ASSIGNMENT-4
CUSTOMERSEGMENTATIONANALYSIS

Assignment Date	28October2022
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MaximumMarks	2 Marks

Importing the
librariesimport pandas
as pd**import**numpy**as**
np
importmatplotlib.pyplot**as**plt
importseaborn**as**sns

Loadingthe dataset:
Input:

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

Output:

	CustomerID	Gender	Age	AnnualIncome (k$)	SpendingScore(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

200rows× 5columns

Encoding Categorical

ColumnsInput:

```
from sklearn.preprocessing import
LabelEncoderle =LabelEncoder()
df['Gender'] =
le.fit_transform(df['Gender'])df
```

Output:

	CustomerID	Gender	Age	AnnualIncome(k$)	Spending Score(1-100)	Cluster
0	1	1	19	15.00	39	2
1	2	1	21	15.00	81	2
2	3	0	20	16.00	6	2
3	4	0	23	16.00	77	2
4	5	0	31	17.00	40	2
...	...	...	...	...	...	...
195	196	0	35	120.00	79	3
196	197	0	45	126.00	28	1
197	198	1	32	126.00	74	3
198	199	1	32	60.55	18	1
199	200	1	30	60.55	83	3

200rows ×6 columns

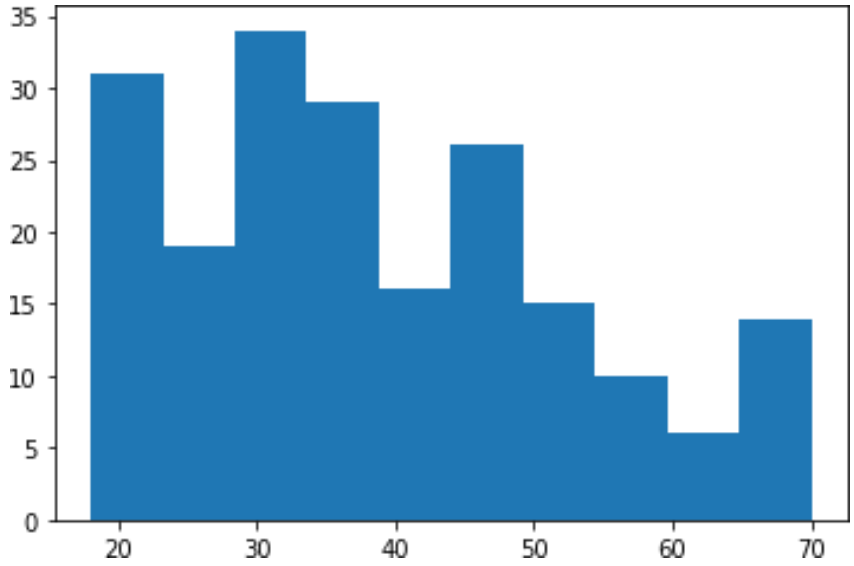
VisualizationsUniv ariateAnalysis

Input:

```
plt.hist(df['Age'])
```

Output:

```
(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.]),
  )
```

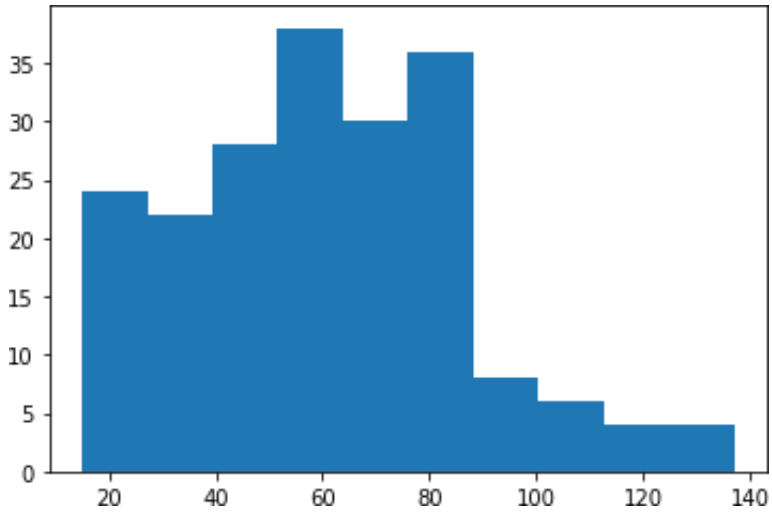


Input:

```
plt.hist(df['AnnualIncome(k$)'])
```

Output:

```
(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.]),
  )
```

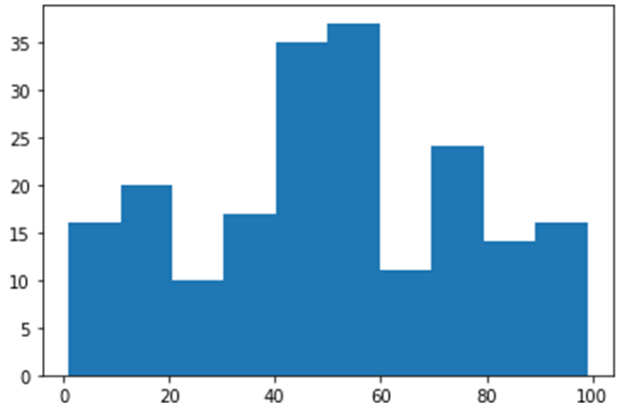


Input:

```
plt.hist(df['SpendingScore(1-100)'])
```

Output:

