Assignment - 4
Python Programming

Assignment Date	**05 OCTOBER 2022**
Student Name	**AJAY**
Student Roll Number	**720819106004**
Maximum Marks	**2 Marks**

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

2.Loading the DataSet

```
df=pd.read_csv("Mall_Customers.csv")
df
```

```
     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
..          ...     ...  ...                 ...                     ...
195         196  Female   35                 120                      79
196         197  Female   45                 126                      28
197         198    Male   32                 126                      74
198         199    Male   32                 137                      18
199         200    Male   30                 137                      83

[200 rows x 5 columns]
```

```
df.drop(["CustomerID"],axis="columns",inplace=True)
```

3. Performing Visualizations

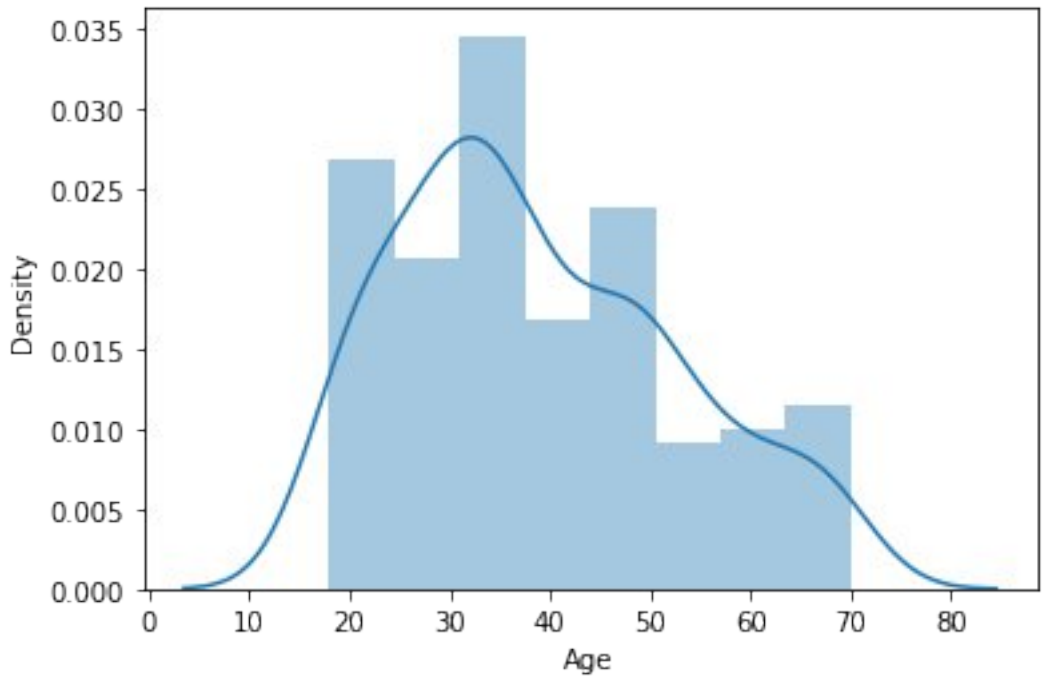
3.1 Univarient Analysis

```
sns.distplot(df.Age)
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2619:
FutureWarning: `distplot` is a deprecated function and will be removed in a
```

