Assignment 4
Python Programming

Assignment Date	25/10/2022
Student Name	Jaffrin Deno
Student Roll Number	311119106017
Maximum Marks	2 Marks

Question 1:

1 . Importing Required Package

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

Question 2:

2 . Loading the Datase

```
db = pd.read_csv('/content/Mall_Customers.csv')
db
```

```
     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]
```

Question 3:

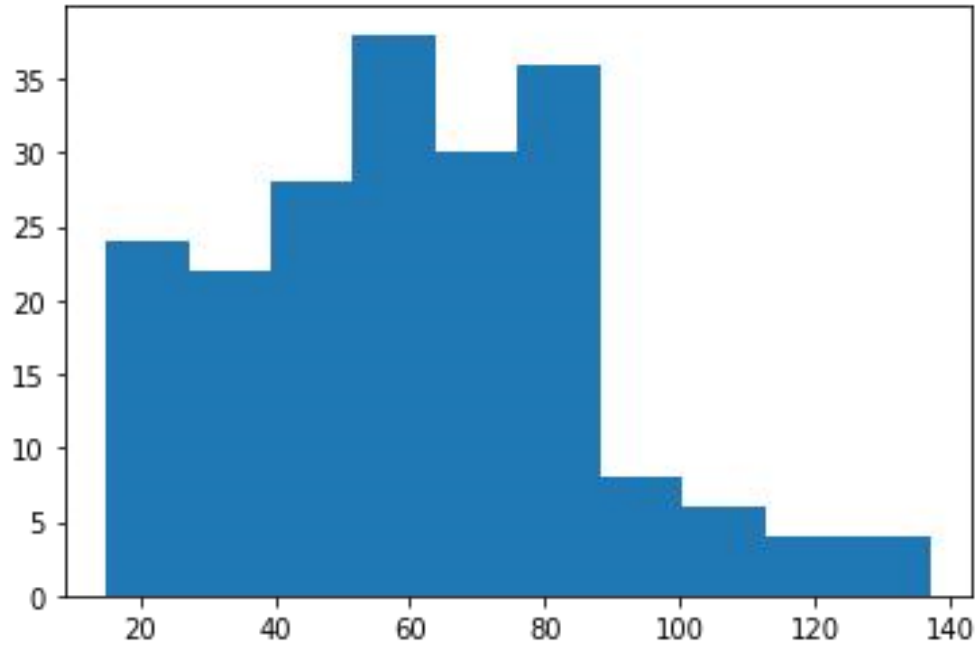
3. Visualizations

3.1 UniVariate Analysis 3.1.1

Solution

```
plt.hist(db['Annual
Income (k$)'])
```

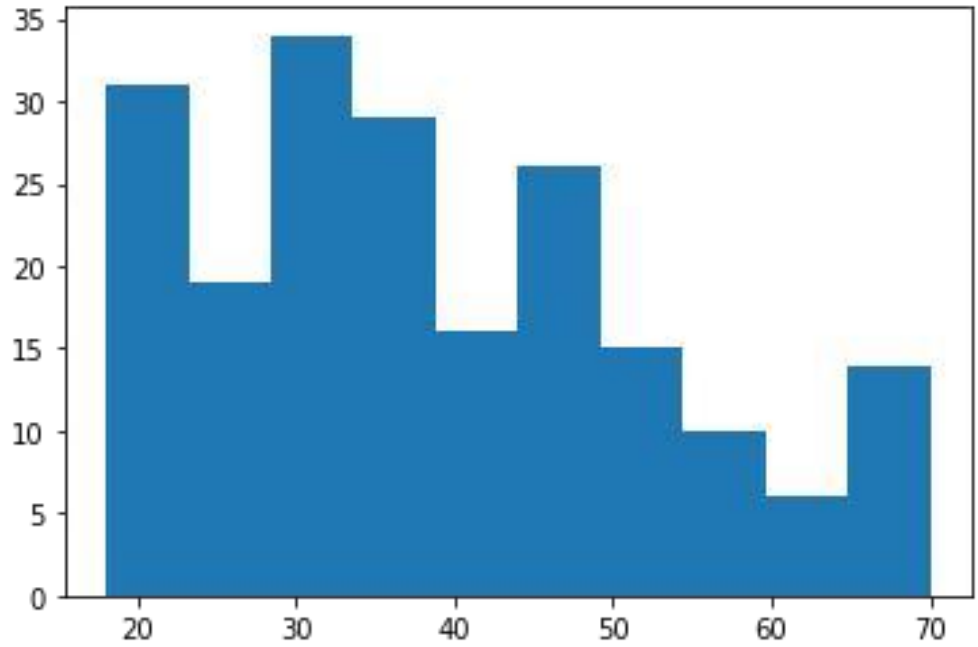
```
(array([24., 22., 28., 38., 30., 36., 8., 6., 4., 4.]), array([ 15. ,
 27.2, 39.4, 51.6, 63.8, 76. , 88.2, 100.4, 112.6, 124.8, 137. ]),
 <a list of 10 Patch objects>)
```



3.1.2 Solution

```
plt.hist(db['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>)
```



3.1.3 Solution

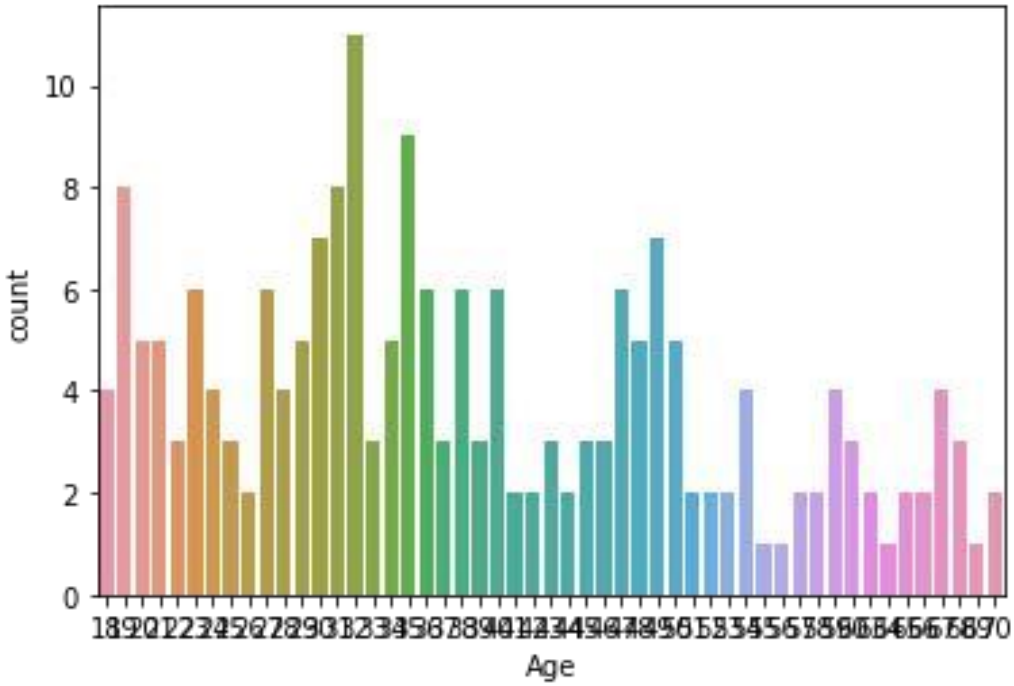
```
sbn.countplot(db['Age'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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.

FutureWarning

<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0afd0090>
```



