Assignment -4

Python Programming

Assignment Date	25 October 2022
Student Name	S.veeramani
Student Roll Number	621319106099
Maximum Marks	2 Marks

Question-1:

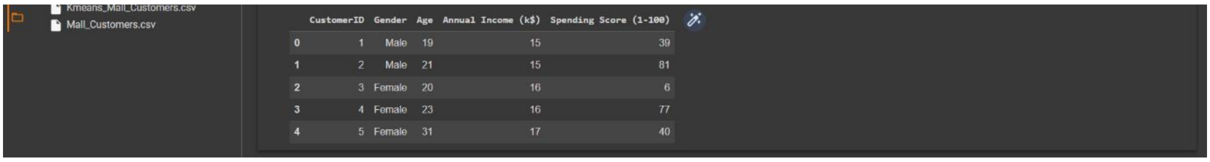
AFTER DOWNLOADING THE DATASET ,IMPORT NECESSARY LIBRARIES

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

LOAD THE DATASET

```
data=pd.read_csv('Mall_Customers.csv')
data.head()
```

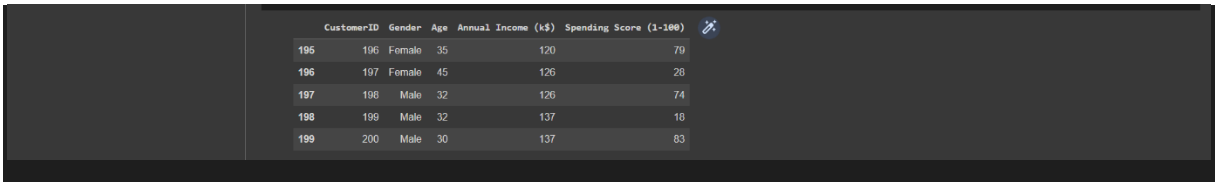
Solution:



	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

```
data.tail()
```

Solution:



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

```
data.info()
```

Solution:

```
<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.shape
```

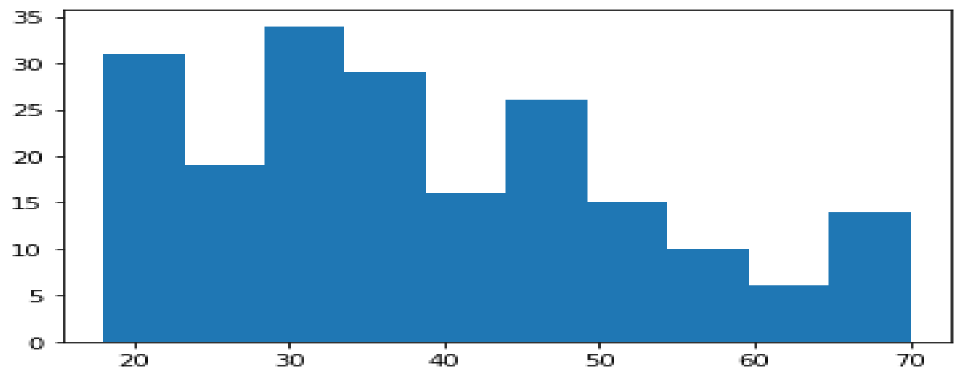
Solution:

```
(200, 5)
```

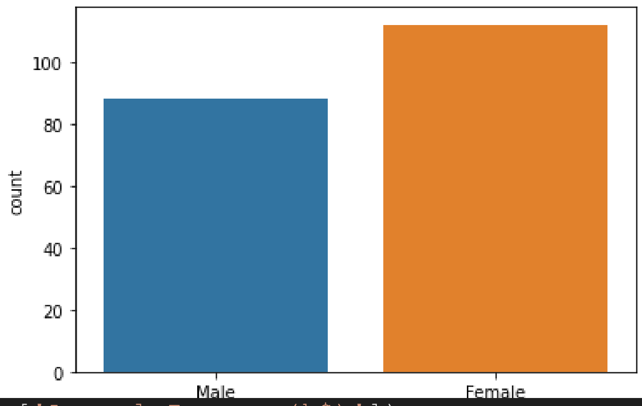
Question-2:

```
#Univariate Analysis
plt.hist(data['Age'])
```

Solution:

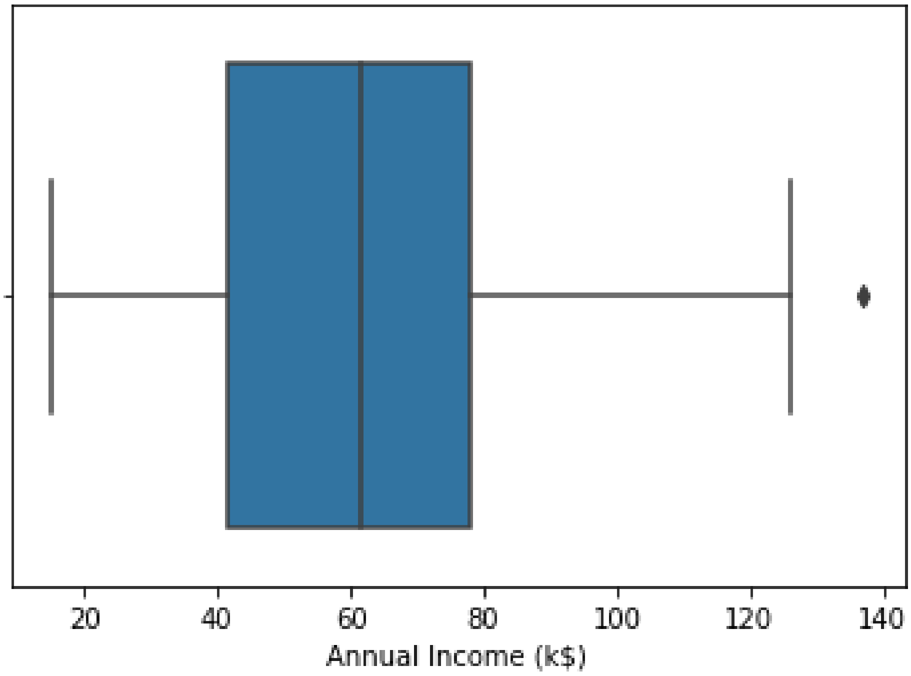


```
sns.countplot(data.Gender)
```

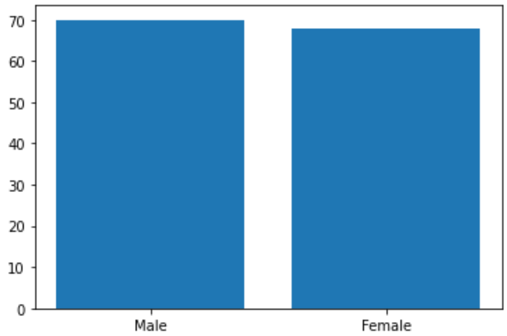


```
sns.boxplot(data['Annual Income (k$)'])
```

Solution:

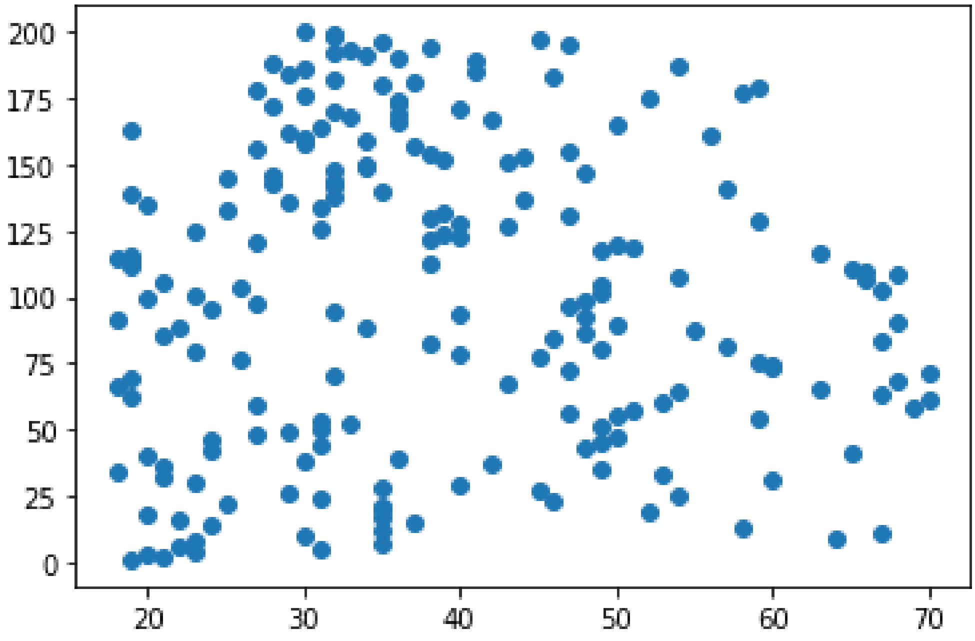


```
#Bi- Variate Analysis
plt.bar(data['Gender'],data['Age'])
```