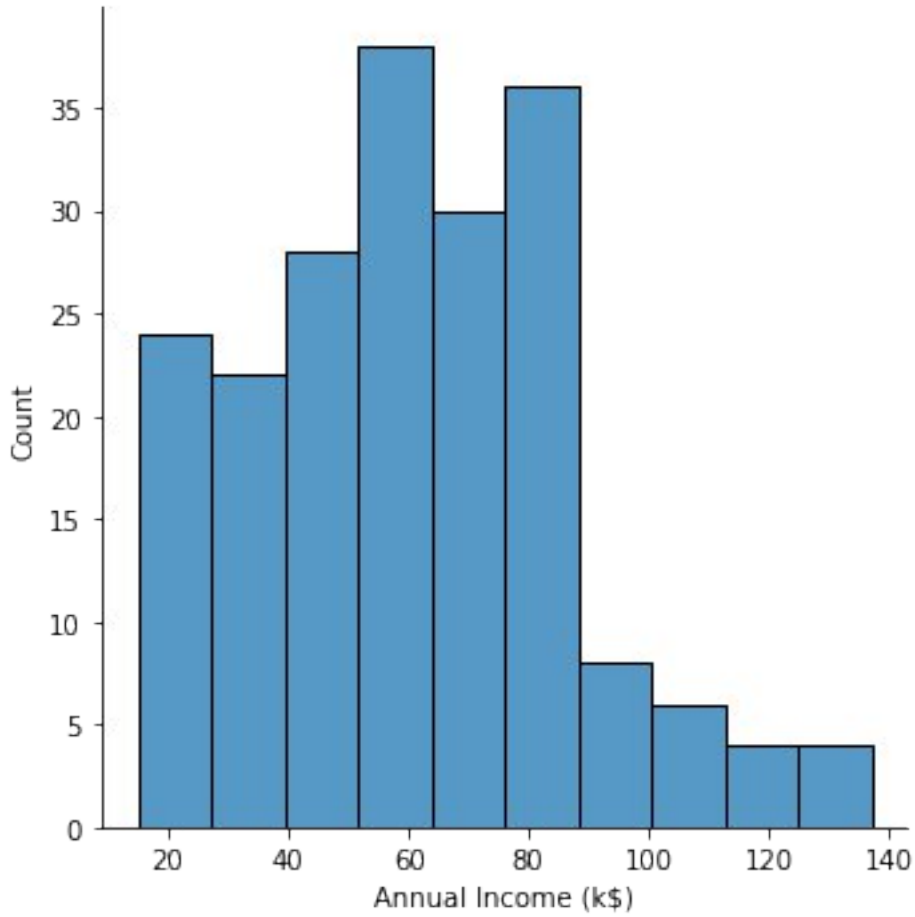
```
future version. Please adapt your code to use either `displot` (a figure-
level function with similar flexibility) or `histplot` (an axes-level
function for histograms).
  warnings.warn(msg, FutureWarning)
```

```
<AxesSubplot:xlabel='Age', ylabel='Density'>
```




```
sns.displot(df["Annual Income (k$)"])
```

```
<seaborn.axisgrid.FacetGrid at 0x201934f91f0>
```