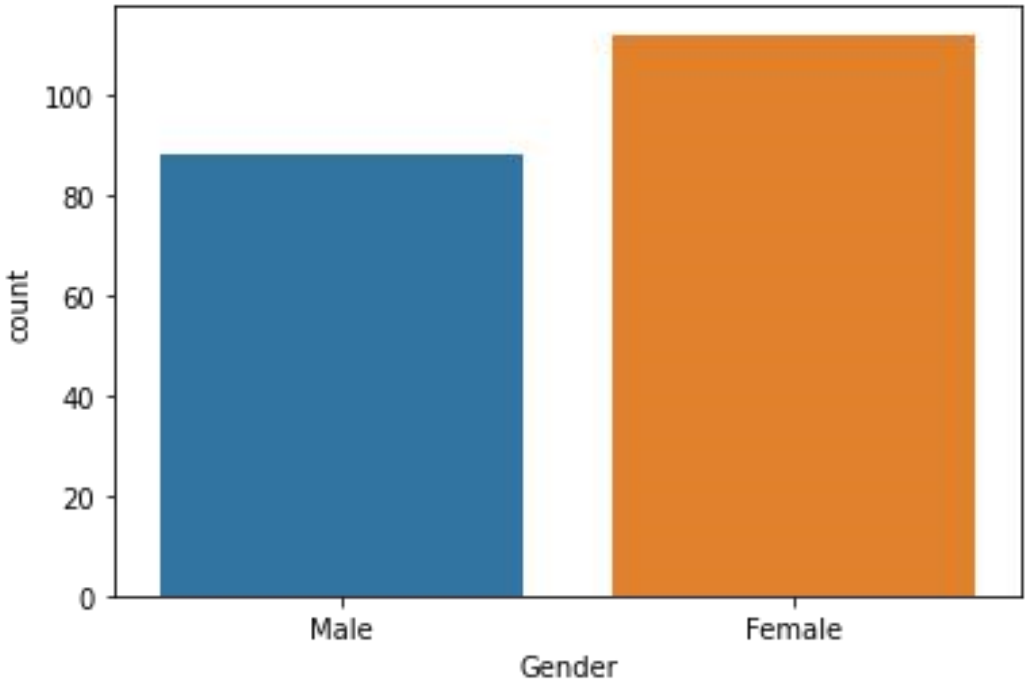
3.1.4 Solution

```
sbn.countplot(db['Gender

'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning

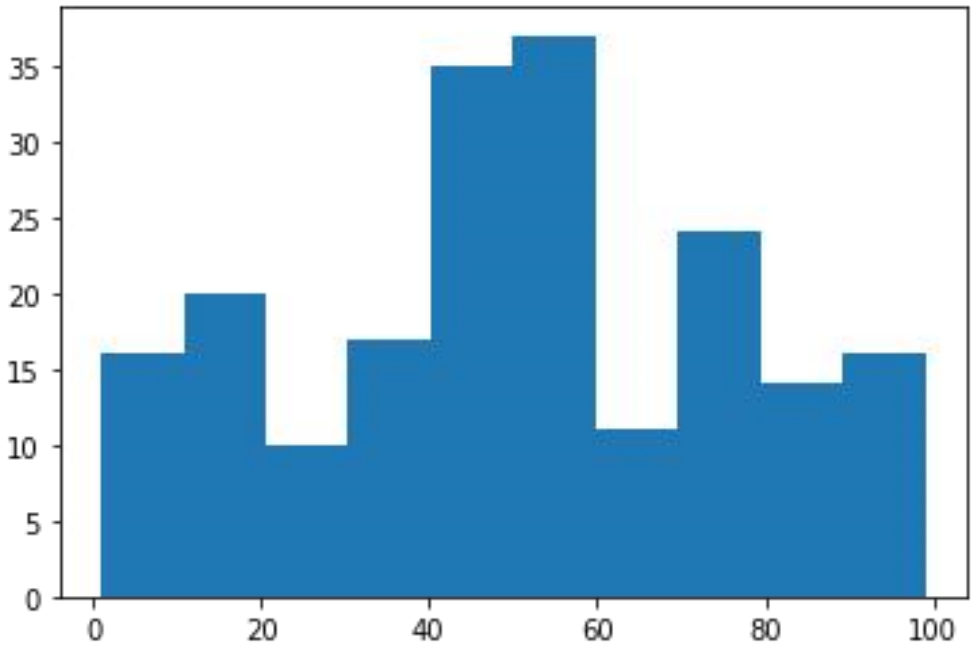
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0ae45790>
```



3.1.5 Solution

```
plt.hist(db['Spending
Score (1-100)'])
```

```
(array([16., 20., 10., 17., 35., 37., 11., 24., 14., 16.]), array([ 1. ,
 10.8, 20.6, 30.4, 40.2, 50. , 59.8, 69.6, 79.4, 89.2, 99. ]), <a list of
 10 Patch objects>)
```

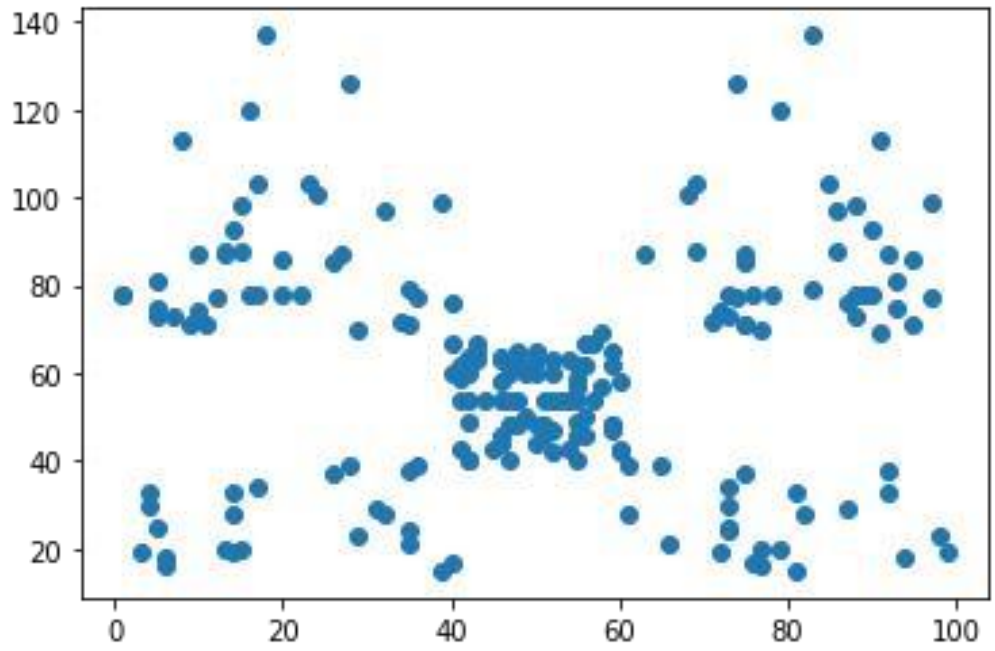


3.2 Bi-Variate Analysis

3.2.1 Solution

```
plt.scatter(db['Spending Score (1-100)'],db['Annual Income (k$)'])
```

```
<matplotlib.collections.PathCollection at 0x7f4b0acfadd0>
```