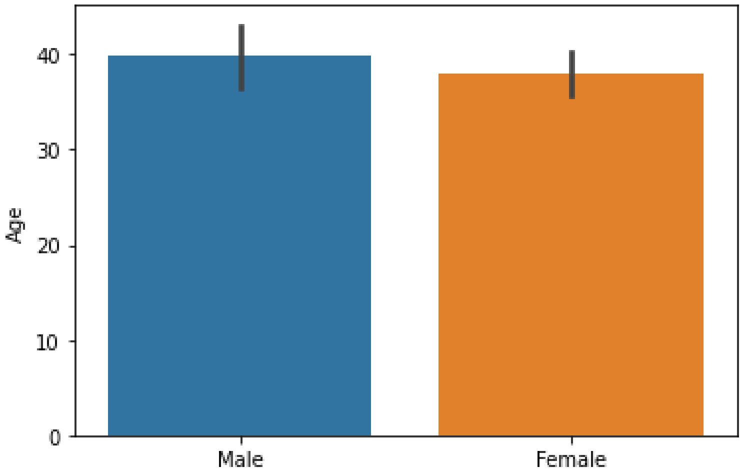
```
plt.scatter(data['Age'],data['CustomerID'])
```

Solution:



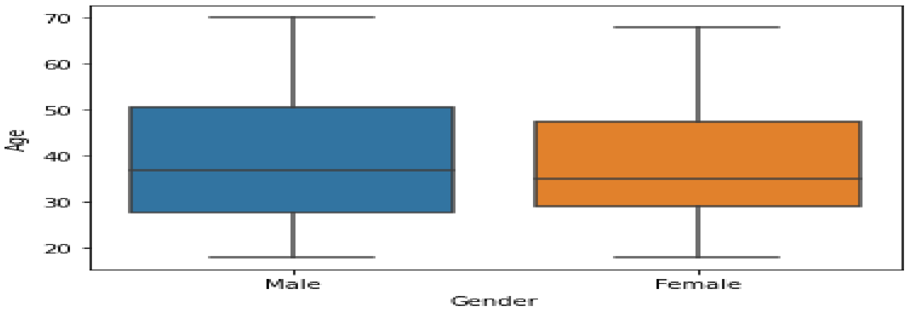
```
sns.barplot(x=data.Gender,y=data.Age)
```

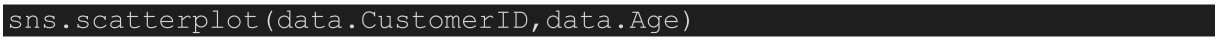
Solution:



```
sns.boxplot(x=data.Gender,y=data.Age)
```

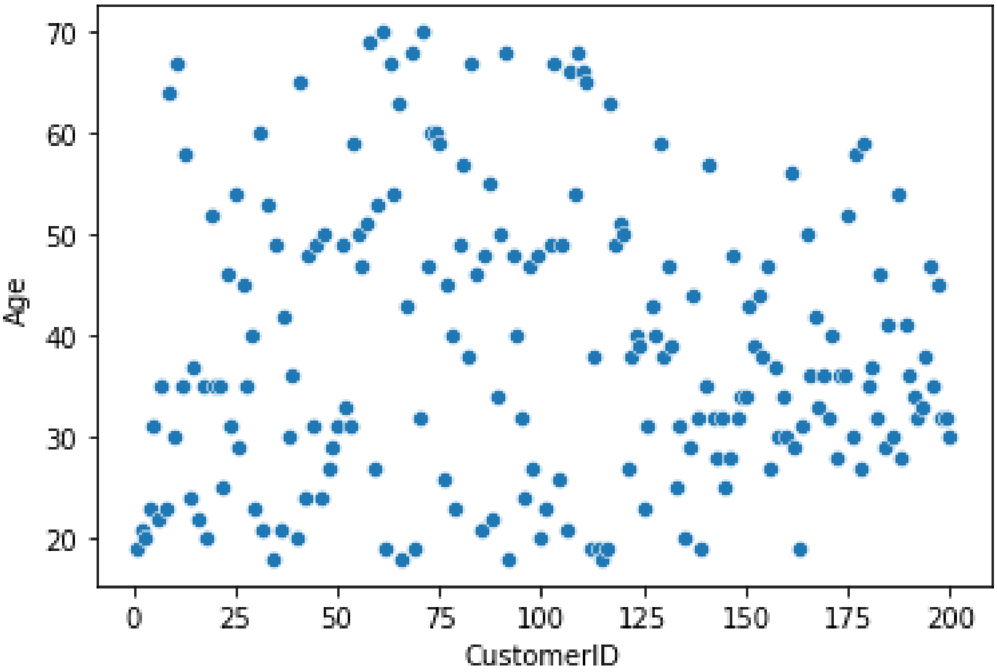
Solution:



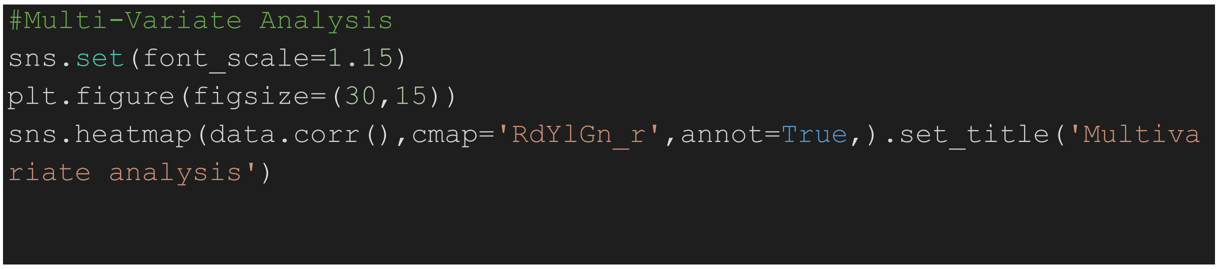


```
sns.scatterplot(data.CustomerID,data.Age)
```

Solution:

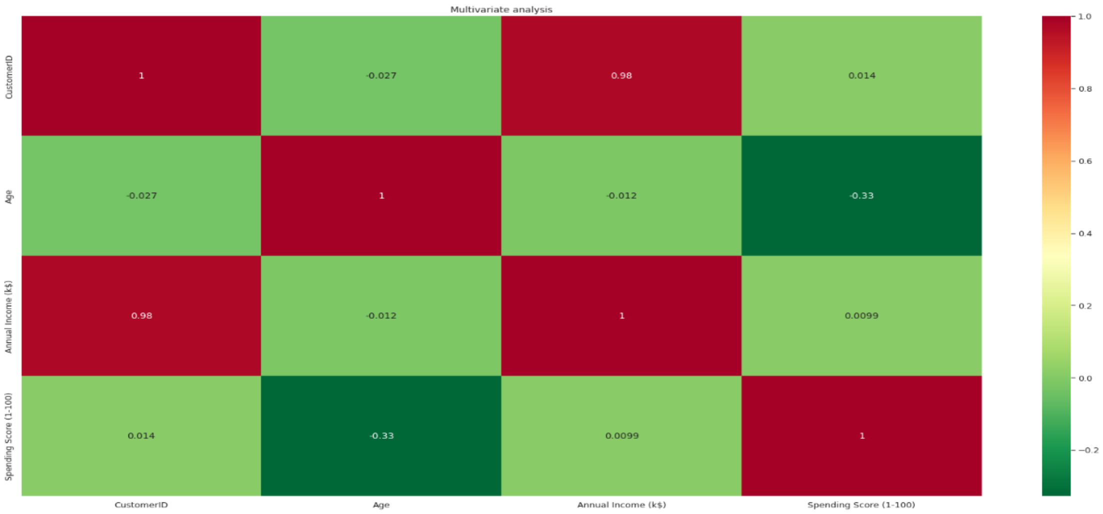


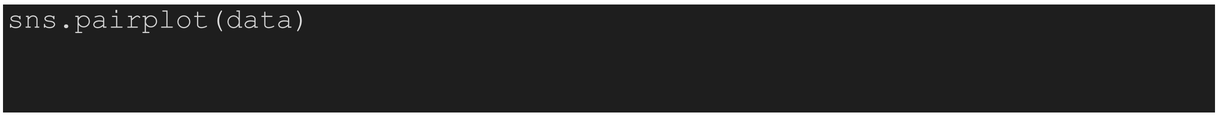
Question-4:



```
#Multi-Variate Analysis
sns.set(font_scale=1.15)
plt.figure(figsize=(30,15))
sns.heatmap(data.corr(),cmap='RdYlGn_r',annot=True,).set_title('Multiva
riate analysis')
```