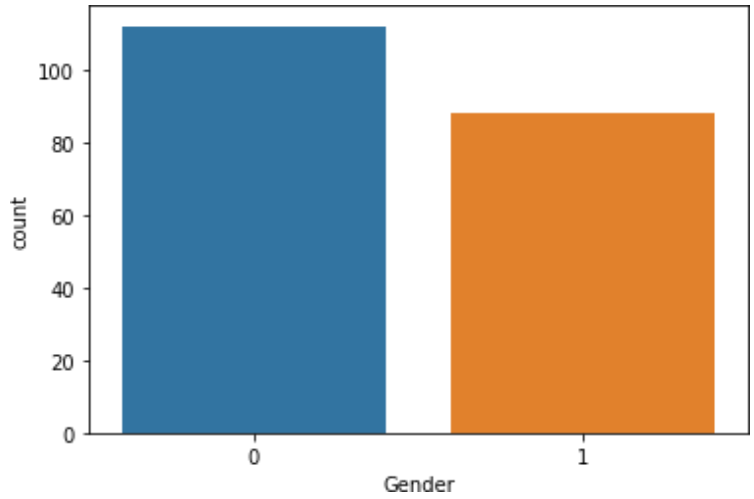
```
(array([16.,20.,10.,17.,35.,37.,11.,24.,14.,16.]),
  array([1.,10.8,20.6,30.4,40.2,50.,59.8,69.6,79.4,89.2,99.]),
  )
```



Input:

sns.countplot(df['Gender'])

Output:

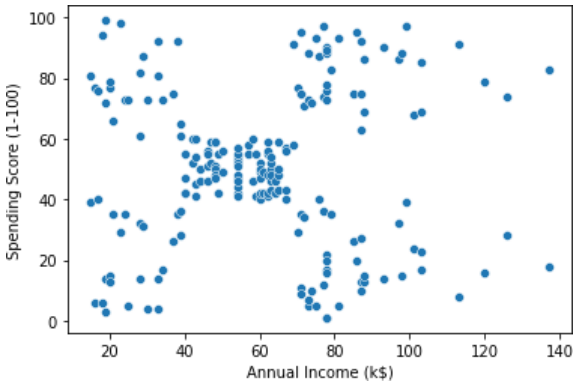


Bi-VariateAnalysis

Input:

sns.scatterplot(df['AnnualIncome(k$)'],df['SpendingScore(1-100)'])

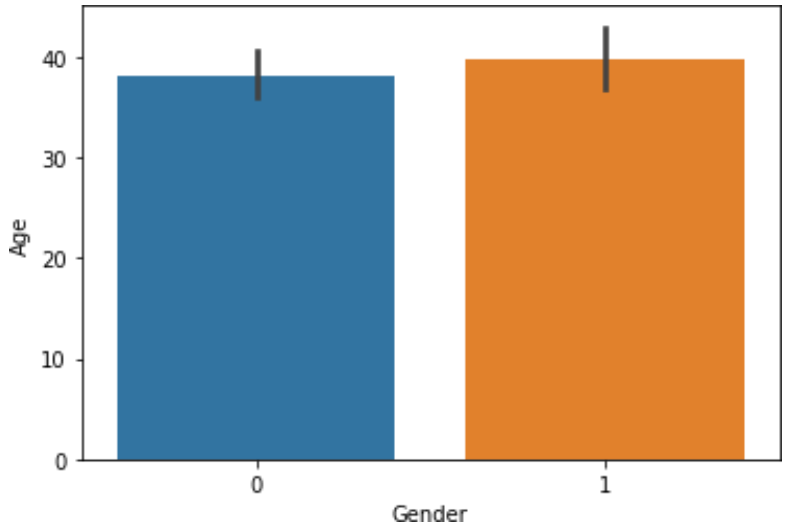
Output:



Input:

sns.barplot(df['Gender'],df['Age'])

Output:



Input:

sns.heatmap(df.corr(),annot=**True**)