3.2.2 Solution

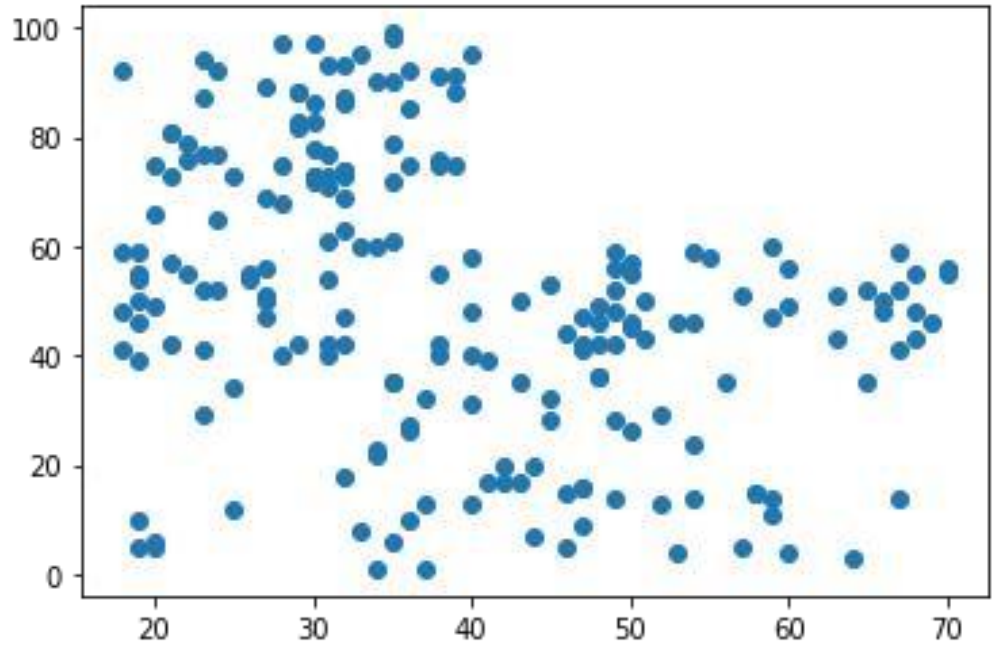
```
plt.scatter(db['Gender'],db['Annual Income (k$)'])
```

```
<matplotlib.collections.PathCollection at 0x7f4b0acd3410>
```

3.2.3 Solution

```
plt.scatter(db['Age'],db['Spending Score
(1-100)'])
```

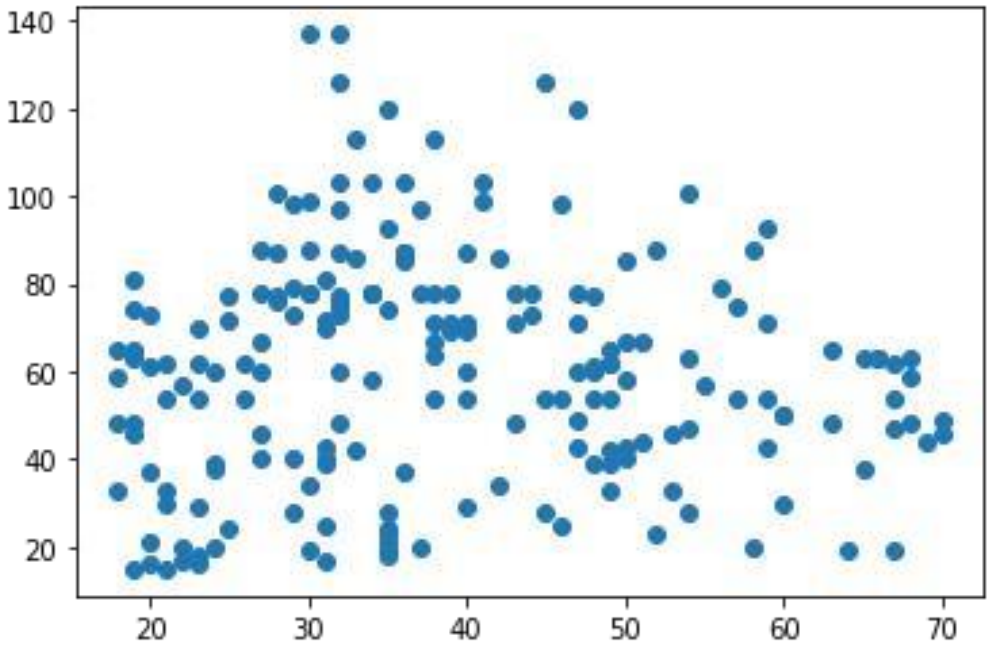
```
<matplotlib.collections.PathCollection at 0x7f4b0aca6550>
```



3.2.4 Solution

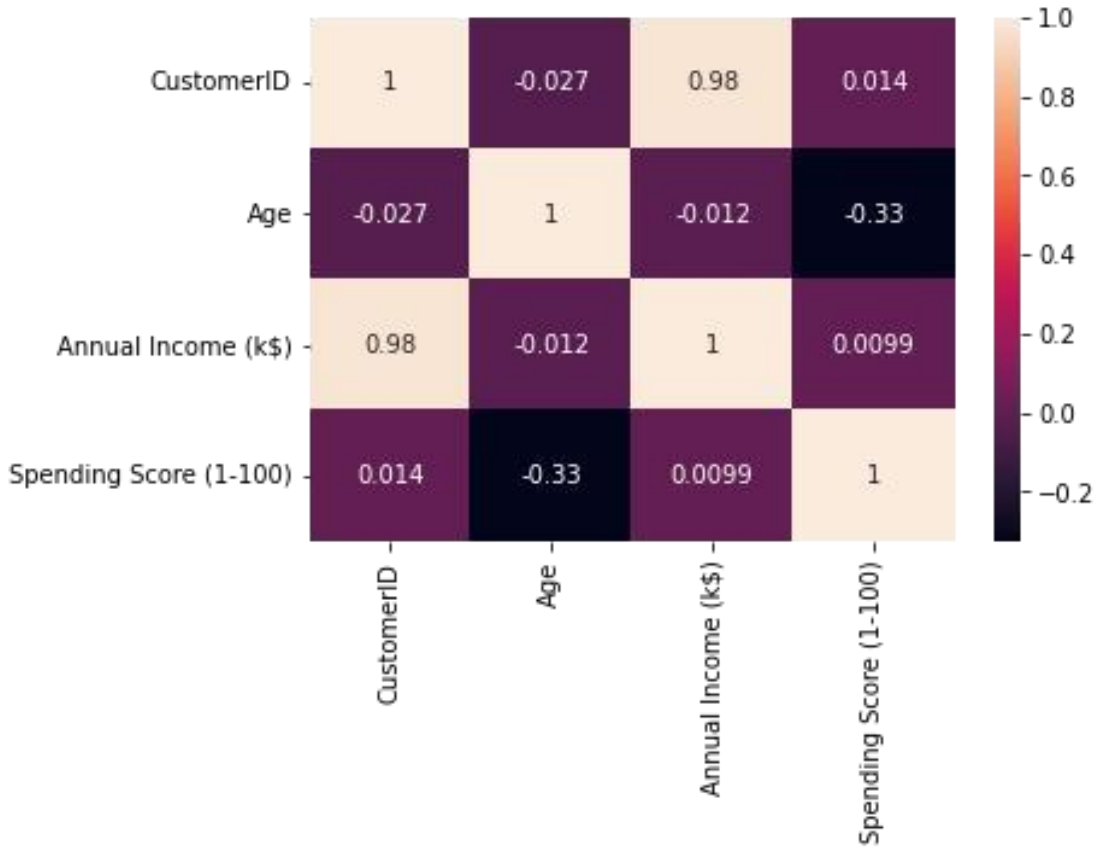
```
plt.scatter(db['Age'],db['Annual Income
```

```
(k$)'])
<matplotlib.collections.PathCollection at
0x7f4b0c009790>
```