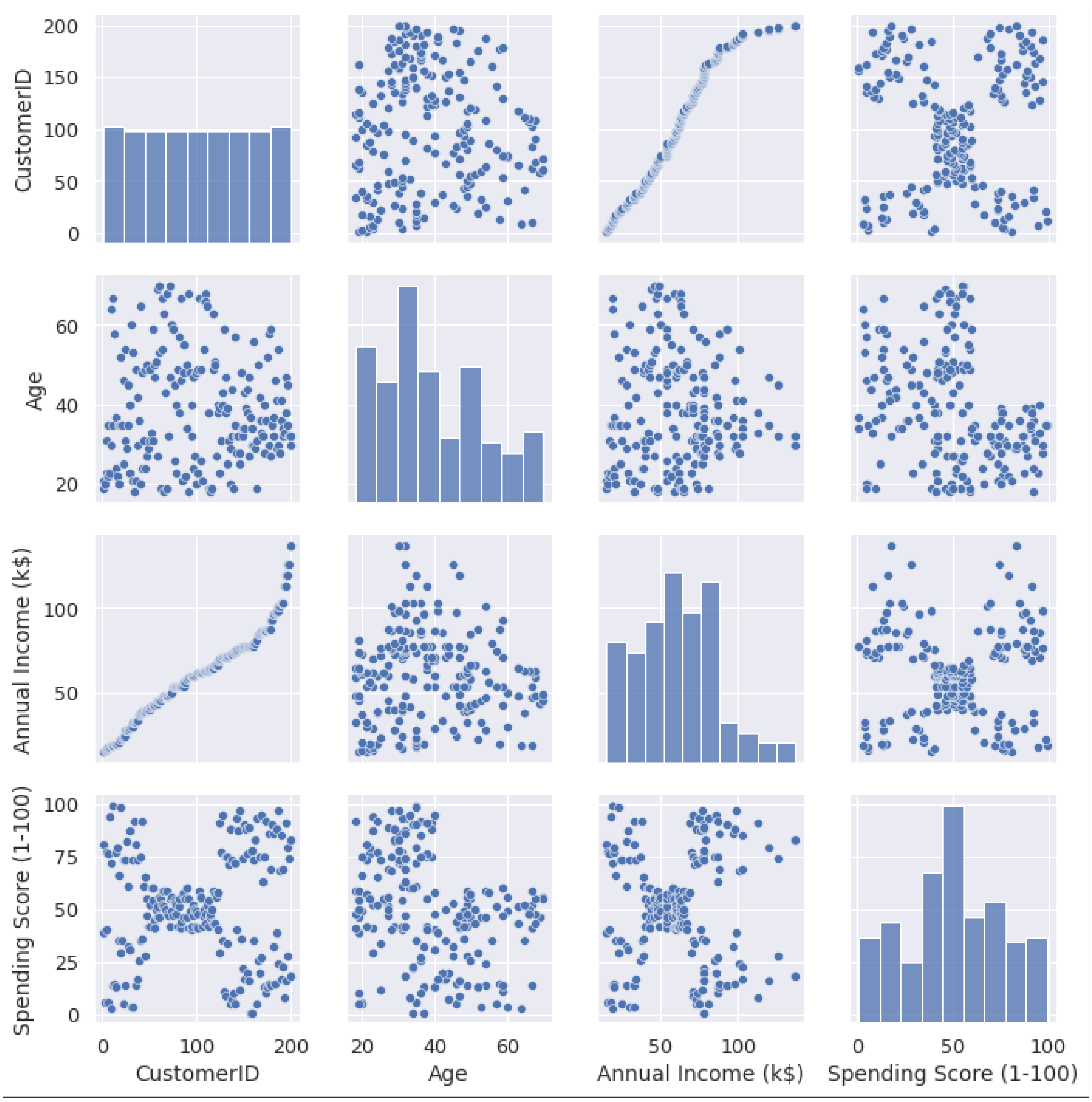
Solution:



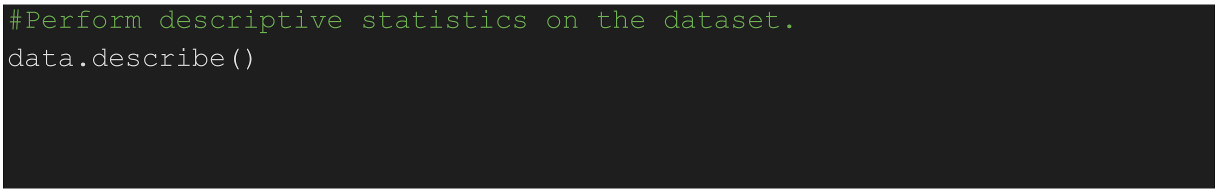


```
sns.pairplot(data)
```

Solution:

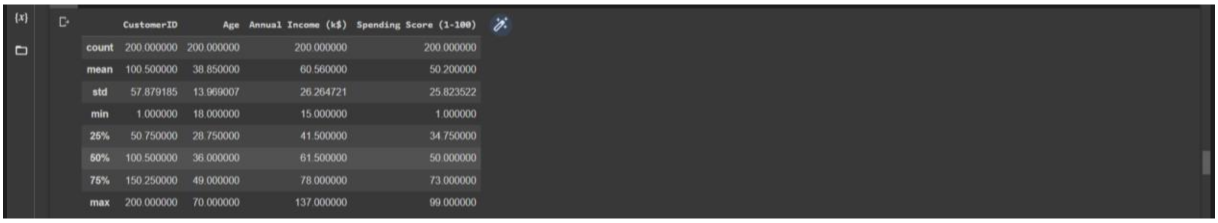


Question-6:



```
#Perform descriptive statistics on the dataset.
data.describe()
```

Solution:



	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

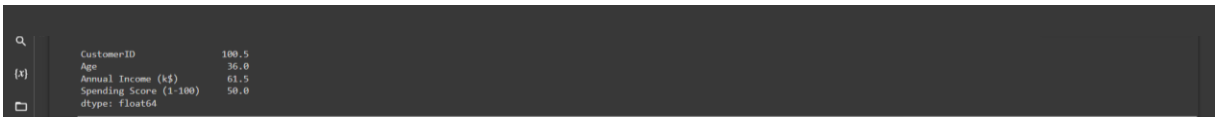
```
#mean
data['Age'].mean()
```

Solution:

```
38.85
```

```
#median
data.median()
```

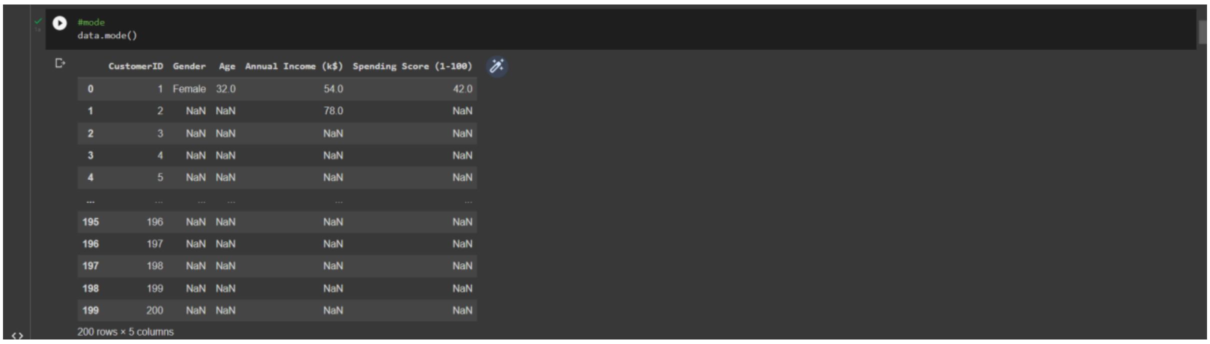
Solution:



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

```
#mode
data.mode()
```

Solution:



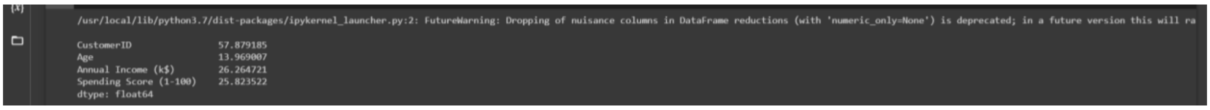
```
#mode
data.mode()
```

	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
198	199	NaN	NaN	NaN	NaN
199	200	NaN	NaN	NaN	NaN

200 rows × 5 columns

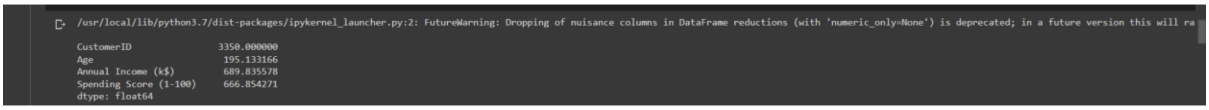
```
#std
data.std()
```

Solution:



```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will ra

CustomerID                57.879185
Age                       13.969007
Annual Income (k$)        26.264721
Spending Score (1-100)    25.823522
dtype: float64
```

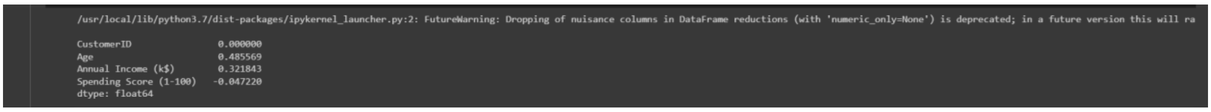
```
#var
data.var()
```



```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will ra

CustomerID                3350.000000
Age                        195.133166
Annual Income (k$)         689.835578
Spending Score (1-100)     666.854271
dtype: float64
```

```
#skewness
data.skew()
```

