

**Assignment -4**  
Python Programming

Assignment Date	25 October 2022
Student Name	Karthikeyan M
Student Roll Number	621319106310
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
```

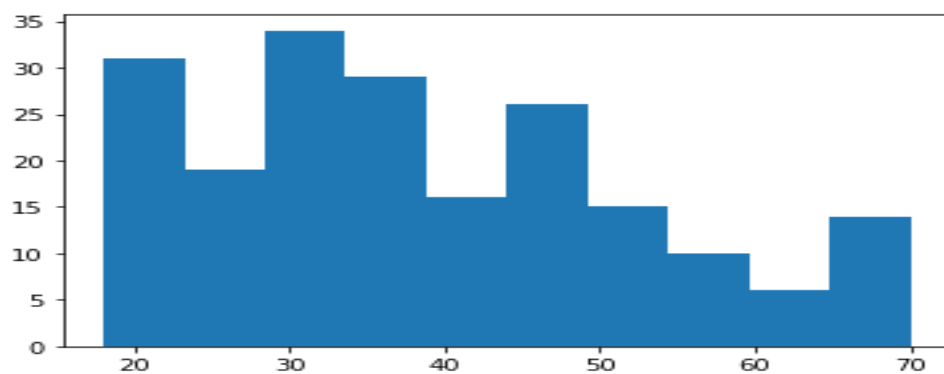
#### Solution:

```
(200, 5)
```

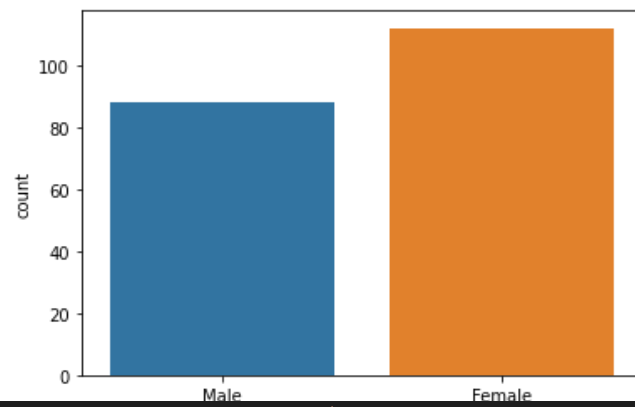
#### Question-2:

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

#### Solution:

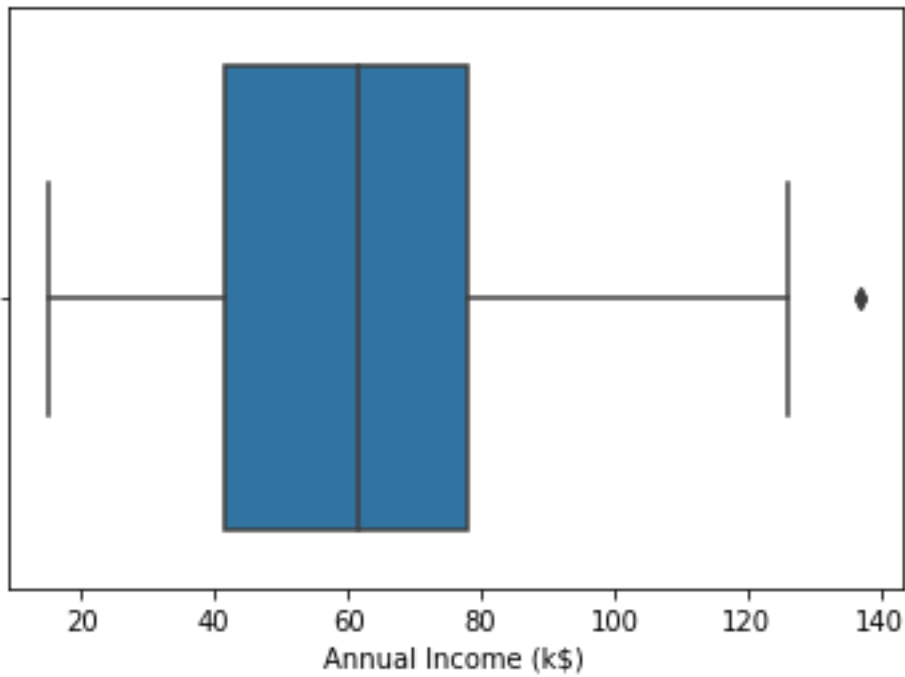