3.2.5 Solution

```
sbn.heatmap(db.corr(), annot
= True)
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0b527450>
```

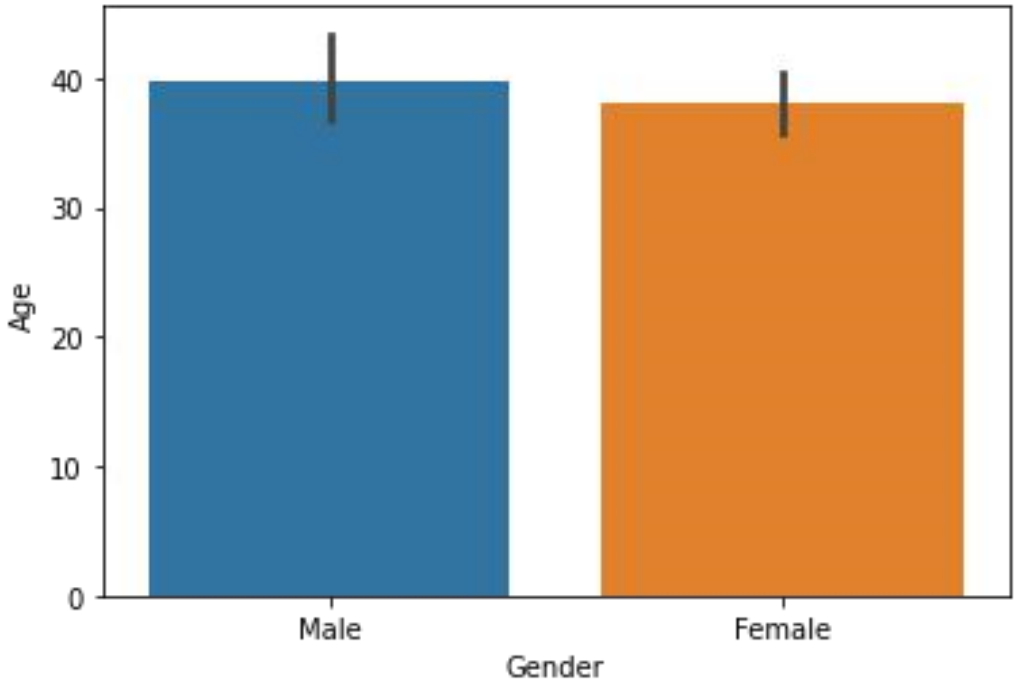


3.2.6 Solution

```
sbn.barplot(db['Gender'],
db['Age'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b0830c450>
```