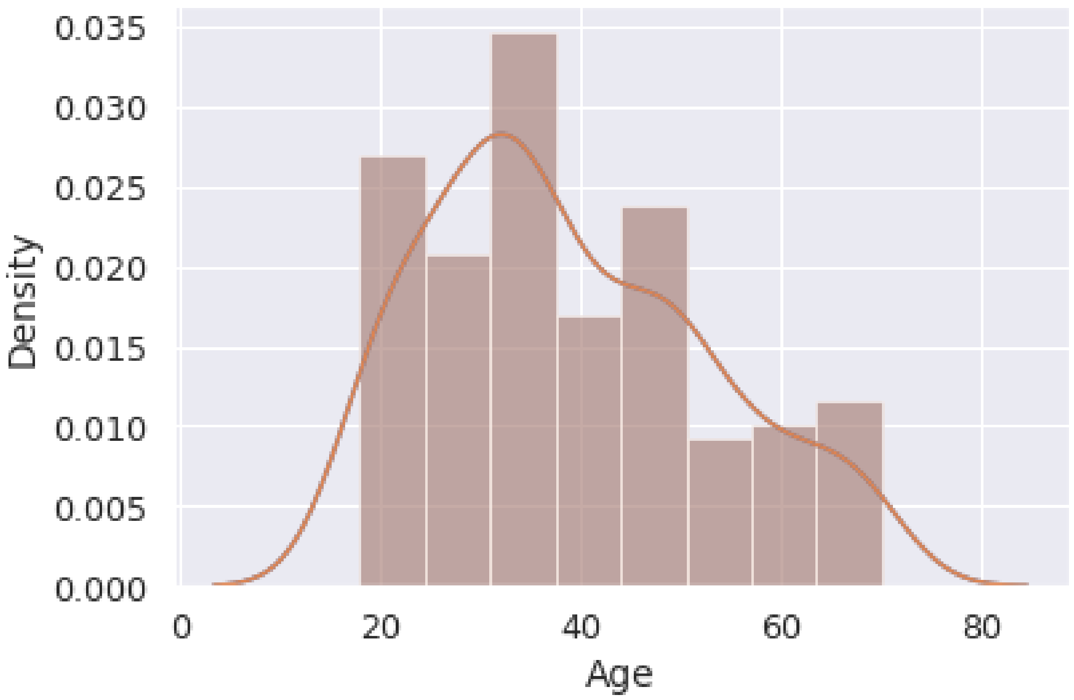
Solution:



```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will ra

CustomerID                0.000000
Age                       0.485569
Annual Income (k$)        0.321843
Spending Score (1-100)   -0.047220
dtype: float64
```

```
print(sns.distplot(data['Age'])),print(sns.distplot(data['Age'],kde=Tru
e,))
```

Solution:



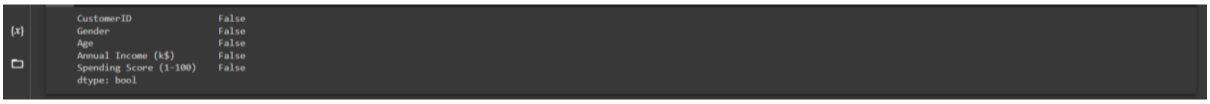
```
#Check for Missing values and deal with them.
data.isna().any().sum()
```

Solution:

```
0
```

```
# checking missing values we use isnull() function
data.isnull().any()
```

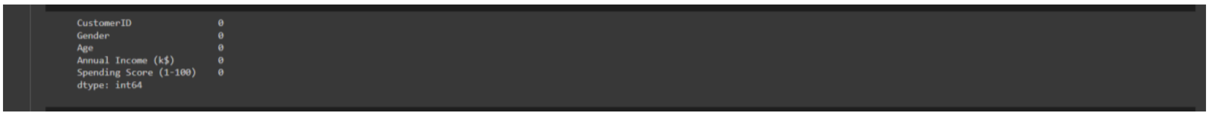
Solution:



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

```
#check sum of all null values
data.isnull().sum()
```

Solution:

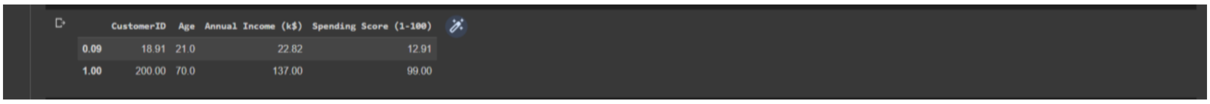


```
CustomerID                0
Gender                    0
Age                       0
Annual Income (k$)        0
Spending Score (1-100)    0
dtype: int64
```

Question-9:

```
#Find the outliers and replace them outliers
qnt=data.quantile(q=(0.09,1.00))
qnt
```

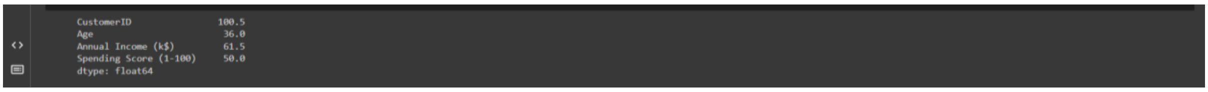
Solution:



```
      CustomerID  Age  Annual Income (k$)  Spending Score (1-100)
0.09       18.91  21.0              22.82                   12.91
1.00      200.00  70.0             137.00                   99.00
```

```
Q1 = data.Age.quantile(0.25)
Q3 = data.Age.quantile(0.175)
IQR = Q3 - Q1
lower_limit = Q1 - 1.5 * IQR
data.median(numeric_only=True)
```

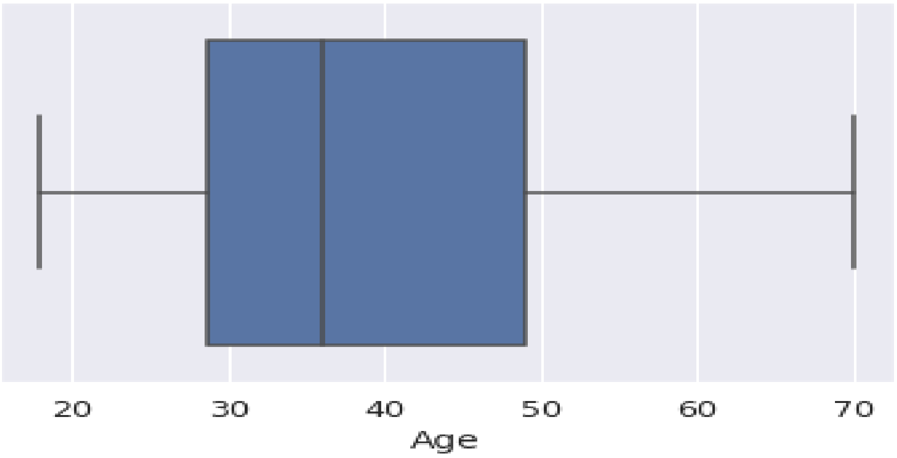
Solution:



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

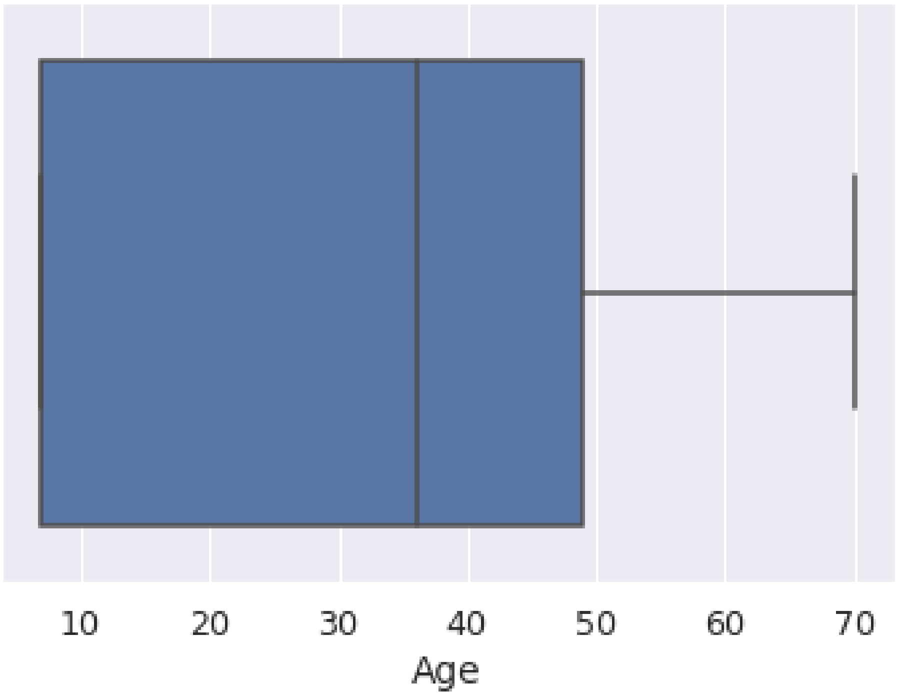
```
sns.boxplot(x=data.Age)
```

Solution:



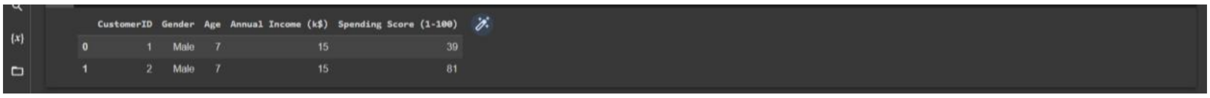
```
data['Age'] = np.where(data['Age'] < lower_limit, 7, data['Age'])
sns.boxplot(x=data.Age,showfliers = False)
```

