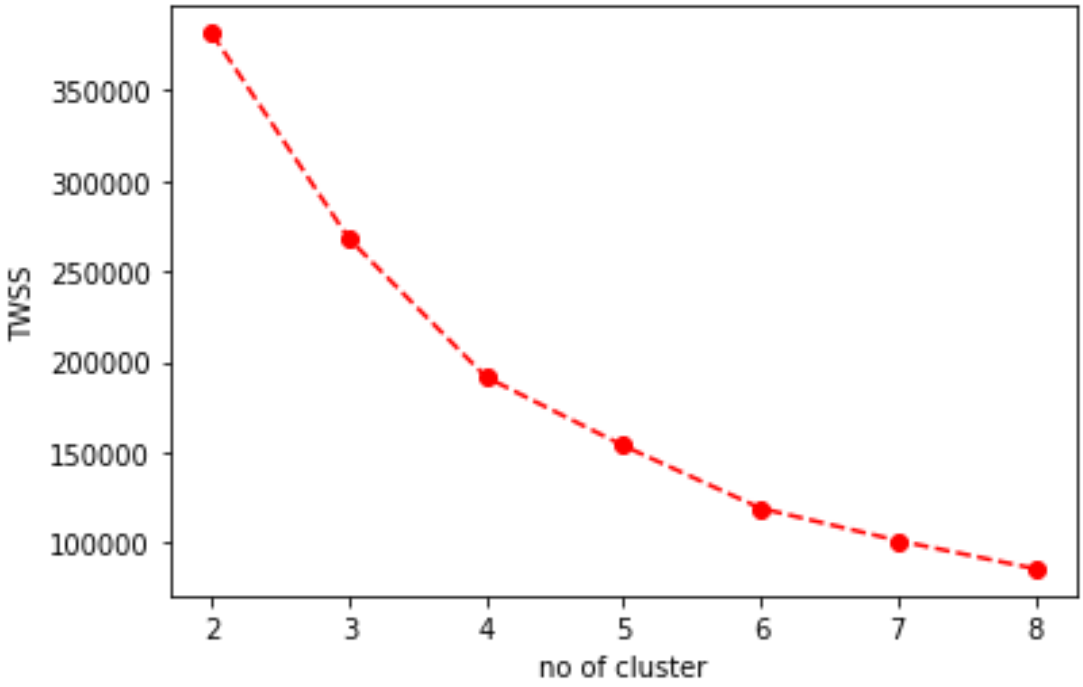
```
from sklearn.cluster import KMeans
TWSS=[]
k=list(range(2,9))

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

```
[381550.684068407,
 268094.6217895609,
 191630.05635683762,
 153791.95873953705,
 119223.63779954851,
 101388.31724386726,
 85843.96748485434]
```

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

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




```
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, 3, 1, 3, 3, 3, 3,
       3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
       3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3,
       3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 0, 3, 0, 3, 0, 2, 0, 2, 0,
       2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0,
       2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0,
       2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0, 2, 0,
       2, 0], dtype=int32)

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
```

1. 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      0
196      2
197      0
198      2
199      0
```

1. Split the data into dependent and independent variables

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

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

```
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
```

1. 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,random_state
=0)
```

1. Build the Model

```
from sklearn.ensemble import RandomForestClassifier
rf=RandomForestClassifier()
```

1. Train the Model

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

```
RandomForestClassifier()
```

1. Test the Model

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

1. Measure the performance using Evaluvation Metrics

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

```
0.975
```

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

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