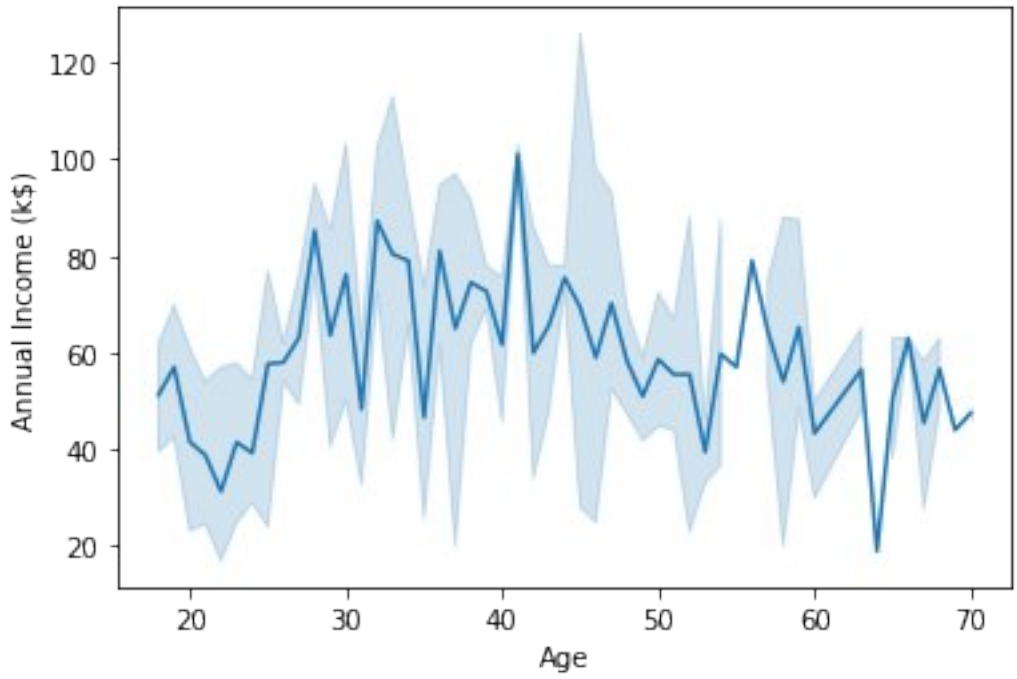


3.2 Bi-variant Analysis

```
sns.lineplot(df.Age,df["Annual Income (k$)"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. 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(
```

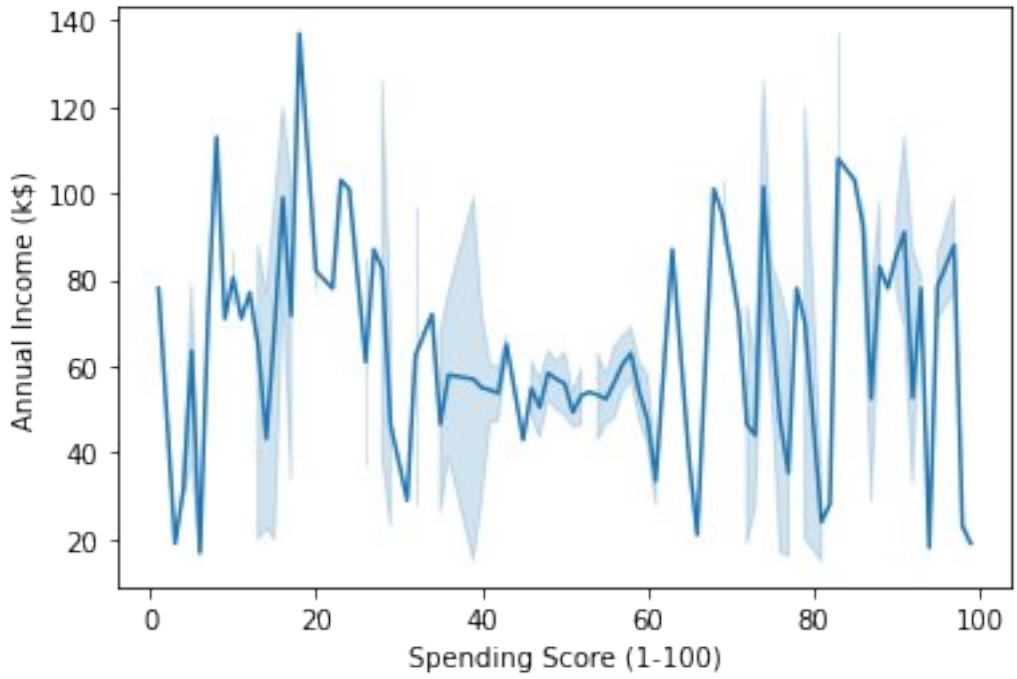
```
<AxesSubplot:xlabel='Age', ylabel='Annual Income (k$)'>
```




```
sns.lineplot(df["Spending Score (1-100)"],df["Annual Income (k$)"])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\_decorators.py:36:
FutureWarning: Pass the following variables as keyword args: x, y. 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(
```

```
<AxesSubplot:xlabel='Spending Score (1-100)', ylabel='Annual Income (k$)'>
```



4. Perform descriptive statistics on the dataset.

```
df.describe()
```

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

5. Check for Missing values and deal with them.

```
df.isnull().any()
```

```
Gender                  False
Age                     False
Annual Income (k$)      False
Spending Score (1-100)  False
dtype: bool
```

```
df.isnull().sum()
```

```
Gender                  0
Age                     0
```