Solution:



```
#Check for Categorical columns and perform encoding.
data.head(2)
```

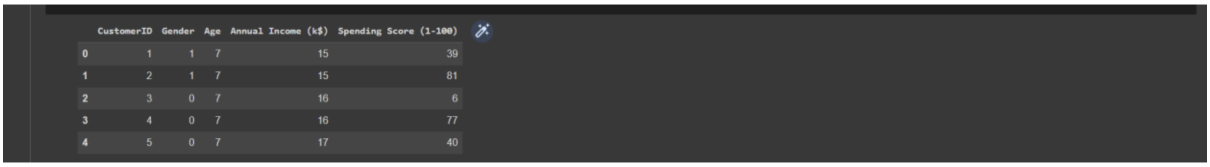
Solution:



	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	7	15	39
1	2	Male	7	15	81

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

Solution:



	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	1	7	15	39
1	2	1	7	15	81
2	3	0	7	16	6
3	4	0	7	16	77
4	5	0	7	17	40

```
#Scaling the data
x=data
names=x.columns
names
```

Solution:

Index(['CustomerID', 'Gender', 'Age', 'Annual Income (k$)',

'Spending Score (1-100)'],

dtype='object')

```
from sklearn.preprocessing import scale
x=scale(x)
x
```

Solution:

```
array([[-1.7234121 , 1.12815215, -1.04704552, -1.73899919, -
0.43480148], [-1.70609137, 1.12815215, -1.04704552, -1.73899919,
1.19570407], [-1.68877065, -0.88640526, -1.04704552, -1.70082976, -
1.71591298], [-1.67144992, -0.88640526, -1.04704552, -1.70082976,
1.04041783], [-1.6541292 , -0.88640526, -1.04704552, -1.66266033, -
0.39597992], [-1.63680847, -0.88640526, -1.04704552, -1.66266033,
1.00159627], [-1.61948775, -0.88640526, 0.21690251, -1.62449091, -
1.71591298], [-1.60216702, -0.88640526, -1.04704552, -1.62449091,
1.70038436], [-1.5848463 , 1.12815215, 1.52599154, -1.58632148, -
1.83237767], [-1.56752558, -0.88640526, -1.04704552, -1.58632148,
0.84631002], [-1.55020485, 1.12815215, 1.66141454, -1.58632148, -
1.4053405 ], [-1.53288413, -0.88640526, 0.21690251, -1.58632148,
1.89449216], [-1.5155634 , -0.88640526, 1.25514553, -1.54815205, -
```