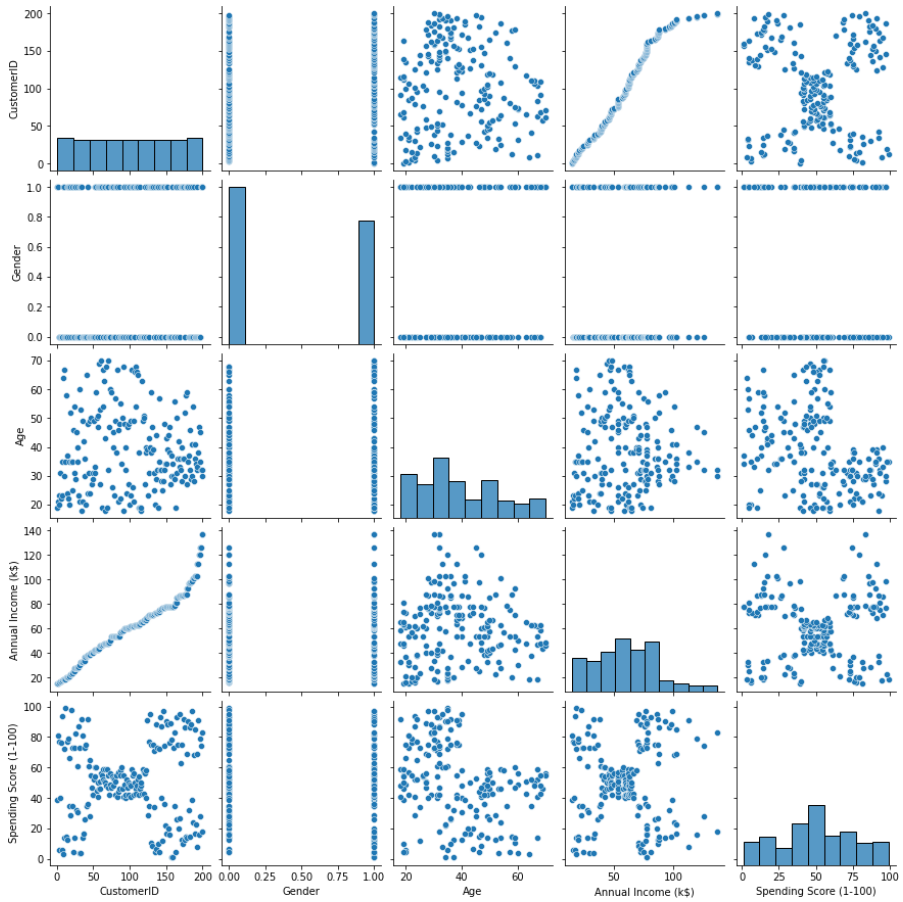
Output:

Multi-variate

AnalysisInput:

sns.pairplot(df)

output:



DescriptiveStatistics

Input:

df.info()

Output:

RangeIndex: 200 entries, 0 to 199Datacolumns(total5columns):

#	Column	Non-NullCount	Dtype
0	CustomerID	200 non-null	int64
1	Gender	200 non-null	int64
2	Age	200 non-null	int64
3	AnnualIncome (k$)	200 non-null	int64
4	SpendingScore(1-100)	200non-null	int64dtypes:int64(5)

memoryusage:7.9KB

Input:

df.describe()

Output:

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

	CustomerID	Gender	Age	AnnualIncome(k$)	Spending Score(1-100)
count	200.000000	200.000000	200.000000	200.000000	200.000000
mean	100.500000	0.440000	38.850000	60.560000	50.200000
std	57.879185	0.497633	13.969007	26.264721	25.823522
min	1.000000	0.000000	18.000000	15.000000	1.000000
25%	50.750000	0.000000	28.750000	41.500000	34.750000
50%	100.500000	0.000000	36.000000	61.500000	50.000000
75%	150.250000	1.000000	49.000000	78.000000	73.000000
max	200.000000	1.000000	70.000000	137.000000	99.000000

Input:

df.skew()

Output:

CustomerID 0.000000
Gender 0.243578
Age 0.485569
AnnualIncome (k$) 0.321843
SpendingScored (1-100) -0.047220
type:float64

Input:

df.kurt()

Output:

CustomerID -1.200000
Gender -1.960375
Age -0.671573
AnnualIncome (k$) -0.098487
SpendingScore(1-100) -
0.826629dtype:float64

Input:

df.corr()

Output:

	CustomerID	Gender	Age	AnnualIncome(k$)	SpendingScore(1-100)
CustomerID	1.000000	0.057400	-0.026763	0.977548	0.013835
Gender	0.057400	1.000000	0.060867	0.056410	-0.058109
Age	-0.026763	0.060867	1.000000	-0.012398	-0.327227
AnnualIncome(k$)	0.977548	0.056410	-0.012398	1.000000	0.009903
SpendingScore(1-100)	0.013835	-0.058109	-0.327227	0.009903	1.000000

Input:

df.var()

Output:

CustomerID 3350.000000
Gender 0.247638
Age 195.133166
AnnualIncome (k$) 689.835578
SpendingScored (1-100) 666.854271
type:float64

Input:

df.std()

Output:

CustomerID 57.879185
Gender 0.497633
Age 13.969007
AnnualIncome (k$) 26.264721
SpendingScore(1-100) 25.823522
dtype:float64

Checking for missing

valuesInput:

df.isna().sum()

Output:

```
CustomerID                    0
Gender                        0
Age                           0
AnnualIncome          (k$)    0
SpendingScore(1-100)          0
dtype:int64
```

Input:

```
df.isna().sum().sum()
```

Output:

0

Input:

```
df.duplicated().sum()
```

Output:

0

Finding &HandlingOuliers

Input:

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

Output:

	CustomerID	Gender	Age	AnnualIncome(k$)	SpendingScore(1-100)
0.25	50.75	0.0	28.75	41.5	34.75
0.75	150.25	1.0	49.00	78.0	73.00

Input:

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

Output:

```
CustomerID                    99.50
Gender                         1.00
Age                           20.25
AnnualIncome(k$)              36.50
SpendingScore(1-100)          38.25
dtype:float64
```