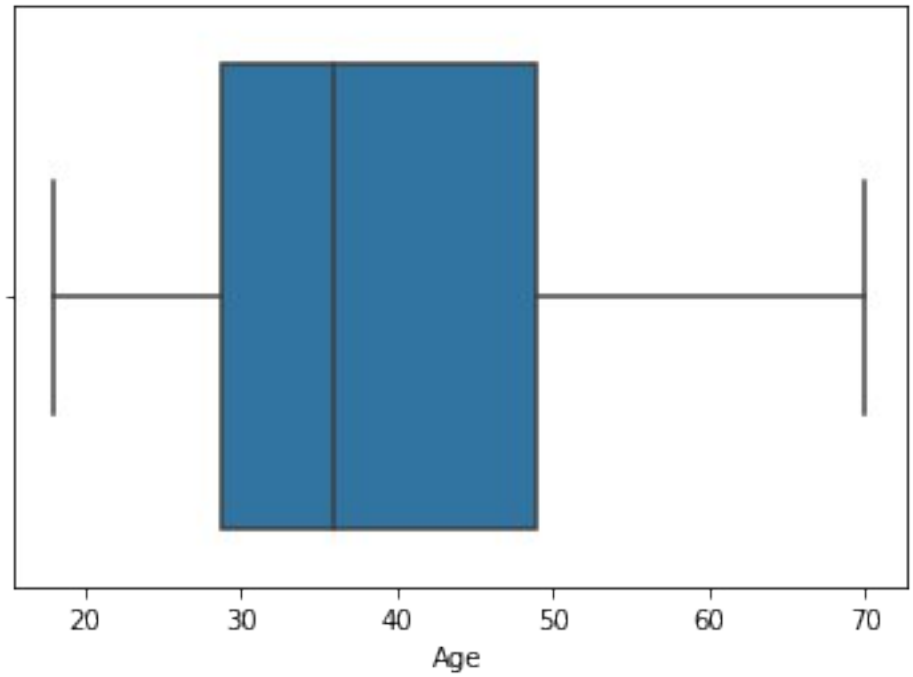
```
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

6. Find the outliers and replace the outliers

```
sns.boxplot(df.Age)
```

```
C:\ProgramData\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(
```

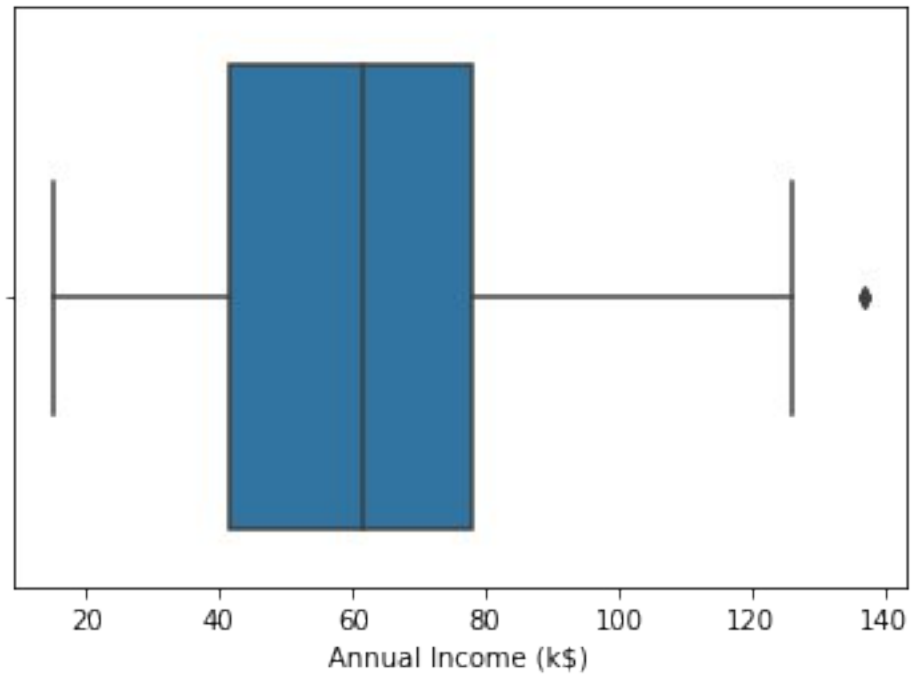
```
<AxesSubplot:xlabel='Age'>
```