```
sns.countplot(data.Gender)
```



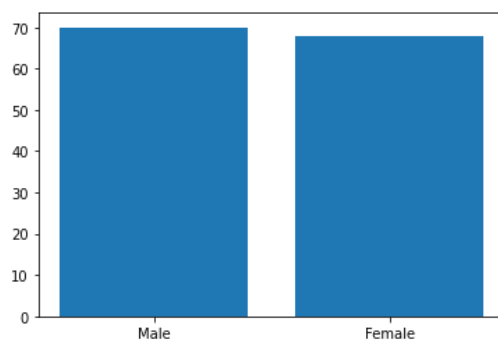
```
sns.boxplot(data['Annual Income (k$)'])
```

**Solution:**



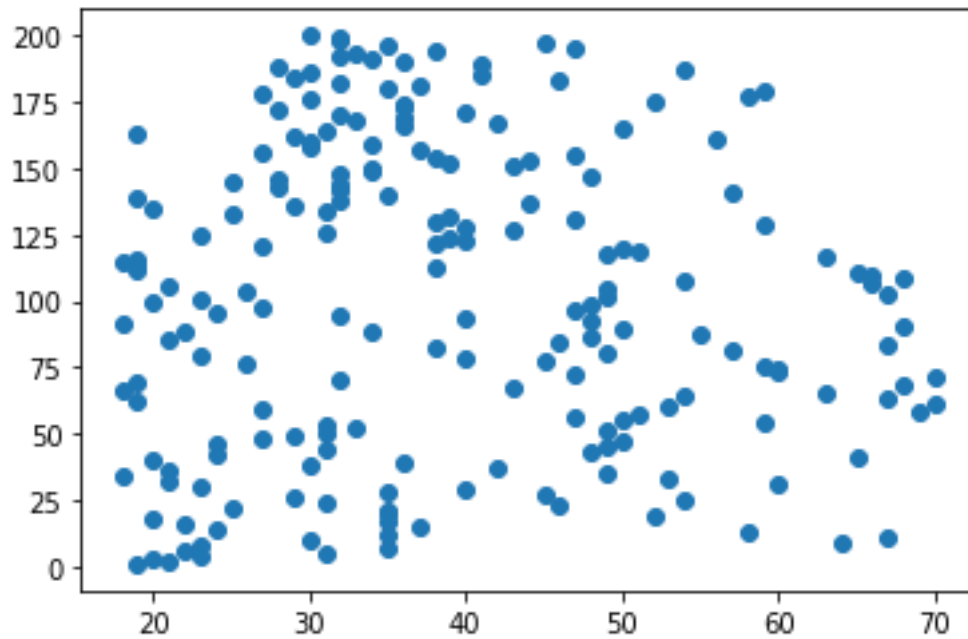
```
#Bi- Variate Analysis
```