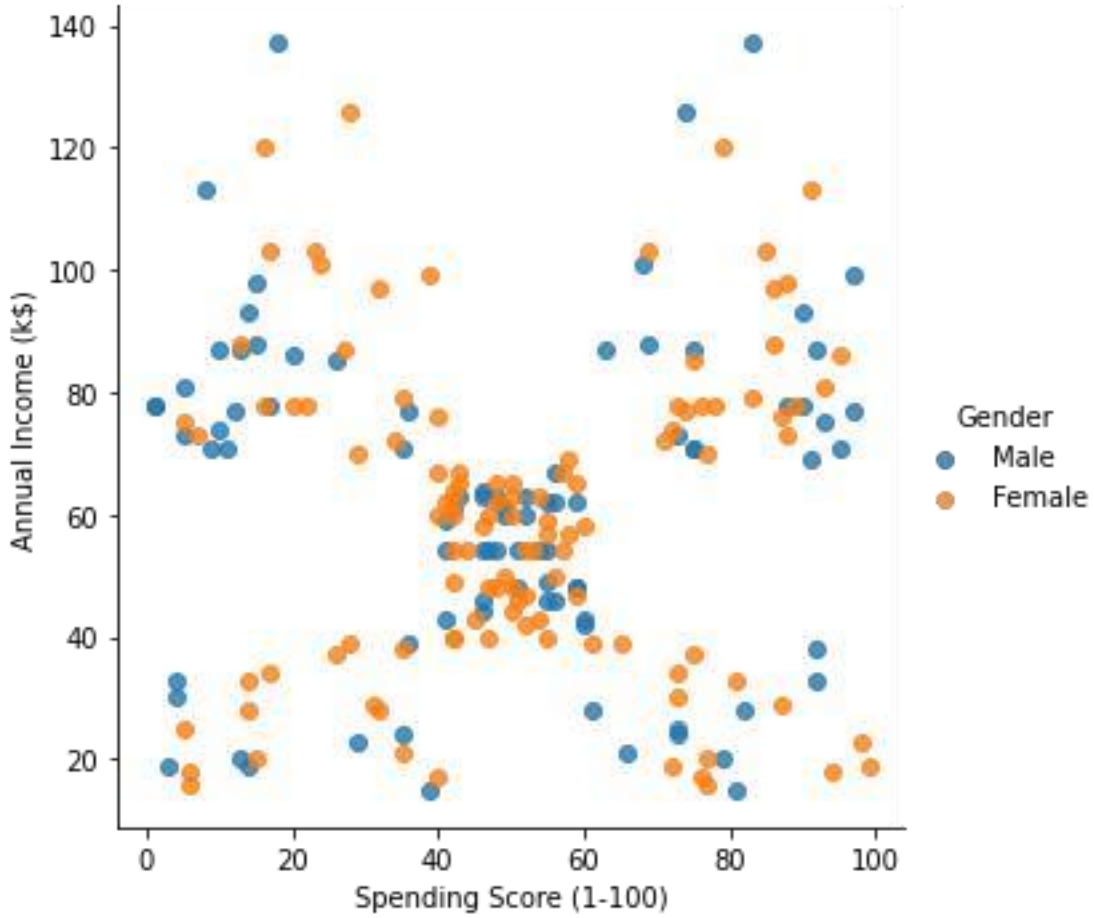


3.3 Multi-Variate Analysis

3.3.1 Solution

```
sbn.lmplot("Spending Score (1-100)","Annual Income (k$)", db, hue="Gender",
fit_reg=False);
```

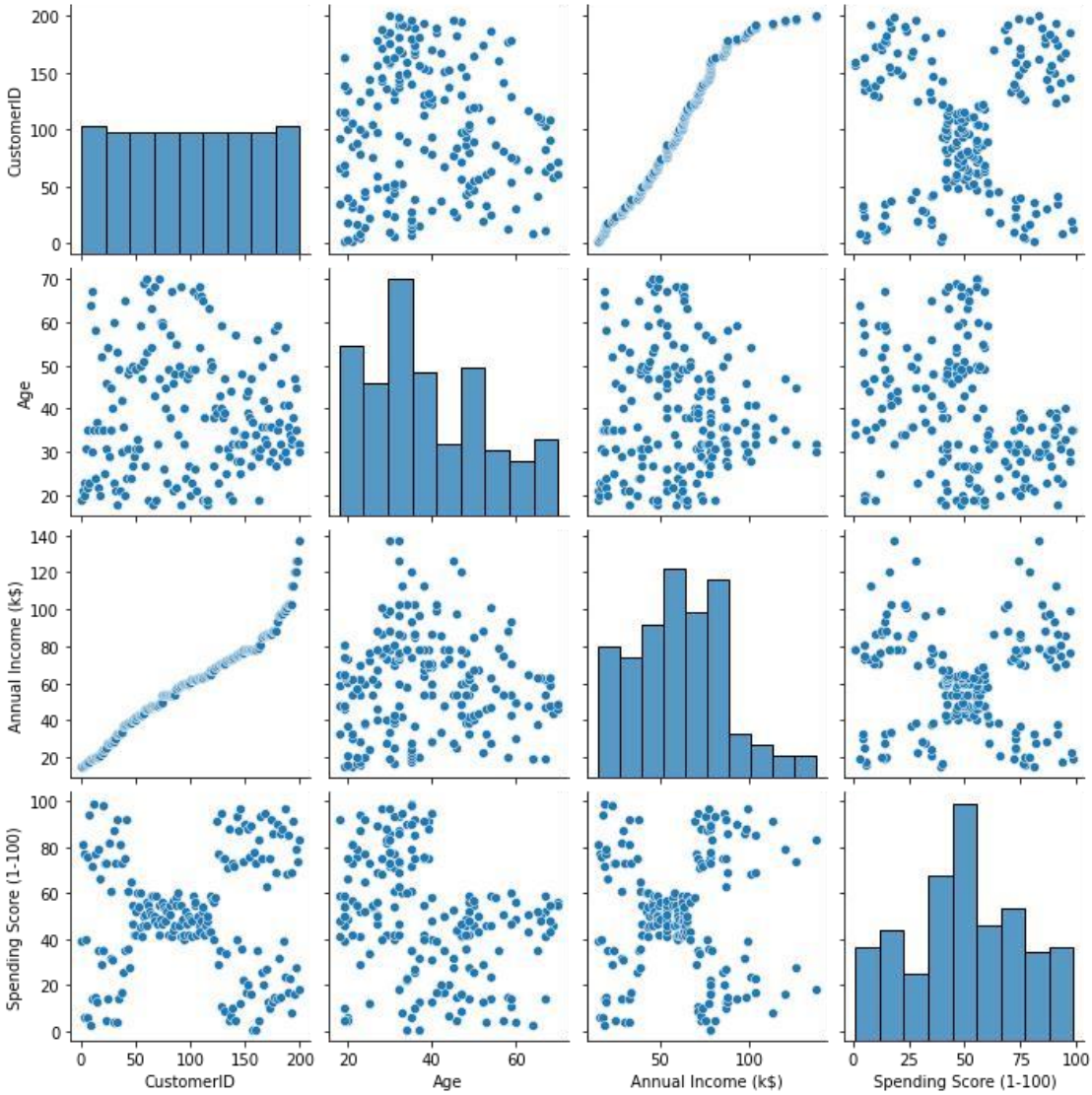
```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
FutureWarning: Pass the following variables as keyword args: x, y, data. From
version 0.12, the only valid positional argument will be `data`, and passing
other arguments without an explicit keyword will result in an error or
misinterpretation.
  FutureWarning
```



3.3.2 Solution

```
sbn.pairplot(db)
```

```
<seaborn.axisgrid.PairGrid at 0x7f4b081f76d0>
```



Question 4:

4. Perform descriptive statistics on the dataset 4.1

Solution `db.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

4.2 Solution

```
db.dtypes
```

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

4.3 Solution

```
db.var()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
TypeError. Select only valid columns before calling the reduction.
"""Entry point for launching an IPython kernel.
```

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

4.4 Solution

```
db.skew()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
TypeError. Select only valid columns before calling the reduction.
"""Entry point for launching an IPython kernel.
```

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

4.5 Solution

```
db.corr()
```

```
                      CustomerID    Age Annual Income (k$) \ CustomerID
1.000000 -0.026763      0.977548
Age                     -0.026763 1.000000          -0.012398
Annual Income (k$)        0.977548 -0.012398           1.000000
Spending Score (1-100)    0.013835 -0.327227           0.009903
                      Spending Score (1-100)
CustomerID                          0.013835
Age                                -0.327227
Annual Income (k$)                  0.009903
Spending Score (1-100)              1.000000
```

4.6 Solution

```
db.std()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
TypeError. Select only valid columns before calling the reduction.
"""Entry point for launching an IPython kernel.
```

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

Question 5:

5. Check for Missing values and deal with them 5.1 Solution

```
db.isna().sum()
```

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

5.2 Solution

```
db.isna().sum().sum()
```

```
0
```

5.3 Solution

```
db.duplicated().sum()
```

```
0
```

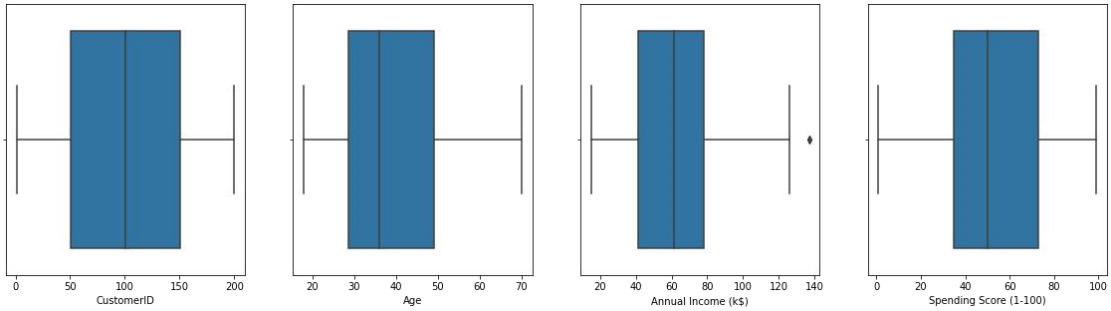
Question 6:

6 . Find the outliers and replace them outliers

6.1 Solutiion

```
ig,ax=plt.subplots(figsize=(25,5))
plt.subplot(1, 5, 2)
sbn.boxplot(x=db['Age'])
plt.subplot(1, 5, 3)
sbn.boxplot(x=db['Annual Income (k$)'])
plt.subplot(1, 5, 4)
sbn.boxplot(x=db['Spending Score (1-100)'])
plt.subplot(1, 5, 1)
sbn.boxplot(x=db['CustomerID'])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b061aa610>
```