```
sns.boxplot(df["Annual Income (k$)"])
```

```
C:\ProgramData\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(
```

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




```
a99=df["Annual Income (k$)"].quantile(0.99)
a99
```

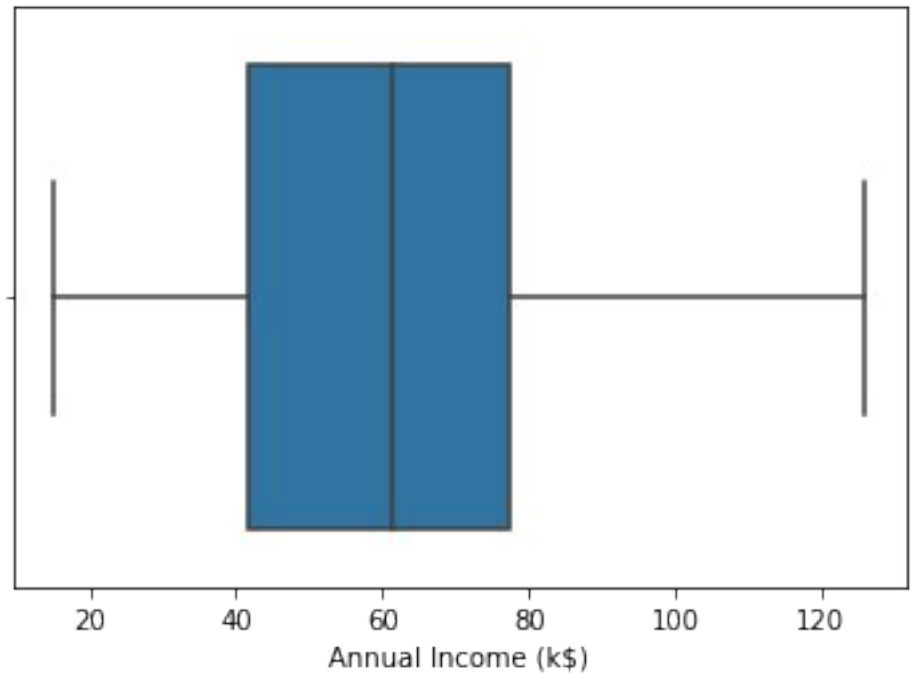
```
126.1099999999999
```

```
df["Annual Income (k$)"]=np.where(df["Annual Income (k$)"]>=a99,df["Annual Income (k$)"].median(),df["Annual Income (k$)"])
```