Input:

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

Output:

CustomerID 299.500
Gender 2.500
Age 79.375
AnnualIncome (k$) 132.750
SpendingScore(1-100)dtype:float64 130.375

Input: lower=quantile.iloc[0]lower -(1.5* IQR)

Output:

CustomerID -98.500
Gender -1.500
Age -1.625
AnnualIncome(k$) -13.250
SpendingScore(1-100)dtype:float64 -22.625

Input:

df.mean()

Output:

CustomerID 100.50
Gender 0.44
Age 38.85
AnnualIncome(k$) 60.56
SpendingScore(1-100) 50.20
dtype:float64

Input:

df['AnnualIncome(k$)'].max()

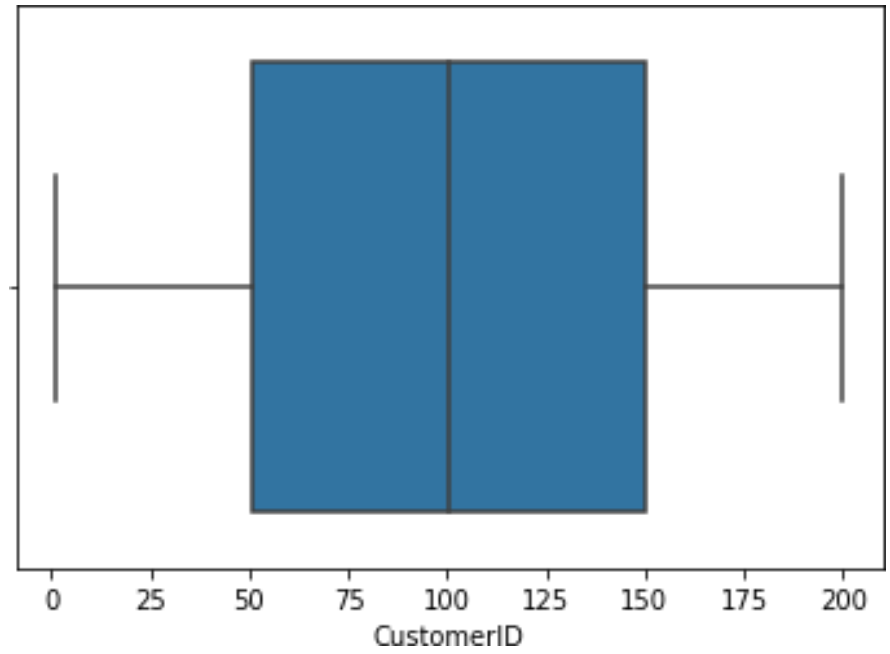
Output:

137

Input:

sns.boxplot(df['CustomerID'])

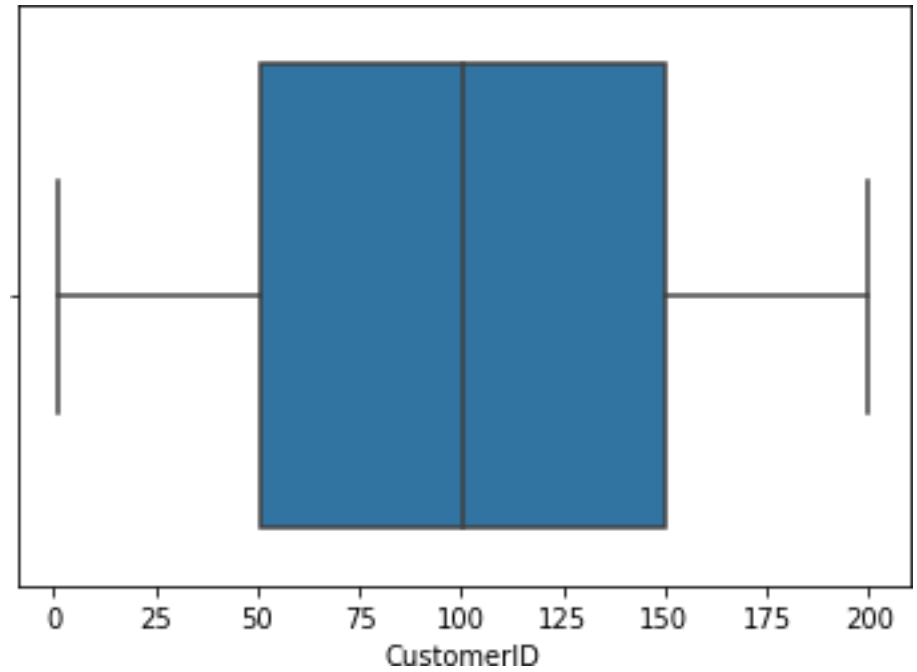
Output:



Input:

sns.boxplot(df['Gender'])