```
plt.bar(data['Gender'], data['Age'])
```



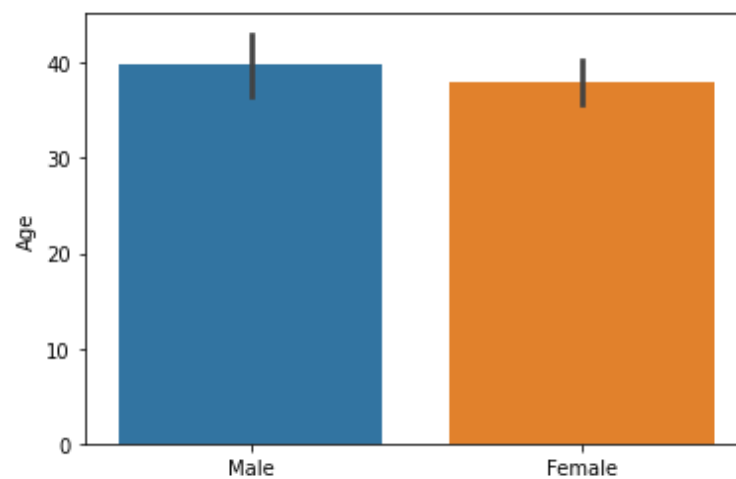
```
plt.scatter(data['Age'],data['CustomerID'])
```

Solution:



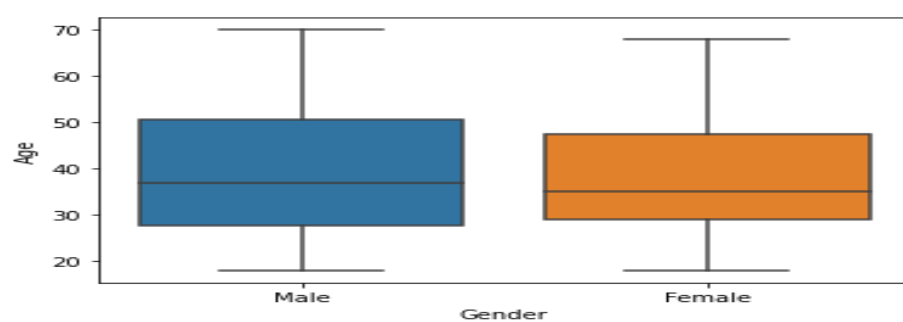
```
sns.barplot(x=data.Gender,y=data.Age)
```

Solution:



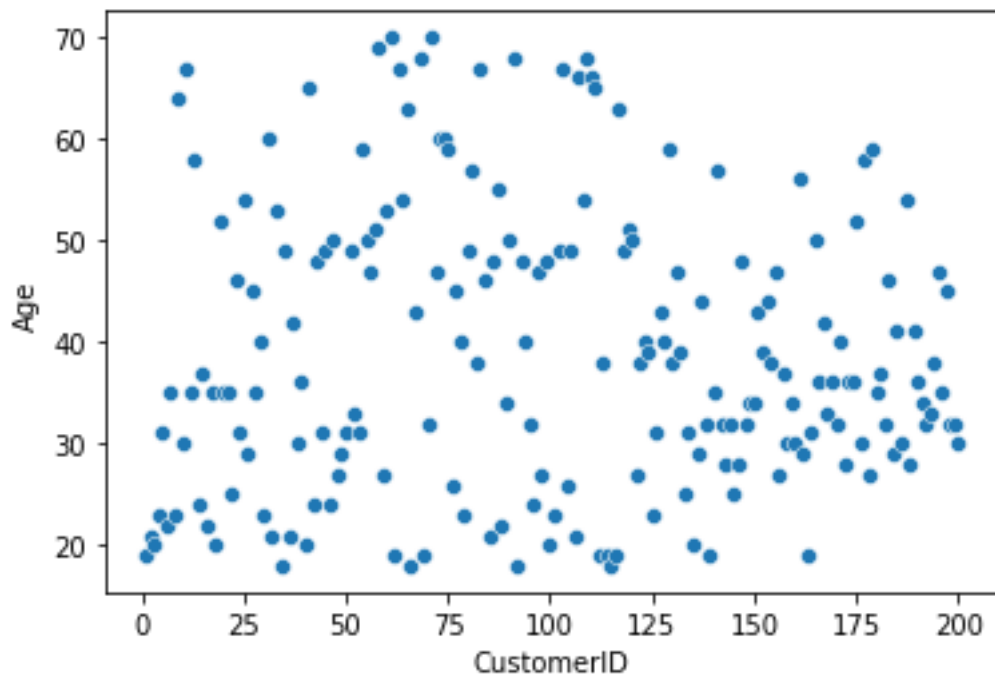
```
sns.boxplot(x=data.Gender,y=data.Age)
```

Solution:



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

**Solution:**



**Question-4:**

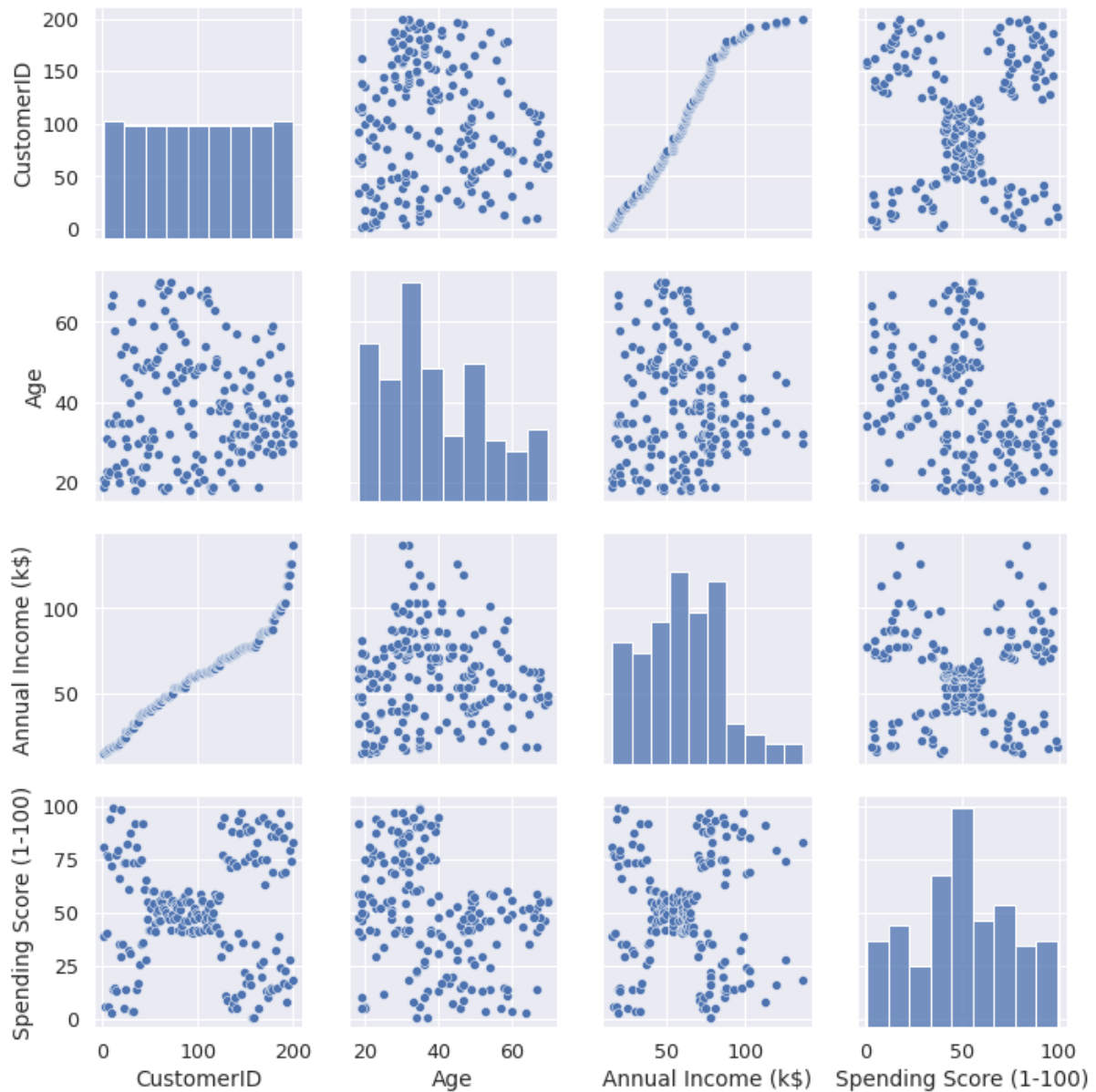
```
#Multi-Variate Analysis
sns.set(font_scale=1.15)
plt.figure(figsize=(30,15))
sns.heatmap(data.corr(),cmap='RdYlGn_r',annot=True,).set_title('Multivariate analysis')
```

**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:

	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

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

## Solution:

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 raise an error.
CustomerID      3359.000000
Age             195.133166
Annual Income (k$)  689.835578
Spending Score (1-100)  666.854271
dtype: float64
```