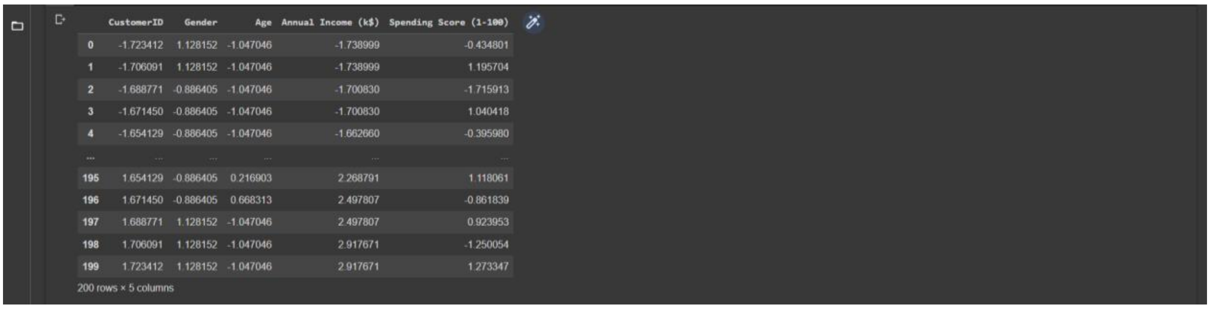
```
1.36651894], [-1.49824268, -0.88640526, -1.04704552, -1.54815205,
1.04041783], [-1.48092195, 1.12815215, 0.30718451, -1.54815205, -
1.44416206], [-1.46360123, 1.12815215, -1.04704552, -1.54815205,
1.11806095], [-1.4462805 , -0.88640526, 0.21690251, -1.50998262, -
0.59008772], [-1.42895978, 1.12815215, -1.04704552, -1.50998262,
0.61338066], [-1.41163905, 1.12815215, 0.98429952, -1.43364376, -
0.82301709], [-1.39431833, -0.88640526, 0.21690251, -1.43364376,
1.8556706 ], [-1.3769976 , 1.12815215, 0.21690251, -1.39547433, -
0.59008772], [-1.35967688, 1.12815215, -1.04704552, -1.39547433,
0.88513158], [-1.34235616, -0.88640526, 0.71345352, -1.3573049 , -
1.75473454], [-1.32503543, 1.12815215, -1.04704552, -1.3573049 ,
0.88513158], [-1.30771471, -0.88640526, 1.07458153, -1.24279661, -
1.4053405 ], [-1.29039398, 1.12815215, -1.04704552, -1.24279661,
1.23452563], [-1.27307326, -0.88640526, 0.66831252, -1.24279661, -
0.7065524 ], [-1.25575253, 1.12815215, 0.21690251, -1.24279661,
0.41927286], [-1.23843181, -0.88640526, 0.44260751, -1.20462718, -
0.74537397], [-1.22111108, -0.88640526, -1.04704552, -1.20462718,
1.42863343], [-1.20379036, 1.12815215, 1.34542753, -1.16645776, -
1.7935561 ], [-1.18646963, -0.88640526, -1.04704552, -1.16645776,
0.88513158], [-1.16914891, 1.12815215, 1.02944053, -1.05194947, -
1.7935561 ], [-1.15182818, 1.12815215, -1.04704552, -1.05194947,
1.62274124], [-1.13450746, -0.88640526, 0.84887652, -1.05194947, -
1.4053405 ], [-1.11718674, -0.88640526, -1.04704552, -1.05194947,
1.19570407], [-1.09986601, -0.88640526, 0.53288952, -1.01378004, -
1.28887582], [-1.08254529, -0.88640526, -1.04704552, -1.01378004,
0.88513158], [-1.06522456, -0.88640526, 0.26204351, -0.89927175, -
0.93948177], [-1.04790384, -0.88640526, -1.04704552, -0.89927175,
0.96277471], [-1.03058311, -0.88640526, 1.57113254, -0.86110232, -
0.59008772], [-1.01326239, 1.12815215, -1.04704552, -0.86110232,
1.62274124], [-0.99594166, 1.12815215, 0.80373552, -0.82293289, -
0.55126616], [-0.97862094, -0.88640526, -1.04704552, -0.82293289,
0.41927286], [-0.96130021, -0.88640526, 0.84887652, -0.82293289, -
0.86183865], [-0.94397949, -0.88640526, -1.04704552, -0.82293289,
0.5745591 ], [-0.92665877, -0.88640526, 0.89401752, -0.78476346,
0.18634349], [-0.90933804, -0.88640526, -1.04704552, -0.78476346, -
0.12422899], [-0.89201732, -0.88640526, -1.04704552, -0.78476346, -
0.3183368 ], [-0.87469659, -0.88640526, -1.04704552, -0.78476346, -
0.3183368 ], [-0.85737587, -0.88640526, 0.84887652, -0.70842461,
0.06987881], [-0.84005514, 1.12815215, -1.04704552, -0.70842461,
0.38045129], [-0.82273442, -0.88640526, -1.04704552, -0.67025518,
0.14752193], [-0.80541369, 1.12815215, 1.30028653, -0.67025518,
0.38045129], [-0.78809297, -0.88640526, 0.89401752, -0.67025518, -
0.20187212], [-0.77077224, 1.12815215, 0.75859452, -0.67025518, -
0.35715836], [-0.75345152, -0.88640526, 0.93915852, -0.63208575, -
0.00776431], [-0.73613079, 1.12815215, 1.75169654, -0.63208575, -
0.16305055], [-0.71881007, -0.88640526, -1.04704552, -0.55574689,
0.03105725], [-0.70148935, 1.12815215, 1.02944053, -0.55574689, -
0.16305055], [-0.68416862, 1.12815215, 1.79683754, -0.55574689,
0.22516505], [-0.6668479 , 1.12815215, -1.04704552, -0.55574689,
0.18634349], [-0.64952717, -0.88640526, 1.66141454, -0.51757746,
0.06987881], [-0.63220645, -0.88640526, 1.07458153, -0.51757746,
0.34162973], [-0.61488572, 1.12815215, 1.48085053, -0.47940803,
0.03105725], [-0.597565 , 1.12815215, -1.04704552, -0.47940803,
0.34162973], [-0.58024427, -0.88640526, 0.57803052, -0.47940803, -
```

```
0.00776431], [-0.56292355, -0.88640526, 1.70655554, -0.47940803, -
0.08540743], [-0.54560282, 1.12815215, -1.04704552, -0.47940803,
0.34162973], [-0.5282821 , -0.88640526, -1.04704552, -0.47940803, -
0.12422899], [-0.51096138, 1.12815215, 1.79683754, -0.4412386 ,
0.18634349], [-0.49364065, -0.88640526, 0.75859452, -0.4412386 , -
0.3183368 ], [-0.47631993, -0.88640526, 1.34542753, -0.40306917, -
0.04658587], [-0.4589992 , -0.88640526, 1.34542753, -0.40306917,
0.22516505], [-0.44167848, 1.12815215, 1.30028653, -0.25039146, -
0.12422899], [-0.42435775, 1.12815215, -1.04704552, -0.25039146,
0.14752193], [-0.40703703, -0.88640526, 0.66831252, -0.25039146,
0.10870037], [-0.3897163 , 1.12815215, 0.44260751, -0.25039146, -
0.08540743], [-0.37239558, -0.88640526, -1.04704552, -0.25039146,
0.06987881], [-0.35507485, -0.88640526, 0.84887652, -0.25039146, -
0.3183368 ], [-0.33775413, 1.12815215, 1.21000453, -0.25039146,
0.03105725], [-0.3204334 , 1.12815215, 0.35232551, -0.25039146,
0.18634349], [-0.30311268, 1.12815215, 1.66141454, -0.25039146, -
0.35715836], [-0.28579196, -0.88640526, 0.71345352, -0.25039146, -
0.24069368], [-0.26847123, -0.88640526, -1.04704552, -0.25039146,
0.26398661], [-0.25115051, 1.12815215, 0.80373552, -0.25039146, -
0.16305055], [-0.23382978, -0.88640526, 1.11972253, -0.13588317,
0.30280817], [-0.21650906, -0.88640526, -1.04704552, -0.13588317,
0.18634349], [-0.19918833, -0.88640526, -1.04704552, -0.09771374,
0.38045129], [-0.18186761, -0.88640526, 0.89401752, -0.09771374, -
0.16305055], [-0.16454688, -0.88640526, 1.70655554, -0.05954431,
0.18634349], [-0.14722616, 1.12815215, -1.04704552, -0.05954431, -
0.35715836], [-0.12990543, 1.12815215, 0.80373552, -0.02137488, -
0.04658587], [-0.11258471, -0.88640526, 0.44260751, -0.02137488, -
0.39597992], [-0.09526399, -0.88640526, -1.04704552, -0.02137488, -
0.3183368 ], [-0.07794326, 1.12815215, -1.04704552, -0.02137488,
0.06987881], [-0.06062254, -0.88640526, 0.75859452, -0.02137488, -
0.12422899], [-0.04330181, -0.88640526, -1.04704552, -0.02137488, -
0.00776431], [-0.02598109, 1.12815215, 0.80373552, 0.01679455, -
0.3183368 ], [-0.00866036, 1.12815215, -1.04704552, 0.01679455, -
0.04658587], [ 0.00866036, -0.88640526, -1.04704552, 0.05496398, -
0.35715836], [ 0.02598109, -0.88640526, 0.84887652, 0.05496398, -
0.08540743], [ 0.04330181, 1.12815215, 1.66141454, 0.05496398,
0.34162973], [ 0.06062254, 1.12815215, -1.04704552, 0.05496398,
0.18634349], [ 0.07794326, 1.12815215, 0.84887652, 0.05496398,
0.22516505], [ 0.09526399, -0.88640526, -1.04704552, 0.05496398, -
0.3183368 ], [ 0.11258471, -0.88640526, 1.61627354, 0.09313341, -
0.00776431], [ 0.12990543, 1.12815215, 1.07458153, 0.09313341, -
0.16305055], [ 0.14722616, 1.12815215, 1.70655554, 0.09313341, -
0.27951524], [ 0.16454688, 1.12815215, 1.61627354, 0.09313341, -
0.08540743], [ 0.18186761, 1.12815215, 1.57113254, 0.09313341,
0.06987881], [ 0.19918833, -0.88640526, -1.04704552, 0.09313341,
0.14752193], [ 0.21650906, -0.88640526, 0.35232551, 0.13130284, -
0.3183368 ], [ 0.23382978, 1.12815215, -1.04704552, 0.13130284, -
0.16305055], [ 0.25115051, -0.88640526, -1.04704552, 0.16947227, -
0.08540743], [ 0.26847123, -0.88640526, -1.04704552, 0.16947227, -
0.00776431], [ 0.28579196, -0.88640526, 1.48085053, 0.16947227, -
0.27951524], [ 0.30311268, -0.88640526, 0.84887652, 0.16947227,
0.34162973], [ 0.3204334 , -0.88640526, 0.93915852, 0.24581112, -
0.27951524], [ 0.33775413, -0.88640526, 0.89401752, 0.24581112,
0.26398661], [ 0.35507485, 1.12815215, -1.04704552, 0.24581112,
0.22516505], [ 0.37239558, -0.88640526, 0.35232551, 0.24581112, -
0.39597992], [ 0.3897163 , -0.88640526, 0.44260751, 0.32214998,
0.30280817], [ 0.40703703, 1.12815215, 0.39746651, 0.32214998,
1.58391968], [ 0.42435775, -0.88640526, -1.04704552, 0.36031941, -
0.82301709], [ 0.44167848, -0.88640526, -1.04704552, 0.36031941,
1.04041783], [ 0.4589992 , 1.12815215, 0.57803052, 0.39848884, -
0.59008772], [ 0.47631993, 1.12815215, 0.44260751, 0.39848884,
1.73920592], [ 0.49364065, 1.12815215, 1.30028653, 0.39848884, -
1.52180518], [ 0.51096138, 1.12815215, 0.35232551, 0.39848884,
0.96277471], [ 0.5282821 , 1.12815215, 0.75859452, 0.39848884, -
1.5994483 ], [ 0.54560282, 1.12815215, 0.39746651, 0.39848884,
0.96277471], [ 0.56292355, -0.88640526, -1.04704552, 0.43665827, -
0.62890928], [ 0.58024427, -0.88640526, -1.04704552, 0.43665827,
0.80748846], [ 0.597565 , 1.12815215, -1.04704552, 0.4748277 , -
1.75473454], [ 0.61488572, -0.88640526, -1.04704552, 0.4748277 ,
1.46745499], [ 0.63220645, -0.88640526, 0.62317152, 0.4748277 , -
1.67709142], [ 0.64952717, 1.12815215, -1.04704552, 0.4748277 ,
0.88513158], [ 0.6668479 , 1.12815215, -1.04704552, 0.51299713, -
1.56062674], [ 0.68416862, -0.88640526, 0.21690251, 0.51299713,
0.84631002], [ 0.70148935, -0.88640526, 1.21000453, 0.55116656, -
1.75473454], [ 0.71881007, 1.12815215, -1.04704552, 0.55116656,
1.6615628 ], [ 0.73613079, -0.88640526, -1.04704552, 0.58933599, -
0.39597992], [ 0.75345152, -0.88640526, -1.04704552, 0.58933599,
1.42863343], [ 0.77077224, 1.12815215, -1.04704552, 0.62750542, -
1.48298362], [ 0.78809297, 1.12815215, -1.04704552, 0.62750542,
1.81684904], [ 0.80541369, 1.12815215, 0.80373552, 0.62750542, -
0.55126616], [ 0.82273442, -0.88640526, -1.04704552, 0.62750542,
0.92395314], [ 0.84005514, -0.88640526, -1.04704552, 0.66567484, -
1.09476801], [ 0.85737587, 1.12815215, -1.04704552, 0.66567484,
1.54509812], [ 0.87469659, 1.12815215, 0.57803052, 0.66567484, -
1.28887582], [ 0.89201732, 1.12815215, 0.39746651, 0.66567484,
1.46745499], [ 0.90933804, -0.88640526, 0.62317152, 0.66567484, -
1.17241113], [ 0.92665877, -0.88640526, 0.35232551, 0.66567484,
1.00159627], [ 0.94397949, -0.88640526, 0.75859452, 0.66567484, -
1.32769738], [ 0.96130021, -0.88640526, -1.04704552, 0.66567484,
1.50627656], [ 0.97862094, 1.12815215, 0.30718451, 0.66567484, -
1.91002079], [ 0.99594166, -0.88640526, -1.04704552, 0.66567484,
1.07923939], [ 1.01326239, 1.12815215, -1.04704552, 0.66567484, -
1.91002079], [ 1.03058311, -0.88640526, -1.04704552, 0.66567484,
0.88513158], [ 1.04790384, -0.88640526, 1.16486353, 0.70384427, -
0.59008772], [ 1.06522456, -0.88640526, -1.04704552, 0.70384427,
1.27334719], [ 1.08254529, 1.12815215, -1.04704552, 0.78018313, -
1.75473454], [ 1.09986601, -0.88640526, -1.04704552, 0.78018313,
1.6615628 ], [ 1.11718674, 1.12815215, 0.89401752, 0.93286085, -
0.93948177], [ 1.13450746, -0.88640526, 0.26204351, 0.93286085,
0.96277471], [ 1.15182818, 1.12815215, 0.53288952, 0.97103028, -
1.17241113], [ 1.16914891, -0.88640526, -1.04704552, 0.97103028,
1.73920592], [ 1.18646963, -0.88640526, 0.26204351, 1.00919971, -
0.90066021], [ 1.20379036, 1.12815215, -1.04704552, 1.00919971,
0.49691598], [ 1.22111108, 1.12815215, 0.44260751, 1.00919971, -
1.44416206], [ 1.23843181, 1.12815215, -1.04704552, 1.00919971,
0.96277471], [ 1.25575253, 1.12815215, 0.26204351, 1.00919971, -
1.56062674], [ 1.27307326, 1.12815215, 0.26204351, 1.00919971,
1.62274124], [ 1.29039398, -0.88640526, 0.98429952, 1.04736914, -
```

```
1.44416206], [ 1.30771471, -0.88640526, -1.04704552, 1.04736914,
1.38981187], [ 1.32503543, 1.12815215, 1.25514553, 1.04736914, -
1.36651894], [ 1.34235616, 1.12815215, -1.04704552, 1.04736914,
0.72984534], [ 1.35967688, 1.12815215, 1.30028653, 1.23821628, -
1.4053405 ], [ 1.3769976 , 1.12815215, 0.21690251, 1.23821628,
1.54509812], [ 1.39431833, -0.88640526, 0.30718451, 1.390894 , -
0.7065524 ], [ 1.41163905, -0.88640526, -1.04704552, 1.390894 ,
1.38981187], [ 1.42895978, 1.12815215, 0.71345352, 1.42906343, -
1.36651894], [ 1.4462805 , -0.88640526, -1.04704552, 1.42906343,
1.46745499], [ 1.46360123, -0.88640526, 0.48774851, 1.46723286, -
0.43480148], [ 1.48092195, 1.12815215, -1.04704552, 1.46723286,
1.81684904], [ 1.49824268, -0.88640526, 1.07458153, 1.54357172, -
1.01712489], [ 1.5155634 , 1.12815215, -1.04704552, 1.54357172,
0.69102378], [ 1.53288413, -0.88640526, 0.48774851, 1.61991057, -
1.28887582], [ 1.55020485, -0.88640526, 0.26204351, 1.61991057,
1.35099031], [ 1.56752558, -0.88640526, -1.04704552, 1.61991057, -
1.05594645], [ 1.5848463 , -0.88640526, -1.04704552, 1.61991057,
0.72984534], [ 1.60216702, 1.12815215, -1.04704552, 2.00160487, -
1.63826986], [ 1.61948775, -0.88640526, 0.35232551, 2.00160487,
1.58391968], [ 1.63680847, -0.88640526, 0.75859452, 2.26879087, -
1.32769738], [ 1.6541292 , -0.88640526, 0.21690251, 2.26879087,
1.11806095], [ 1.67144992, -0.88640526, 0.66831252, 2.49780745, -
0.86183865], [ 1.68877065, 1.12815215, -1.04704552, 2.49780745,
0.92395314], [ 1.70609137, 1.12815215, -1.04704552, 2.91767117, -
1.25005425], [ 1.7234121 , 1.12815215, -1.04704552, 2.91767117,
1.27334719]])
```

```
x=pd.DataFrame(x,columns=names)
x
```