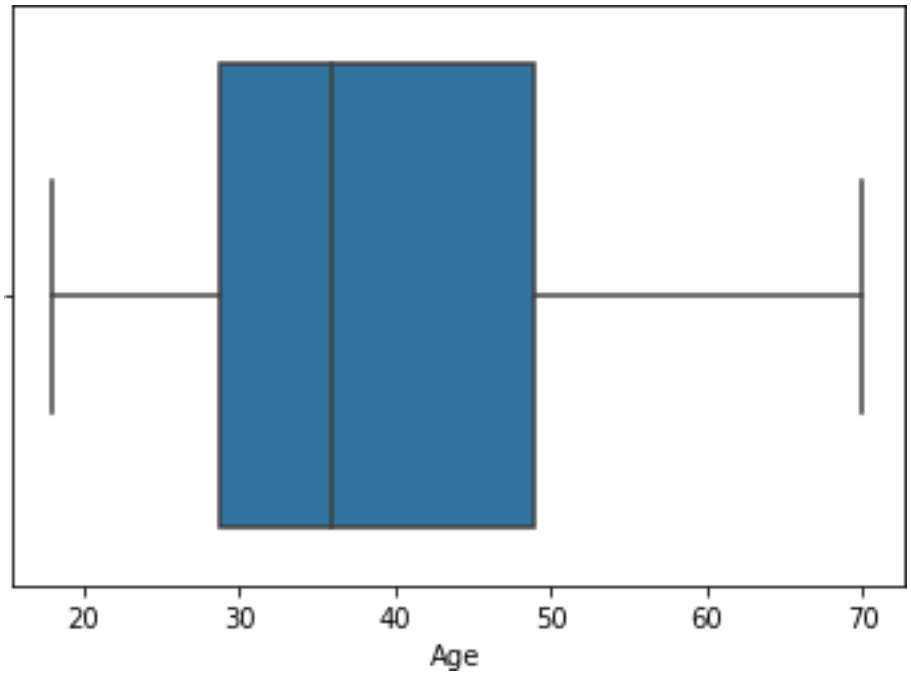
Output:



Input:

sns.boxplot(df['Age'])

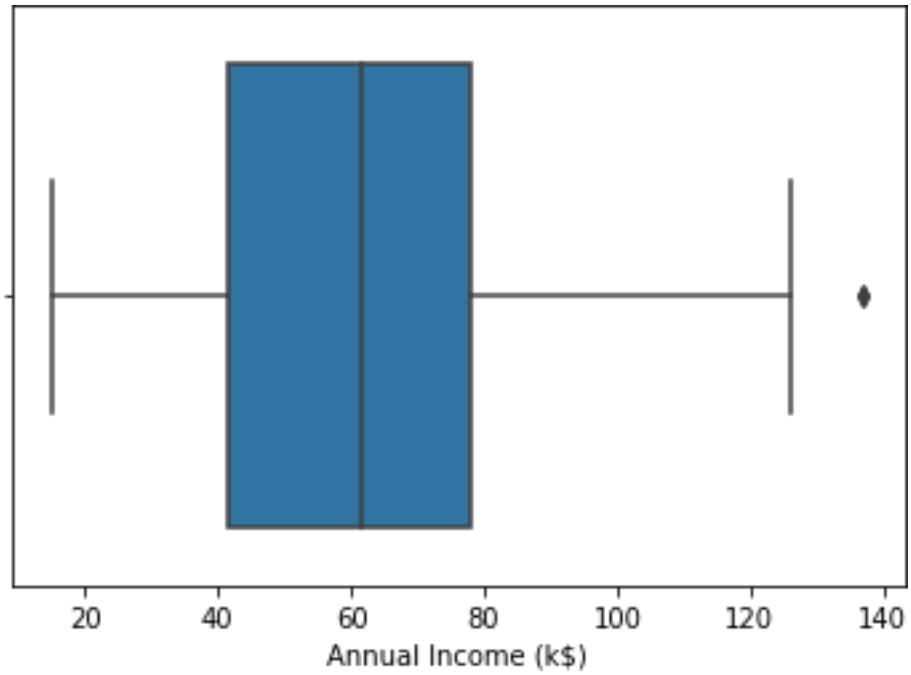
Output:



Input:

```
sns.boxplot(df['AnnualIncome(k$)'])
```

Output:

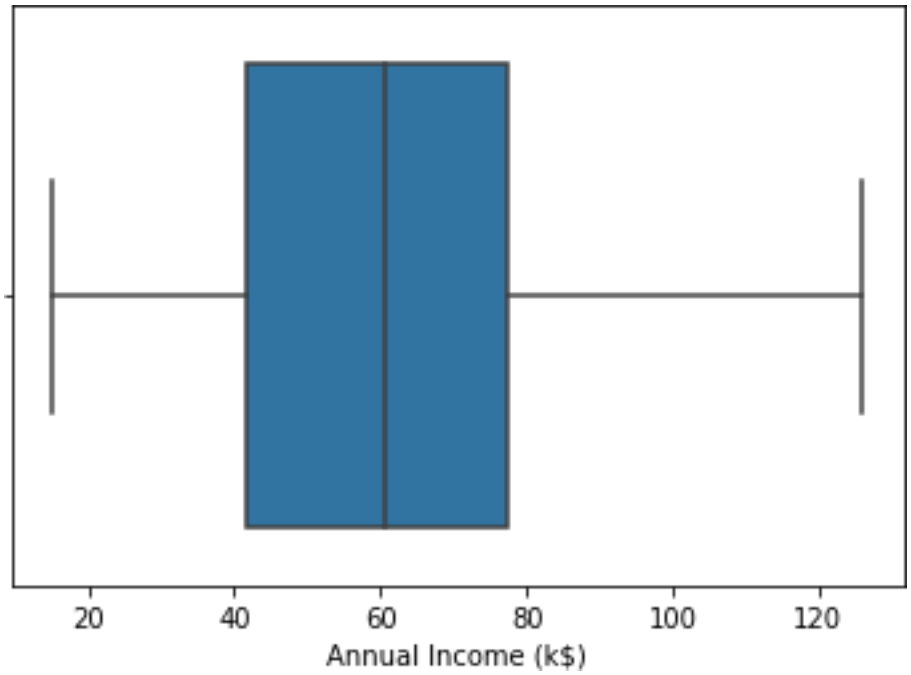


Input:

```
df['Annual Income (k$)'] = np.where(df['Annual Income (k$)'] >
132.750,60.55,df['Annual Income (k$)'])

sns.boxplot(df['AnnualIncome(k$)'])
```

Output:



Input:

```
df['AnnualIncome(k$)'].max()
```

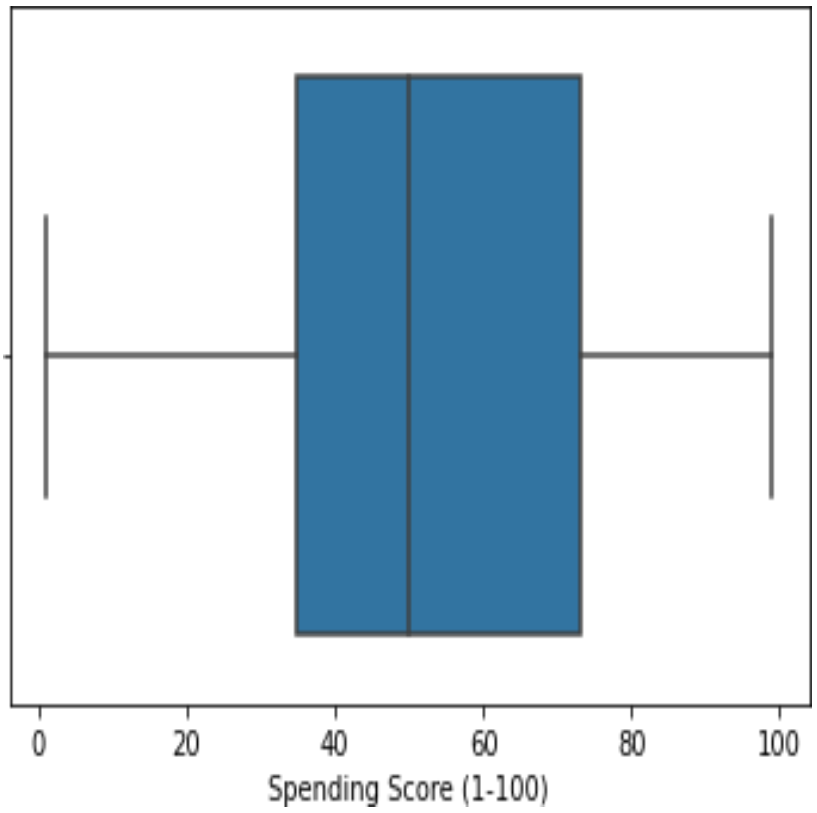
Output:

126.0

Input:

```
sns.boxplot(df['SpendingScore(1-100)'])
```

Output:



Scalingthe data

Input:

```
from sklearn.preprocessing
importStandardScalerss=StandardScaler().fit_transform(df)
ss
```