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

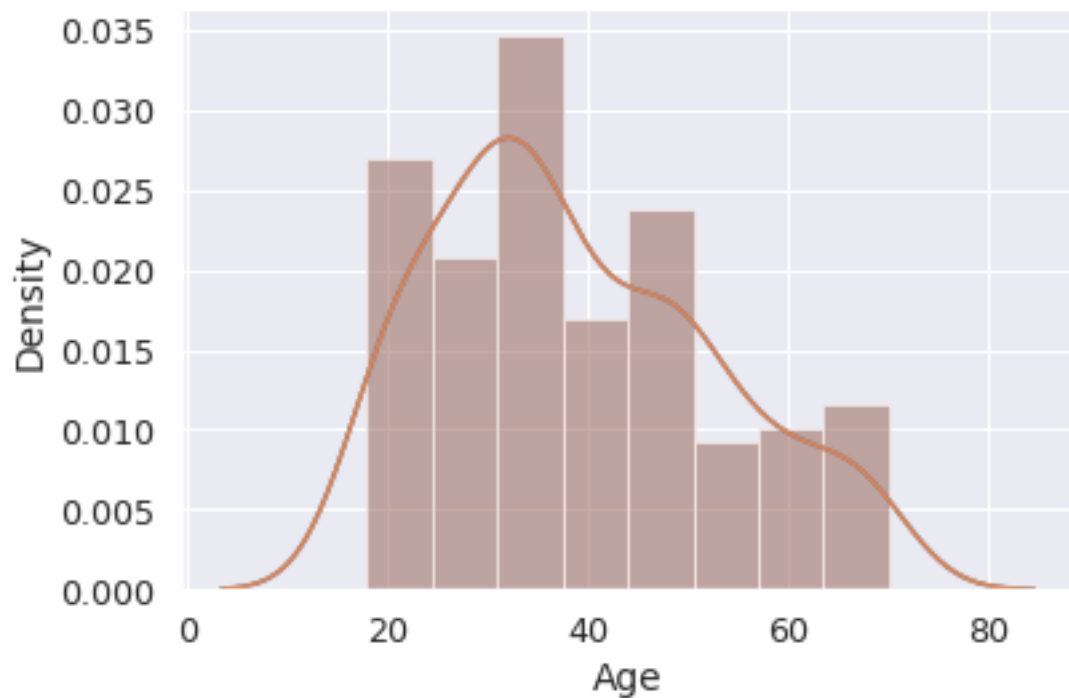
**Solution:**

```

/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 raise an error.
CustomerID      0.000000
Age             0.485569
Annual Income (k$)  0.321843
Spending Score (1-100) -0.047228
dtype: float64
```