```
sns.boxplot(df["Annual Income (k$)"])
```

```
C:\ProgramData\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(
```

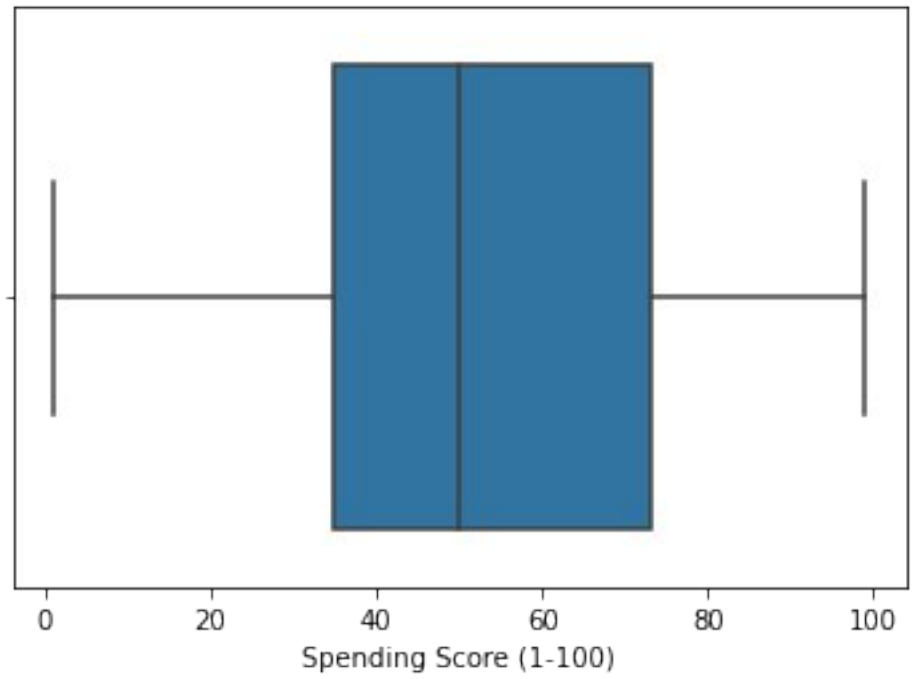
```
<AxesSubplot:xlabel='Annual Income (k$)'>
```




```
sns.boxplot(df["Spending Score (1-100)"])
```

```
C:\ProgramData\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(
```

```
<AxesSubplot:xlabel='Spending Score (1-100)'>
```



7. Check for Categorical columns and perform encoding.

```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
df.Gender=le.fit_transform(df.Gender)
```

```
df.head()
```

	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	19	15.0	39
1	1	21	15.0	81
2	0	20	16.0	6
3	0	23	16.0	77
4	0	31	17.0	40

8. Scaling the data

```
from sklearn.preprocessing import scale
df=pd.DataFrame(scale(df),columns=df.columns)
```

```
df.head()
```

	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1.128152	-1.424569	-1.788777	-0.434801
1	1.128152	-1.281035	-1.788777	1.195704
2	-0.886405	-1.352802	-1.748853	-1.715913
3	-0.886405	-1.137502	-1.748853	1.040418
4	-0.886405	-0.563369	-1.708930	-0.395980

9. Perform any of the clustering algorithms

```
from sklearn.cluster import KMeans
model=KMeans(n_clusters=2)
model
```

```
KMeans(n_clusters=2)
```

```
y_predicted=model.fit_predict(df)
y_predicted
```

```
C:\Users\Arjun\AppData\Roaming\Python\Python39\site-
packages\sklearn\cluster\_kmeans.py:1334: 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(
```

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

10. Add the cluster data with the primary dataset

```
df["clusters"]=y_predicted
df
```

	Gender	Age	Annual Income (k$)	Spending Score (1-100)	clusters
0	1.128152	-1.424569	-1.788777	-0.434801	0
1	1.128152	-1.281035	-1.788777	1.195704	0
2	-0.886405	-1.352802	-1.748853	-1.715913	1
3	-0.886405	-1.137502	-1.748853	1.040418	0
4	-0.886405	-0.563369	-1.708930	-0.395980	0
..	...	...	...	...	...
195	-0.886405	-0.276302	2.403201	1.118061	0
196	-0.886405	0.441365	2.642742	-0.861839	1
197	1.128152	-0.491602	2.642742	0.923953	0
198	1.128152	-0.491602	0.067670	-1.250054	1
199	1.128152	-0.635135	0.067670	1.273347	0

```
[200 rows x 5 columns]
```

11. Split the data into dependent and independent variables.