Output:

```
array([[-1.7234121,  1.12815215, -1.42456879, -1.78843062, -0.43480148],
       [-1.70609137,  1.12815215, -1.28103541, -1.78843062,  1.19570407],
       [-1.68877065, -0.88640526,  -1.3528021, -1.74850629, -1.71591298],
       [-1.67144992, -0.88640526, -1.13750203, -1.74850629,  1.04041783],
       [ -1.6541292, -0.88640526, -0.56336851, -1.70858195, -0.39597992],
       [-1.63680847, -0.88640526, -1.20926872, -1.70858195,  1.00159627],
       [-1.61948775, -0.88640526, -0.27630176, -1.66865761, -1.71591298],
       [-1.60216702, -0.88640526, -1.13750203, -1.66865761,  1.70038436],
       [ -1.5848463,  1.12815215,  1.80493225, -1.62873328, -1.83237767],
       [-1.56752558, -0.88640526,  -0.6351352, -1.62873328,  0.84631002],
       [-1.55020485,  1.12815215,  2.02023231, -1.62873328,  -1.4053405],
       [-1.53288413, -0.88640526, -0.27630176, -1.62873328,  1.89449216],
       [ -1.5155634, -0.88640526,  1.37433211, -1.58880894, -1.36651894],
       [-1.49824268, -0.88640526, -1.06573534, -1.58880894,  1.04041783],
       [-1.48092195,  1.12815215, -0.13276838, -1.58880894, -1.44416206],
       [-1.46360123,  1.12815215, -1.20926872, -1.58880894,  1.11806095],
       [ -1.4462805, -0.88640526, -0.27630176,  -1.5488846, -0.59008772],
       [-1.42895978,  1.12815215,  -1.3528021,  -1.5488846,  0.61338066],
       [-1.41163905,  1.12815215,  0.94373197, -1.46903593, -0.82301709],
       [-1.39431833, -0.88640526, -0.27630176, -1.46903593,  1.8556706],
       [ -1.3769976,  1.12815215, -0.27630176, -1.42911159, -0.59008772],
       [-1.35967688,  1.12815215, -0.99396865, -1.42911159,  0.88513158],
       [-1.34235616, -0.88640526,  0.51313183, -1.38918726, -1.75473454],
       [-1.32503543,  1.12815215, -0.56336851, -1.38918726,  0.88513158],
       [-1.30771471, -0.88640526,  1.08726535, -1.26941425,  -1.4053405],
       [-1.29039398,  1.12815215, -0.70690189, -1.26941425,  1.23452563],
       [-1.27307326, -0.88640526,  0.44136514, -1.26941425,  -0.7065524],
       [-1.25575253,  1.12815215, -0.27630176, -1.26941425,  0.41927286],
       [-1.23843181, -0.88640526,  0.08253169, -1.22948991, -0.74537397],
       [-1.22111108, -0.88640526, -1.13750203, -1.22948991,  1.42863343],
       [-1.20379036,  1.12815215,  1.51786549, -1.18956557,  -1.7935561],
       [-1.18646963, -0.88640526, -1.28103541, -1.18956557,  0.88513158],
       [-1.16914891,  1.12815215,  1.01549866, -1.06979256,  -1.7935561],
       [-1.15182818,  1.12815215, -1.49633548, -1.06979256,  1.62274124],
       [-1.13450746, -0.88640526,  0.7284319, -1.06979256,  -1.4053405],
       [-1.11718674, -0.88640526, -1.28103541, -1.06979256,  1.19570407],
       [-1.09986601, -0.88640526,  0.22606507, -1.02986823, -1.28887582],
       [-1.08254529, -0.88640526,  -0.6351352, -1.02986823,  0.88513158],
       [-1.06522456, -0.88640526, -0.20453507, -0.91009522, -0.93948177],
       [-1.04790384, -0.88640526,  -1.3528021, -0.91009522,  0.96277471],
       [-1.03058311, -0.88640526,  1.87669894, -0.87017088, -0.59008772],
       [-1.01326239,  1.12815215, -1.06573534, -0.87017088,  1.62274124],
       [-0.99594166,  1.12815215,  0.65666521, -0.83024654, -0.55126616],
       [-0.97862094, -0.88640526, -0.56336851, -0.83024654,  0.41927286],
       [-0.96130021, -0.88640526,  0.7284319, -0.83024654, -0.86183865],
       [-0.94397949, -0.88640526, -1.06573534, -0.83024654,  0.5745591],
       [-0.92665877, -0.88640526,  0.80019859, -0.79032221,  0.18634349],
```

```
[-0.90933804, -0.88640526, -0.85043527, -0.79032221, -0.12422899],
[-0.89201732, -0.88640526, -0.70690189, -0.79032221,  -0.3183368],
[-0.87469659, -0.88640526, -0.56336851, -0.79032221,  -0.3183368],
[-0.85737587, -0.88640526,  0.7284319, -0.71047353,  0.06987881],
[-0.84005514,  1.12815215, -0.41983513, -0.71047353,  0.38045129],
[-0.82273442, -0.88640526, -0.56336851,  -0.6705492 ,  0.14752193],
[-0.80541369,  1.12815215,  1.4460988,  -0.6705492 ,  0.38045129],
[-0.78809297, -0.88640526,  0.80019859,  -0.6705492 , -0.20187212],
[-0.77077224,  1.12815215,  0.58489852,  -0.6705492 , -0.35715836],
[-0.75345152, -0.88640526,  0.87196528, -0.63062486, -0.00776431],
[-0.73613079,  1.12815215,  2.16376569, -0.63062486, -0.16305055],
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[-0.70148935,  1.12815215,  1.01549866, -0.55077619, -0.16305055],
[-0.68416862,  1.12815215,  2.23553238, -0.55077619,  0.22516505],
[-0.6668479,  1.12815215, -1.42456879, -0.55077619,  0.18634349],
[-0.64952717, -0.88640526,  2.02023231, -0.51085185,  0.06987881],
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[-0.61488572,  1.12815215,  1.73316556, -0.47092751,  0.03105725],
[-0.597565,  1.12815215, -1.49633548, -0.47092751,  0.34162973],
[-0.58024427, -0.88640526,  0.29783176, -0.47092751, -0.00776431],
[-0.56292355, -0.88640526,  2.091999, -0.47092751, -0.08540743],
[-0.54560282,  1.12815215, -1.42456879, -0.47092751,  0.34162973],
[-0.5282821, -0.88640526, -0.49160182, -0.47092751, -0.12422899],
[-0.51096138,  1.12815215,  2.23553238, -0.43100318,  0.18634349],
[-0.49364065, -0.88640526,  0.58489852, -0.43100318,  -0.3183368],
[-0.47631993, -0.88640526,  1.51786549, -0.39107884, -0.04658587],
[-0.4589992, -0.88640526,  1.51786549, -0.39107884,  0.22516505],
[-0.44167848,  1.12815215,  1.4460988, -0.23138149, -0.12422899],
[-0.42435775,  1.12815215, -0.92220196, -0.23138149,  0.14752193],
[-0.40703703, -0.88640526,  0.44136514, -0.23138149,  0.10870037],
[-0.3897163,  1.12815215,  0.08253169, -0.23138149, -0.08540743],
[-0.37239558, -0.88640526, -1.13750203, -0.23138149,  0.06987881],
[-0.35507485, -0.88640526,  0.7284319, -0.23138149,  -0.3183368],
[-0.33775413,  1.12815215,  1.30256542, -0.23138149,  0.03105725],
[-0.3204334,  1.12815215, -0.06100169, -0.23138149,  0.18634349],
[-0.30311268,  1.12815215,  2.02023231, -0.23138149, -0.35715836],
[-0.28579196, -0.88640526,  0.51313183, -0.23138149, -0.24069368],
[-0.26847123, -0.88640526, -1.28103541, -0.23138149,  0.26398661],
[-0.25115051,  1.12815215,  0.65666521, -0.23138149, -0.16305055],
[-0.23382978, -0.88640526,  1.15903204, -0.11160848,  0.30280817],
[-0.21650906, -0.88640526, -1.20926872, -0.11160848,  0.18634349],
[-0.19918833, -0.88640526, -0.34806844, -0.07168415,  0.38045129],
[-0.18186761, -0.88640526,  0.80019859, -0.07168415, -0.16305055],
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```

ClusteringAlgorithm

Input:

```
from sklearn.cluster import
KMeansTWSS= [] k=list(range(2,9))
foriink:
    kmeans = KMeans(n_clusters = i , init = 'k-
    means++')kmeans.fit(df) TWSS.append(kmeans.inertia_)

TWSS
```

Output:

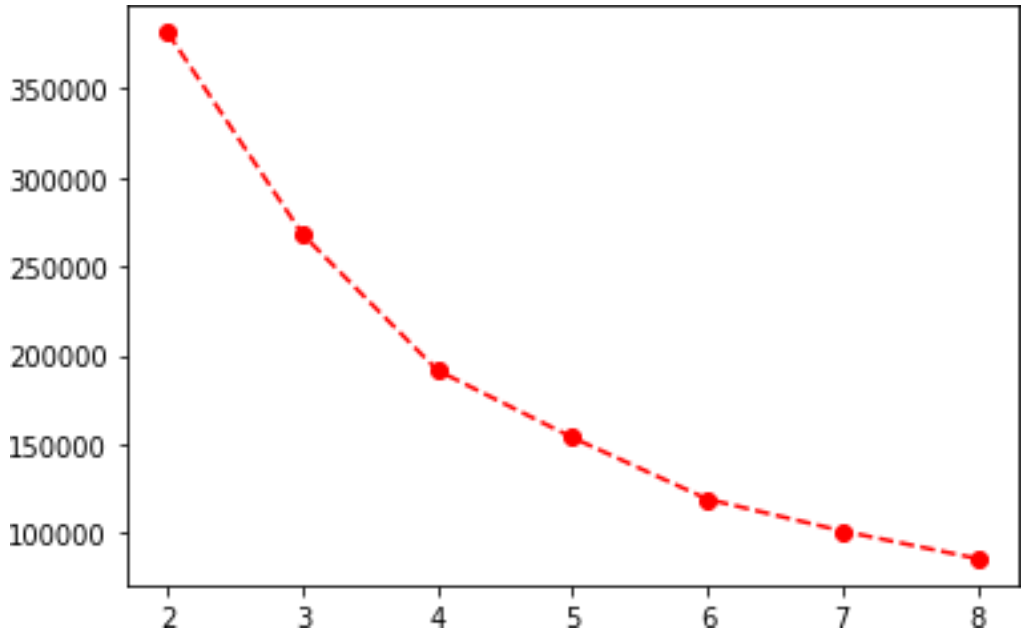
```
[381507.64738523855,
268062.55433747417,
191550.08627670942,
```

153777.55391034693,
119166.15727643928,
101239.32626154403,
85744.90139221892]

Input:

```
plt.plot(k,TWSS,'ro--')
```

Output:




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

Input:

```
model.fit(df)
```

Output:

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

Input:

```
mb = pd.Series(model.labels_)df['C
luster']=mb
df
```

Output:

	CustomerID	Gender	Age	AnnualIncome(k$)	Spending Score(1-100)	Cluster
0	1	1	19	15.00	39	2
1	2	1	21	15.00	81	2

	CustomerID	Gender	Age	AnnualIncome(k$)	Spending Score(1-100)	Cluster
2	3	0	20	16.00	6	2
3	4	0	23	16.00	77	2
4	5	0	31	17.00	40	2
...	...	...	...	...	...	...
195	196	0	35	120.00	79	3
196	197	0	45	126.00	28	1
197	198	1	32	126.00	74	3
198	199	1	32	60.55	18	1
199	200	1	30	60.55	83	3

200rows ×6 columns