Solution:



	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	-1.723412	1.128152	-1.047046	-1.738999	-0.434801
1	-1.706091	1.128152	-1.047046	-1.738999	1.195704
2	-1.688771	-0.886405	-1.047046	-1.700830	-1.715913
3	-1.671450	-0.886405	-1.047046	-1.700830	1.040418
4	-1.654129	-0.886405	-1.047046	-1.662660	-0.395980
...	...	...	...	...	...
195	1.654129	-0.886405	0.216903	2.268791	1.118061
196	1.671450	-0.886405	0.668313	2.497807	-0.861839
197	1.688771	1.128152	-1.047046	2.497807	0.923953
198	1.706091	1.128152	-1.047046	2.917671	-1.250054
199	1.723412	1.128152	-1.047046	2.917671	1.273347

200 rows × 5 columns

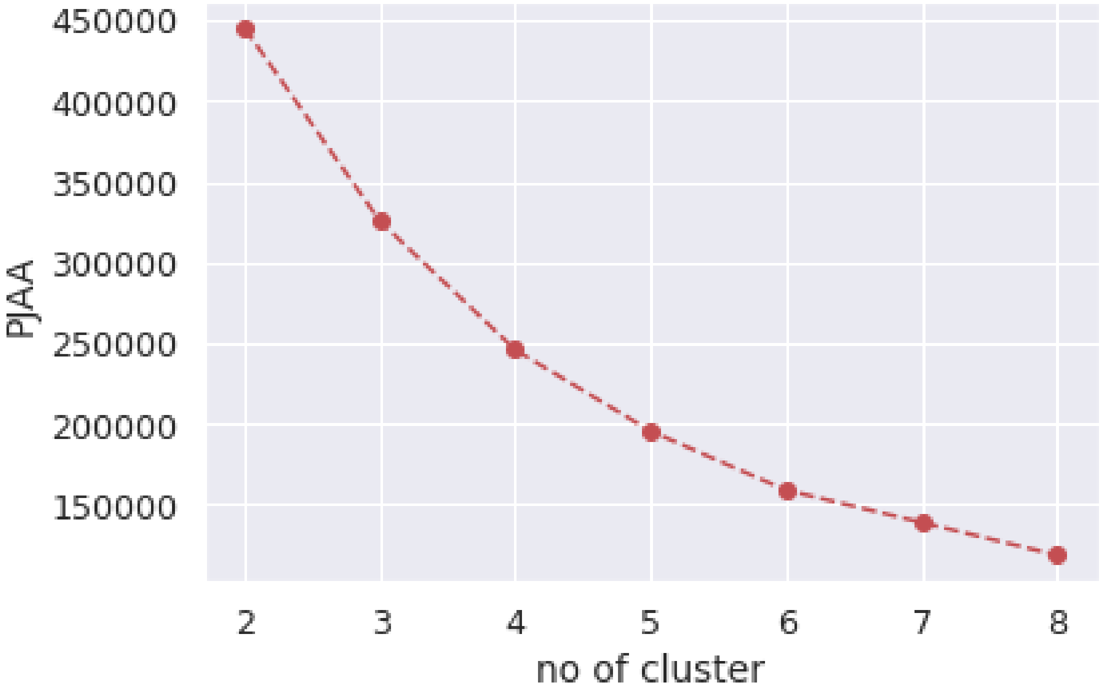
```
#Perform any of the clustering algorithms
#Kmeans clustering
from sklearn.cluster import KMeans
PJAA=[]
k=list(range(2,9))

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

Solution:

```
[445698.6278627863, 325787.09074274875, 245928.9448954999,
195438.05301054876, 158881.73689847524, 138853.0978883425,
118523.53235349475]
```

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

Solution:



```
#Add the cluster data with the primary dataset
model.labels_
```

Solution:

```
array([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, 1, 0, 1, 1, 0, 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, 1, 1, 1, 1, 2, 1, 2, 1, 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, 2], dtype=int32)
```

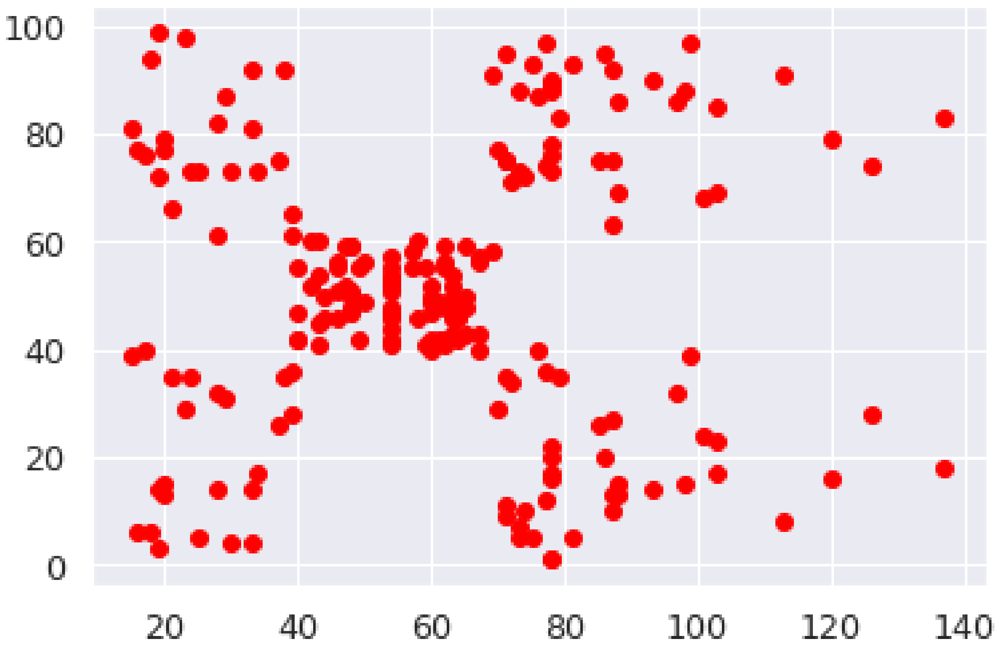
```
data.to_csv('Kmeans_Mall_Customers.csv',encoding='utf-8')
#Split the data into dependent and independent variables.
X=data.iloc[:,:-1].values
y=data.iloc[:,-1].values
X
```

Solution:

```
array([[ 1, 1, 7, 15], [ 2, 1, 7, 15], [ 3, 0, 7, 16], [ 4, 0, 7, 16],
[ 5, 0, 7, 17], [ 6, 0, 7, 17], [ 7, 0, 35, 18], [ 8, 0, 7, 18], [ 9,
1, 64, 19], [ 10, 0, 7, 19], [ 11, 1, 67, 19], [ 12, 0, 35, 19], [ 13,
0, 58, 20], [ 14, 0, 7, 20], [ 15, 1, 37, 20], [ 16, 1, 7, 20], [ 17,
0, 35, 21], [ 18, 1, 7, 21], [ 19, 1, 52, 23], [ 20, 0, 35, 23], [ 21,
1, 35, 24], [ 22, 1, 7, 24], [ 23, 0, 46, 25], [ 24, 1, 7, 25], [ 25,
0, 54, 28], [ 26, 1, 7, 28], [ 27, 0, 45, 28], [ 28, 1, 35, 28], [ 29,
0, 40, 29], [ 30, 0, 7, 29], [ 31, 1, 60, 30], [ 32, 0, 7, 30], [ 33,
1, 53, 33], [ 34, 1, 7, 33], [ 35, 0, 49, 33], [ 36, 0, 7, 33], [ 37,
0, 42, 34], [ 38, 0, 7, 34], [ 39, 0, 36, 37], [ 40, 0, 7, 37], [ 41,
0, 65, 38], [ 42, 1, 7, 38], [ 43, 1, 48, 39], [ 44, 0, 7, 39], [ 45,
0, 49, 39], [ 46, 0, 7, 39], [ 47, 0, 50, 40], [ 48, 0, 7, 40], [ 49,
0, 7, 40], [ 50, 0, 7, 40], [ 51, 0, 49, 42], [ 52, 1, 7, 42], [ 53, 0,
7, 43], [ 54, 1, 59, 43], [ 55, 0, 50, 43], [ 56, 1, 47, 43], [ 57, 0,
51, 44], [ 58, 1, 69, 44], [ 59, 0, 7, 46], [ 60, 1, 53, 46], [ 61, 1,
70, 46], [ 62, 1, 7, 46], [ 63, 0, 67, 47], [ 64, 0, 54, 47], [ 65, 1,
63, 48], [ 66, 1, 7, 48], [ 67, 0, 43, 48], [ 68, 0, 68, 48], [ 69, 1,
7, 48], [ 70, 0, 7, 48], [ 71, 1, 70, 49], [ 72, 0, 47, 49], [ 73, 0,
60, 50], [ 74, 0, 60, 50], [ 75, 1, 59, 54], [ 76, 1, 7, 54], [ 77, 0,
45, 54], [ 78, 1, 40, 54], [ 79, 0, 7, 54], [ 80, 0, 49, 54], [ 81, 1,
57, 54], [ 82, 1, 38, 54], [ 83, 1, 67, 54], [ 84, 0, 46, 54], [ 85, 0,
7, 54], [ 86, 1, 48, 54], [ 87, 0, 55, 57], [ 88, 0, 7, 57], [ 89, 0,
7, 58], [ 90, 0, 50, 58], [ 91, 0, 68, 59], [ 92, 1, 7, 59], [ 93, 1,
48, 60], [ 94, 0, 40, 60], [ 95, 0, 7, 60], [ 96, 1, 7, 60], [ 97, 0,
47, 60], [ 98, 0, 7, 60], [ 99, 1, 48, 61], [100, 1, 7, 61], [101, 0,
7, 62], [102, 0, 49, 62], [103, 1, 67, 62], [104, 1, 7, 62], [105, 1,
49, 62], [106, 0, 7, 62], [107, 0, 66, 63], [108, 1, 54, 63], [109, 1,
68, 63], [110, 1, 66, 63], [111, 1, 65, 63], [112, 0, 7, 63], [113, 0,
38, 64], [114, 1, 7, 64], [115, 0, 7, 65], [116, 0, 7, 65], [117, 0,
63, 65], [118, 0, 49, 65], [119, 0, 51, 67], [120, 0, 50, 67], [121, 1,
7, 67], [122, 0, 38, 67], [123, 0, 40, 69], [124, 1, 39, 69], [125, 0,
7, 70], [126, 0, 7, 70], [127, 1, 43, 71], [128, 1, 40, 71], [129, 1,
59, 71], [130, 1, 38, 71], [131, 1, 47, 71], [132, 1, 39, 71], [133, 0,
7, 72], [134, 0, 7, 72], [135, 1, 7, 73], [136, 0, 7, 73], [137, 0, 44,
73], [138, 1, 7, 73], [139, 1, 7, 74], [140, 0, 35, 74], [141, 0, 57,
75], [142, 1, 7, 75], [143, 0, 7, 76], [144, 0, 7, 76], [145, 1, 7,
77], [146, 1, 7, 77], [147, 1, 48, 77], [148, 0, 7, 77], [149, 0, 7,
78], [150, 1, 7, 78], [151, 1, 43, 78], [152, 1, 39, 78], [153, 0, 44,
78], [154, 0, 38, 78], [155, 0, 47, 78], [156, 0, 7, 78], [157, 1, 37,
78], [158, 0, 7, 78], [159, 1, 7, 78], [160, 0, 7, 78], [161, 0, 56,
79], [162, 0, 7, 79], [163, 1, 7, 81], [164, 0, 7, 81], [165, 1, 50,
85], [166, 0, 36, 85], [167, 1, 42, 86], [168, 0, 7, 86], [169, 0, 36,
87], [170, 1, 7, 87], [171, 1, 40, 87], [172, 1, 7, 87], [173, 1, 36,
87], [174, 1, 36, 87], [175, 0, 52, 88], [176, 0, 7, 88], [177, 1, 58,
88], [178, 1, 7, 88], [179, 1, 59, 93], [180, 1, 35, 93], [181, 0, 37,
97], [182, 0, 7, 97], [183, 1, 46, 98], [184, 0, 7, 98], [185, 0, 41,
99], [186, 1, 7, 99], [187, 0, 54, 101], [188, 1, 7, 101], [189, 0, 41,
103], [190, 0, 36, 103], [191, 0, 7, 103], [192, 0, 7, 103], [193, 1,
7, 113], [194, 0, 38, 113], [195, 0, 47, 120], [196, 0, 35, 120], [197,
0, 45, 126], [198, 1, 7, 126], [199, 1, 7, 137], [200, 1, 7, 137]])
```

```
plt.scatter(data['Annual Income (k$)'],data['Spending Score (1-
100)'],color='red')
```

Solution:



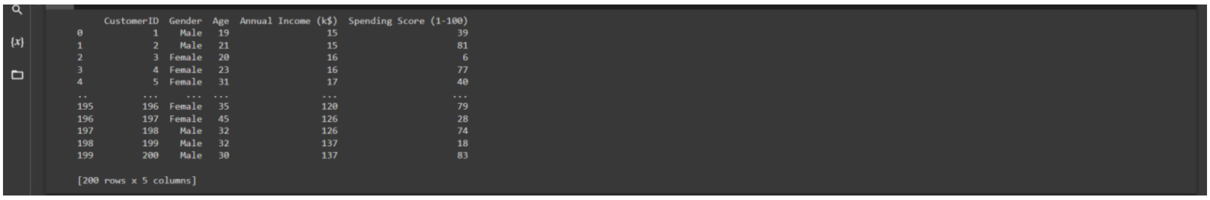
```
#Split the data into training and testing
from sklearn.model_selection import train_test_split

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2)
print(X_train.shape,X_test.shape)
```

Solution:

```
(160, 4) (40, 4)
```

```
# Build the Model
my_dict=pd.read_csv("/content/Mall_Customers.csv")
df = pd.DataFrame(my_dict)
print(df)
```

Solution:



```
     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]
```

```
#  Build the Model
import csv
with open("/content/Mall_Customers.csv") as csv_file:
    csv_reader = csv.reader(csv_file)
    df = pd.DataFrame([csv_reader], index = None)
for val in list(df[1]):
    print(val)
```

Solution:

```
['1', 'Male', '19', '15', '39']
```

```
#Train the Model
model.fit(X_train,y_train)
```

Solution:

```
KMeans(n_clusters=4)
```

```
#Test the Model
pred2=model.predict(X_test)
#Measure the performance using Evaluation Metrics
from sklearn.metrics import accuracy_score
accuracy_score(y_test,pred2)
```

Solution:

```
0.0
```

```
#prediction on the test
pred=rf.predict(X_test)
# Accuracy of DT model
from sklearn.metrics import accuracy_score
accuracy_score(y_test,pred)
```

Solution:

```
0.025
```

```
#Test the model
pred=nb.predict(X_test)
pred
```

Solution:

```
array([90, 58, 77, 97, 92, 40, 10, 77, 54, 97, 40, 58, 28, 40, 97, 40,
40, 92, 58, 92, 90, 97, 73, 32, 90, 77, 97, 77, 74, 77, 77, 90, 58, 77,
73, 32, 92, 77, 51, 51])
```

```
#evalute model matrix
from sklearn.metrics import accuracy_score, confusion_matrix
accuracy_score(y_test,pred)
```

Solution:

```
0.025
```