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

**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:

```
[x] 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

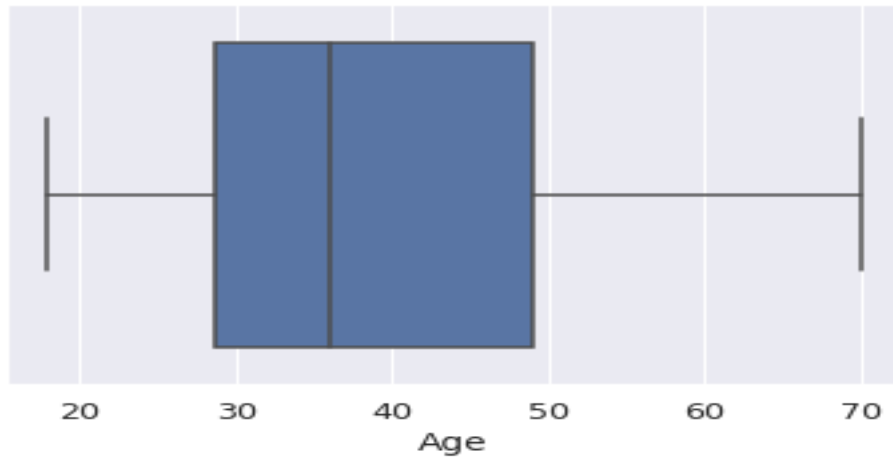
```
Q1 = data.Age.quantile(0.25)
Q3 = data.Age.quantile(0.75)
IQR = Q3 - Q1
lower_limit = Q1 - 1.5 * IQR
data.median(numeric_only=True)
```

### Solution:

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

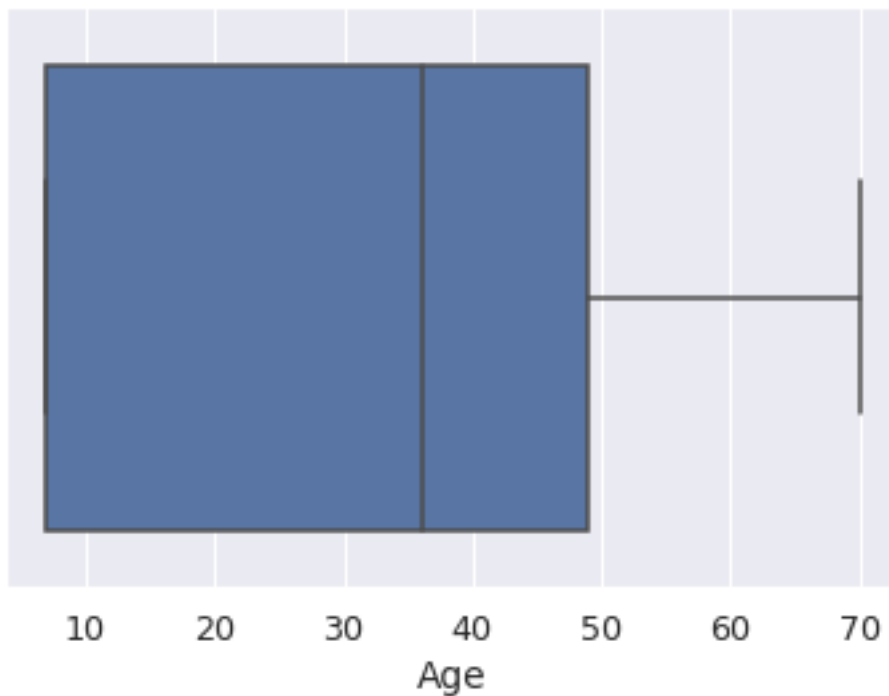
```
sns.boxplot(x=data.Age)
```

**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, -

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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,  
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1.81684904], [ 0.80541369, 1.12815215, 0.80373552, 0.62750542, -  
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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,  
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1.91002079], [ 0.99594166, -0.88640526, -1.04704552, 0.66567484,  
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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, -  
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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,
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1.4053405 ], [ 1.3769976 , 1.12815215, 0.21690251, 1.23821628,
1.54509812], [ 1.39431833, -0.88640526, 0.30718451, 1.390894 , -
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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, -
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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	-1.662960	-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 x 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++')
```