6.2 Solution

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

```
      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
```

6.3 Solution

```
q.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
```

6.4 Solution

```
q.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
```

6.5 Solution

```
IQR=q.iloc[1]-q.iloc[0]
IQR
```

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

```
dtype: float64
```

6.6 Solution

```
upper=q.iloc[1] + (1.5 *IQR)
upper
```

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

6.7 Solution

```
lower=q.iloc[0] - (1.5* IQR)
lower
```

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

6.8 Solution

```
db.mean()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: FutureWarning:
Dropping of nuisance columns in DataFrame reductions (with
'numeric_only=None') is deprecated; in a future version this will raise
TypeError. Select only valid columns before calling the reduction.
"""Entry point for launching an IPython kernel.
```

```
CustomerID              100.50
Age                      38.85
Annual   Income   (k$)   60.56
Spending  Score  (1-100)  50.20
dtype:   float64
```

6.9 Solution

```
db['Annual Income (k$)'].max()
```

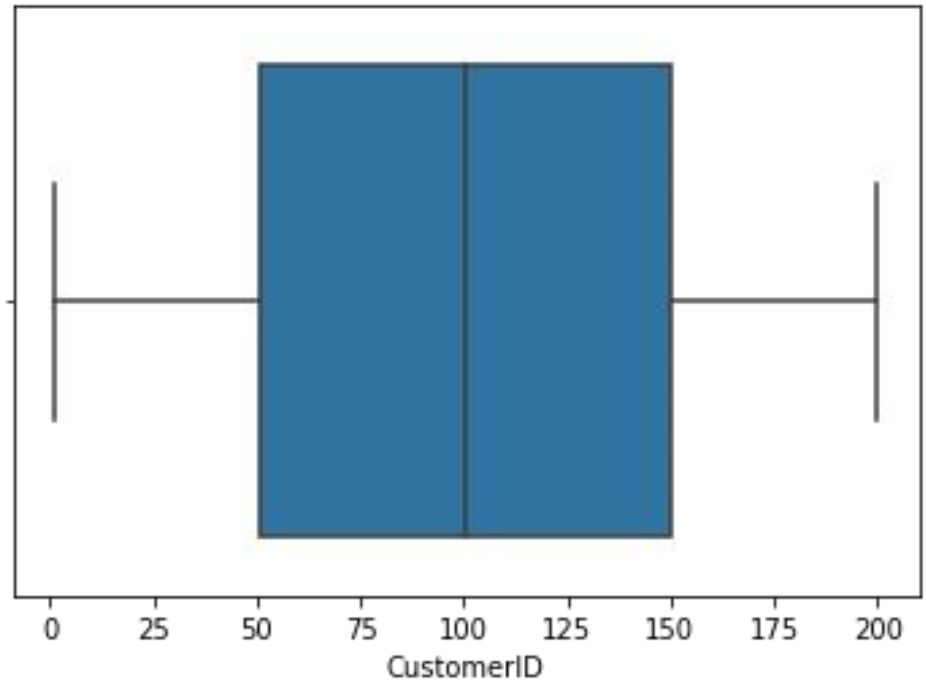
```
137
```

6.10 Solution

```
sbn.boxplot(db['CustomerID'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f94da48bfd0>
```

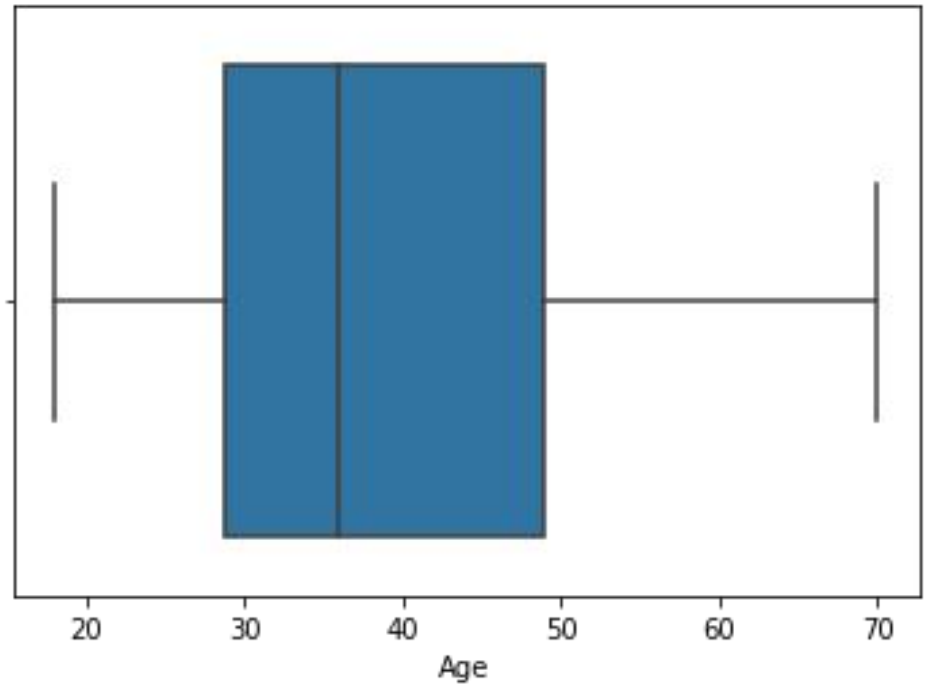


6.11 Solution

```
sbn.boxplot(db['Age'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b06126f10>
```

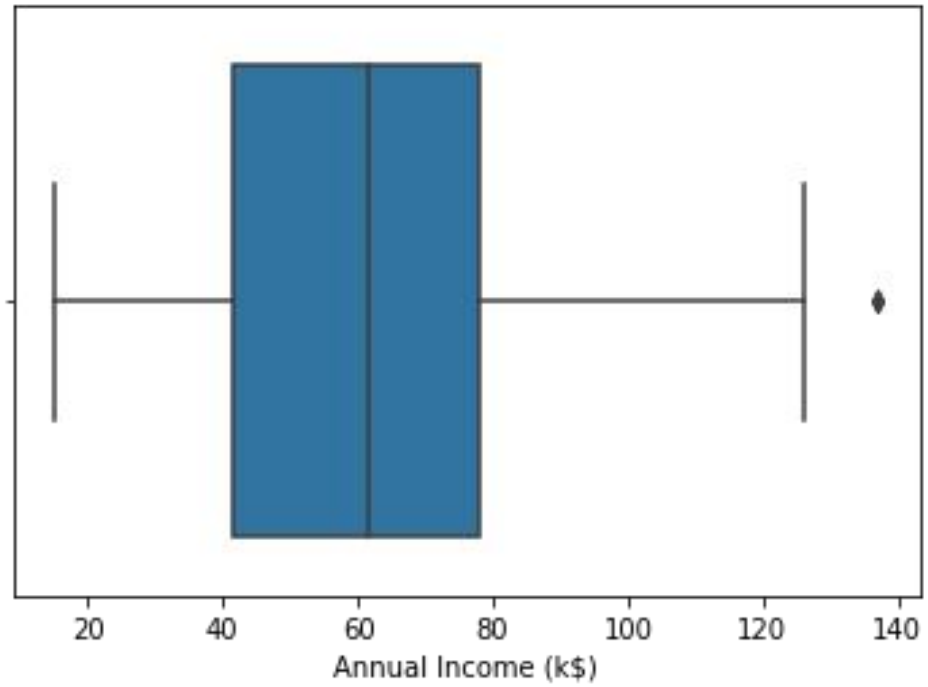


6.12 Solution `sbn.boxplot(db['Annual`

`Income (k$)'])`

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning
```

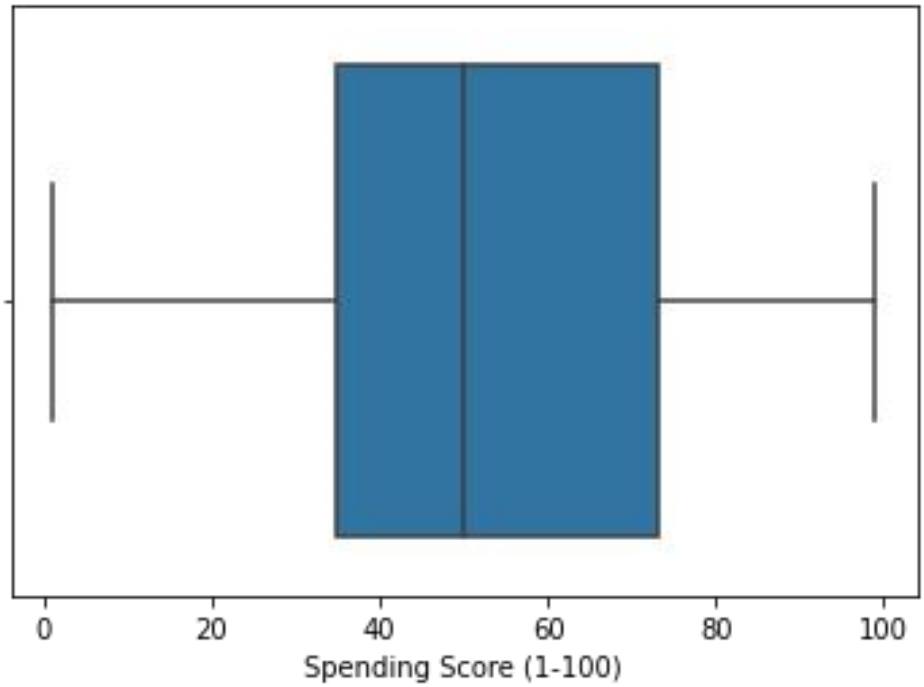
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f94da411d10>
```



6.13 Solution `sbn.boxplot(db['Spending Score (1-100)'])`

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43:
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. FutureWarning
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4b060a9c10>
```



Question 7 7. Check for Categorical columns and perform encoding 7.1 Solution

```
db.select_dtypes(include='object').columns
```

```
Index(['Gender'], dtype='object')
```

7.2 Solution

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

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

7.3 Solution

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

```
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  137   18

199         200    1 30  137   83

[200 rows x 5 columns]
```

7.4 Solution

```
db.head()
```

```