```
x=df.drop("clusters",axis="columns")
x
```

```
       Gender       Age  Annual Income (k$)  Spending Score (1-100)
0    1.128152 -1.424569           -1.788777               -0.434801
1    1.128152 -1.281035           -1.788777                1.195704
2   -0.886405 -1.352802           -1.748853               -1.715913
3   -0.886405 -1.137502           -1.748853                1.040418
4   -0.886405 -0.563369           -1.708930               -0.395980
..        ...       ...                 ...                     ...
195 -0.886405 -0.276302            2.403201                1.118061
196 -0.886405  0.441365            2.642742               -0.861839
197  1.128152 -0.491602            2.642742                0.923953
198  1.128152 -0.491602            0.067670               -1.250054
199  1.128152 -0.635135            0.067670                1.273347

[200 rows x 4 columns]
```

```
y=df.clusters
y
```

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

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,random_state
=23)
```

```
x_train.shape
```

```
(160, 4)
```

```
x_test.shape
```

```
(40, 4)
```

13. Build the Model

```
from sklearn.linear_model import LogisticRegression
lr=LogisticRegression()
```

14. Train the Model

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

```
LogisticRegression()
```

15. Test the Model

```
lr.score(x_test,y_test)
```

```
1.0
```

```
lr.score(x_train,y_train)
```

```
1.0
```

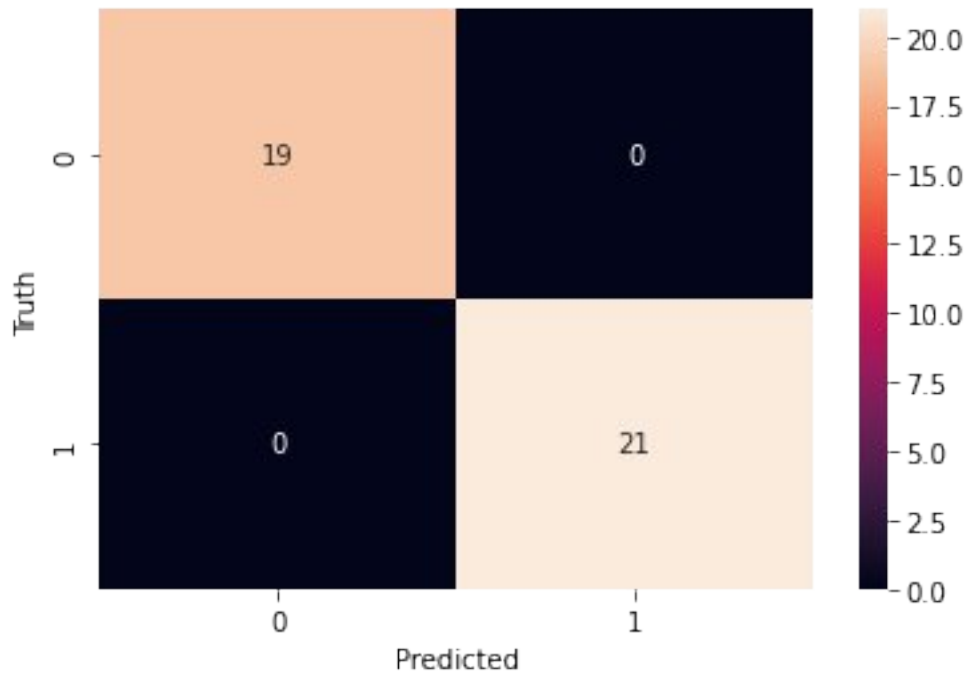
16. Measure the performance using Evaluation Metrics.

```
from sklearn.metrics import confusion_matrix
y_pred = lr.predict(x_test)
cm = confusion_matrix(y_test, y_pred)
cm
```

```
array([[19,  0],
       [ 0, 21]], dtype=int64)
```

```
sns.heatmap(cm, annot=True)
plt.xlabel('Predicted')
plt.ylabel('Truth')
```

```
Text(33.0, 0.5, 'Truth')
```




```
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        19
           1       1.00      1.00      1.00        21

    accuracy                           1.00        40
   macro avg       1.00      1.00      1.00        40
weighted avg       1.00      1.00      1.00        40
```