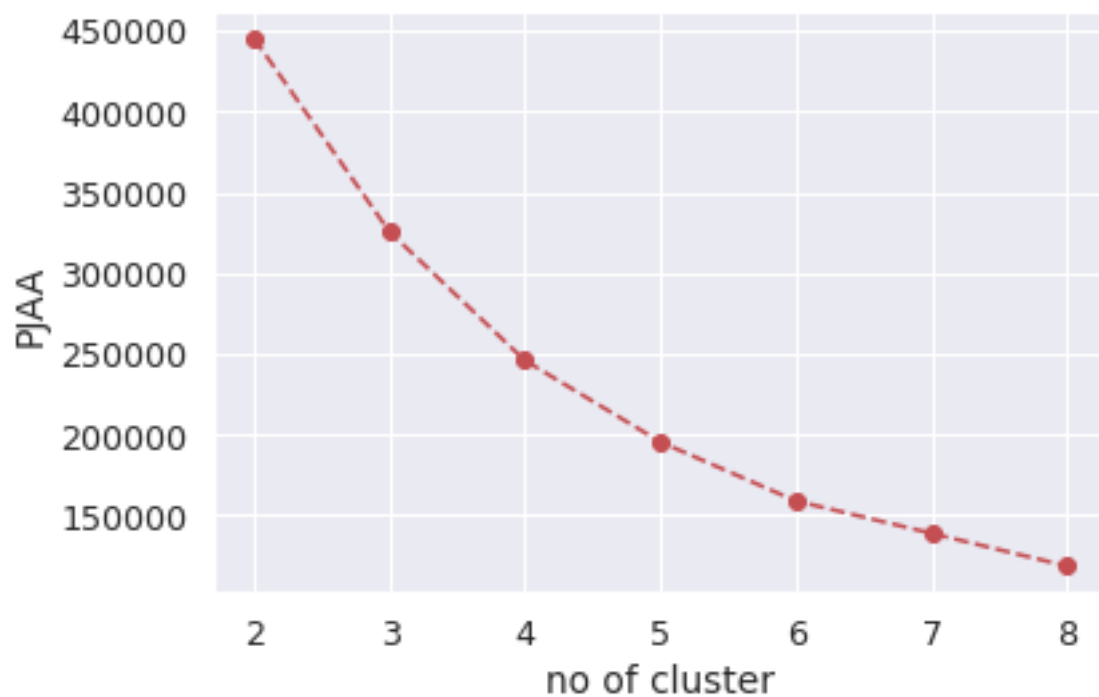
```
kmeans.fit(data)
PJAA.append(kmeans.inertia_)
PJAA
```

### 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, 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], 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
```

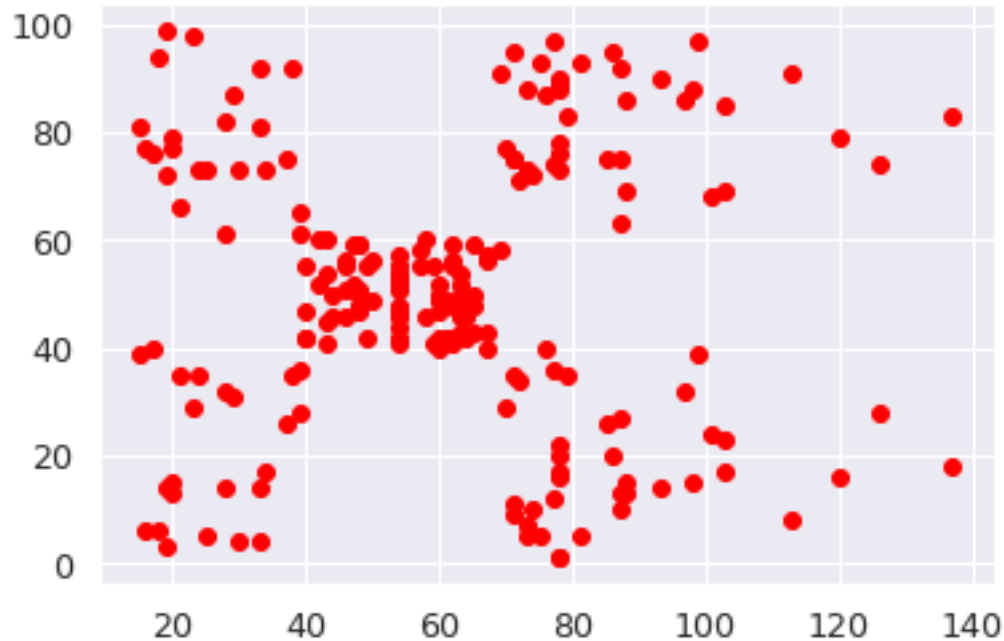
**Solution:**

```
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])
```

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

**Solution:**

```
0.025
```