   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
```

Question 8 8 . Scaling the data 8.1 Solution

```
from sklearn.preprocessing import StandardScaler
ss = StandardScaler().fit_transform(db) ss
```

```
array([[-1.7234121 , 1.12815215, -1.42456879, -1.73899919, -0.43480148],
       [-1.70609137, 1.12815215, -1.28103541, -1.73899919, 1.19570407],
       [-1.68877065, -0.88640526, -1.3528021 , -1.70082976, -1.71591298], [-
       1.67144992, -0.88640526, -1.13750203, -1.70082976, 1.04041783],
       [-1.6541292 , -0.88640526, -0.56336851, -1.66266033, -0.39597992],
       [-1.63680847, -0.88640526, -1.20926872, -1.66266033, 1.00159627],
       [-1.61948775, -0.88640526, -0.27630176, -1.62449091, -1.71591298],
       [-1.60216702, -0.88640526, -1.13750203, -1.62449091, 1.70038436],
       [-1.5848463 , 1.12815215, 1.80493225, -1.58632148, -1.83237767],
       [-1.56752558, -0.88640526, -0.6351352 , -1.58632148, 0.84631002],
       [-1.55020485, 1.12815215, 2.02023231, -1.58632148, -1.4053405 ],
      [-1.53288413, -0.88640526, -0.27630176, -1.58632148, 1.89449216], [-
       1.5155634 , -0.88640526, 1.37433211, -1.54815205, -1.36651894], [-
       1.49824268, -0.88640526, -1.06573534, -1.54815205, 1.04041783], [-
         1.48092195, 1.12815215, -0.13276838, -1.54815205, -1.44416206],
       [-1.46360123, 1.12815215, -1.20926872, -1.54815205, 1.11806095],
       [-1.4462805 , -0.88640526, -0.27630176, -1.50998262, -0.59008772],
       [-1.42895978, 1.12815215, -1.3528021 , -1.50998262, 0.61338066], [-
       1.41163905, 1.12815215, 0.94373197, -1.43364376, -0.82301709],
       [-1.39431833, -0.88640526, -0.27630176, -1.43364376, 1.8556706 ],
       [-1.3769976 , 1.12815215, -0.27630176, -1.39547433, -0.59008772],
       [-1.35967688, 1.12815215, -0.99396865, -1.39547433, 0.88513158],
       [-1.34235616, -0.88640526, 0.51313183, -1.3573049 , -1.75473454],
       [-1.32503543, 1.12815215, -0.56336851, -1.3573049 , 0.88513158],
```

[-1.30771471, -0.88640526, 1.08726535, -1.24279661, -1.4053405], [-1.29039398, 1.12815215, -0.70690189, -1.24279661, 1.23452563],
[-1.27307326, -0.88640526, 0.44136514, -1.24279661, -0.7065524],
[-1.25575253, 1.12815215, -0.27630176, -1.24279661, 0.41927286],
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```

Question 9:

9 . Perform any of the clustering algorithms

9.1 Solution `from sklearn.cluster import`

`KMeans`

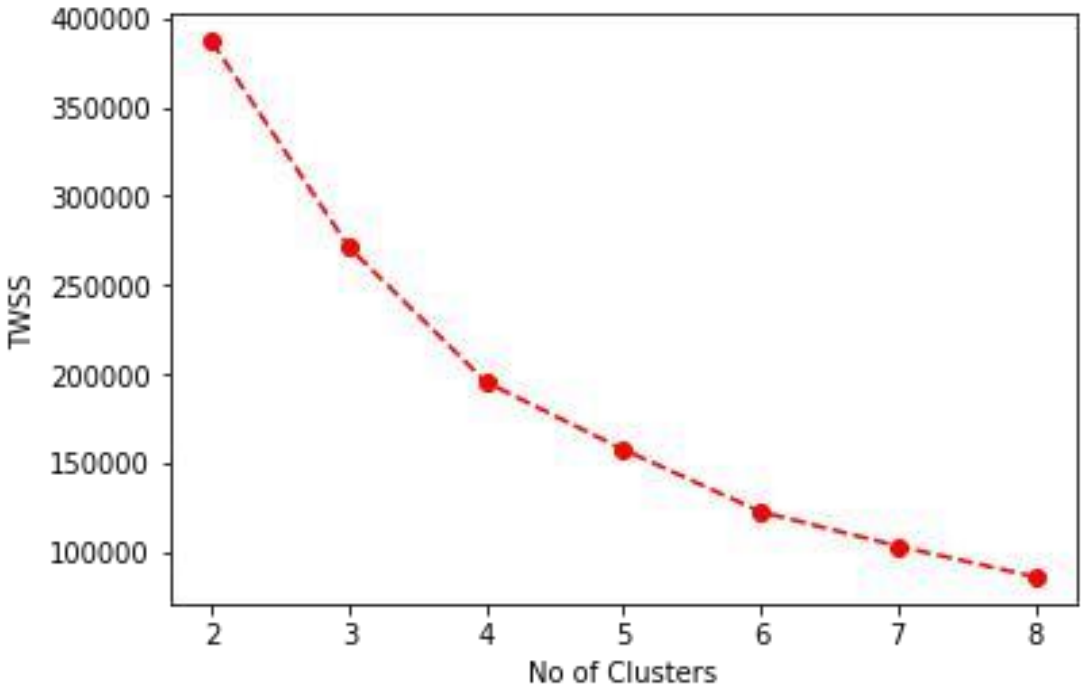
```
TWSS = [] k =
list(range(2,9)) for
i in k:
  kmeans=KMeans(n_clusters=i, init='k-means++')
  kmeans.fit(db)
  TWSS.append(kmeans.inertia_)
TWSS
```

```
[387065.71377137717,
 271384.508782868,
 195401.19855991466,
 157620.9714797914,
 122625.19813553878,
 103244.10476410593,
 86053.67444777445]
```

9.2 Solution

```
plt.plot(k,TWSS, 'ro--')
plt.xlabel('No of Clusters')
plt.ylabel('TWSS')
```

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



9.3 Solution

```
model = KMeans(n_clusters = 4)
model.fit(db)
```

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

9.4 Solution

```
mb = pd.Series(model.labels_)
db['Cluster'] = mb db
```

```
         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  137   18
199         200    1 30  137   83

     Cluster
0          3
1          3
2          3
3          3
4          3
.. ...195                                                              26
196 0                                                                  27
197                                                                    27
198 0                                                                  27
199                                                                    27

[200 rows x 6 columns]
```

9.5 Solution

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

   Cluster
0        3
1        3
2        3
```

Question 10

10 . Add the cluster data with the primary dataset 10.1

Solution

```
db['Cluster']=kmeans.labels_
db.head()
```

```
       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

   Cluster
0        6
1        5
2        6
3        5
4        6
```

10.2 Solution

```
db.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  137   18
199         200    1 30  137   83

     Cluster
195        3
196        1
197        3
198        1
199        3
```

Question 11

11 . Split the data into dependent and independent variables

11.1 Solution

```
X=db.drop('Cluster',axis=1)
Y=db['Cluster']
y=db['Cluster'] y
```

```
0      6
1      5
2      6
3      5
4      6
      ..
195    3
196    1
197    3
198    1
199    3
Name: Cluster, Length: 200, dtype: int32
```

11.2 Solution

```
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
=42)
print("Number transactions X_train dataset: ", X_train.shape)
print("Number transactions y_train dataset: ", y_train.shape)
print("Number transactions X_test dataset: ", X_test.shape)
print("Number transactions y_test dataset: ", y_test.shape)
```

```
Number transactions X_train dataset: (160, 5)
Number transactions y_train dataset: (160,)
Number transactions X_test dataset: (40, 5)
Number transactions y_test dataset: (40,)
```

Question 12 12 . Split the data into training and testing

12.1 Solution

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

79          80       0 49                54                      42

197        198       1 32               126                      74

38          39       0 36                37                      26

24          25       0 54                28                      14

122        123       0 40                69                      58

..         ...     ... ...               ...                     ...

106        107       0 66                63                      50

14          15       1 37                20                      13

92          93       1 48                60                      49
```

179 180 1 35 93 90

102 103 1 67 62 59

[160 rows x 5 columns]

12.2 Solution

X_test

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

95 96 1 24 60 52

15 16 1 22 20 79

30 31 1 60 30 4

158 159 1 34 78 1

128 129 1 59 71 11

115 116 0 19 65 50

69 70 0 32 48 47

170 171 1 40 87 13

174 175 0 52 88 13

45 46 0 24 39 65

66 67 0 43 48 50

182 183 1 46 98 15

165 166 0 36 85 75

78 79 0 23 54 52

186 187 0 54 101 24

177 178 1 27 88 69

56 57 0 51 44 50

152 153 0 44 78 20

82 83 1 67 54 41

68 69 1 19 48 59

124 125 0 23 70 29

16 17 0 35 21 35

148 149 0 34 78 22

93	94	0 40	60	40
65	66	1 18	48	59
60	61	1 70	46	56
84	85	0 21	54	57
67	68	0 68	48	48
125	126	0 31	70	77
132	133	0 25	72	34
9	10	0 30	19	72
18	19	1 52	23	29
55	56	1 47	43	41
75	76	1 26	54	54
150	151	1 43	78	17
104	105	1 49	62	56
135	136	0 29	73	88
137	138	1 32	73	73
164	165	1 50	85	26
76	77	0 45	54	53

12.3 Solution

```
y_train

79     6

197    2

38     4

24     4

122 7

..

106    7

14     4

92     7

179    2
```

```
102    7

Name: Cluster, Length: 160, dtype: int32
```

12.4 Solution

```
y_test
```

```
95     4
15     5
30     6
158    2
128    2
115    4
69     0
170    1
174    1
45     5
66     0
182    1
165    3
78     4
186    1
177    3
56     0
152    2
82     0
68     0
124    2
16     6
148    2
93     4
65     0
60     0
84     4
67     0
125    7
132    2
9      5
18     6
55     0
75     0
150    2
104    4
135    7
137    7
164    1
```

```
76     0
Name: Cluster, dtype: int32
```

Question 13

13 . Build the Model 13. Solution

```
from sklearn.linear_model import LogisticRegression
model=LogisticRegression()
model.fit(X_train, y_train)
```

```
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,
```

```
LogisticRegression()
```

Question 14

14. Train the Model 14.

Solution

```
model.score(X_train,y_train)
```

```
0.85
```

Question 15

15 . Test the Model 15.

Solution

```
model.score(X_test,y_test)
```

```
0.725
```

Question 16 16. Measure the performance using

Evaluation Metrics 16. Solution

```
from sklearn.metrics import confusion_matrix,classification_report
y_pred=model.predict(X_test) confusion_matrix(y_test,y_pred)
```

```
array([[8, 0, 0, 0, 3, 0, 0, 0],
```

```
[0, 2, 3, 0, 0, 0, 0, 0],
[0, 3, 4, 0, 0, 0, 0, 0],
[0, 0, 0, 1, 0, 0, 0, 1],
[0, 0, 0, 1, 5, 0, 0, 0],
[0, 0, 0, 0, 0, 3, 0, 0],
[0, 0, 0, 0, 0, 0, 3, 0],
[0, 0, 0, 0, 0, 0, 0, 3]])
```