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.]),
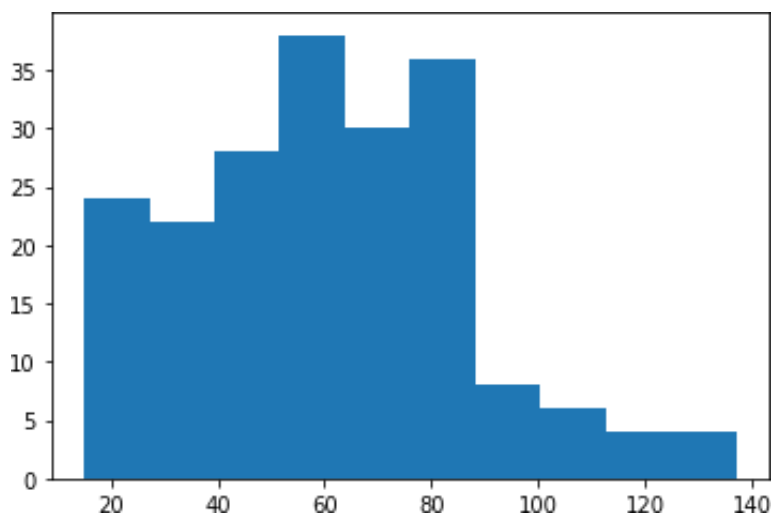 array([18.,23.2,28.4,33.6,38.8,44.,49.2,54.4,59.6,64.8,70.]),
)
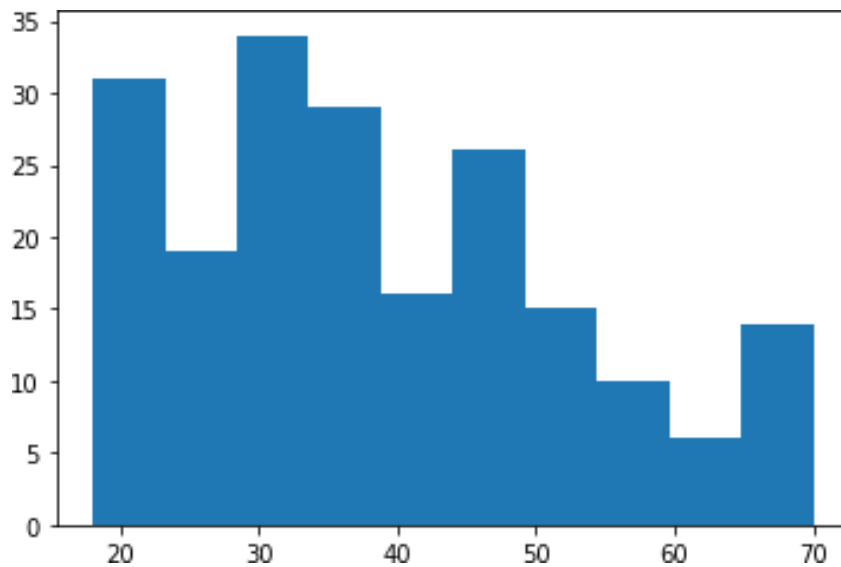
Input:

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

Output:

(array([24.,22.,28.,38.,30.,36.,8.,6.,4.,4.]),
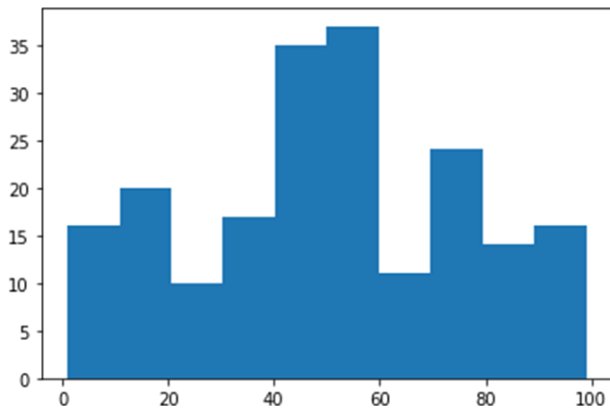 array([15.,27.2,39.4,51.6,63.8,76.,88.2,100.4,112.6,124.8,137.]),
)

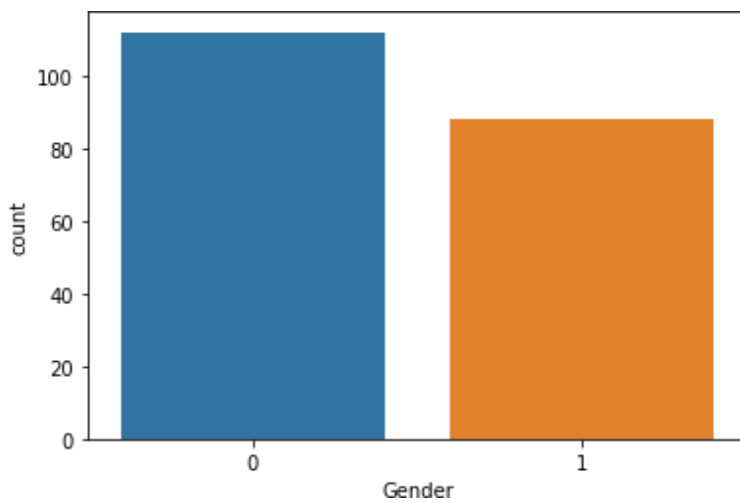**Input:**

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:

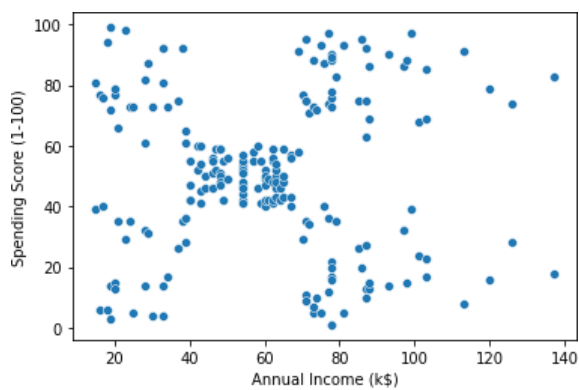**Bi-VariateAnalysis**

Input:

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

Output:
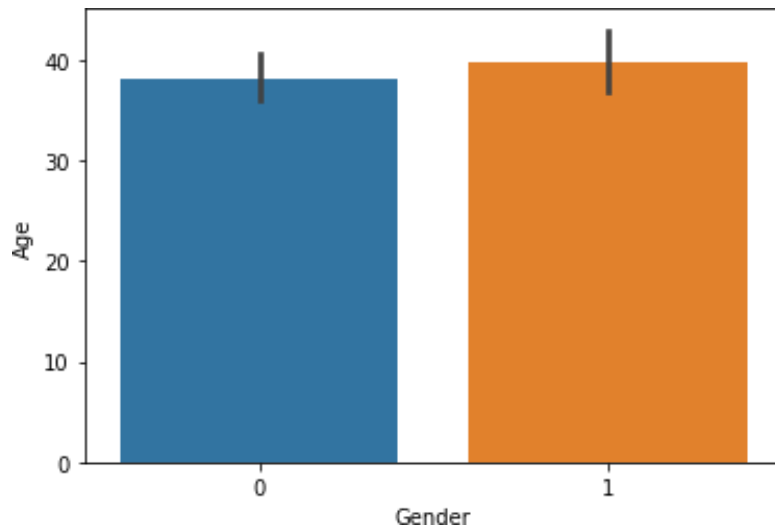
Input:

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

Output:

Input:

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

Output:

Multi-variate

AnalysisInput:

sns.pairplot(df)

output:
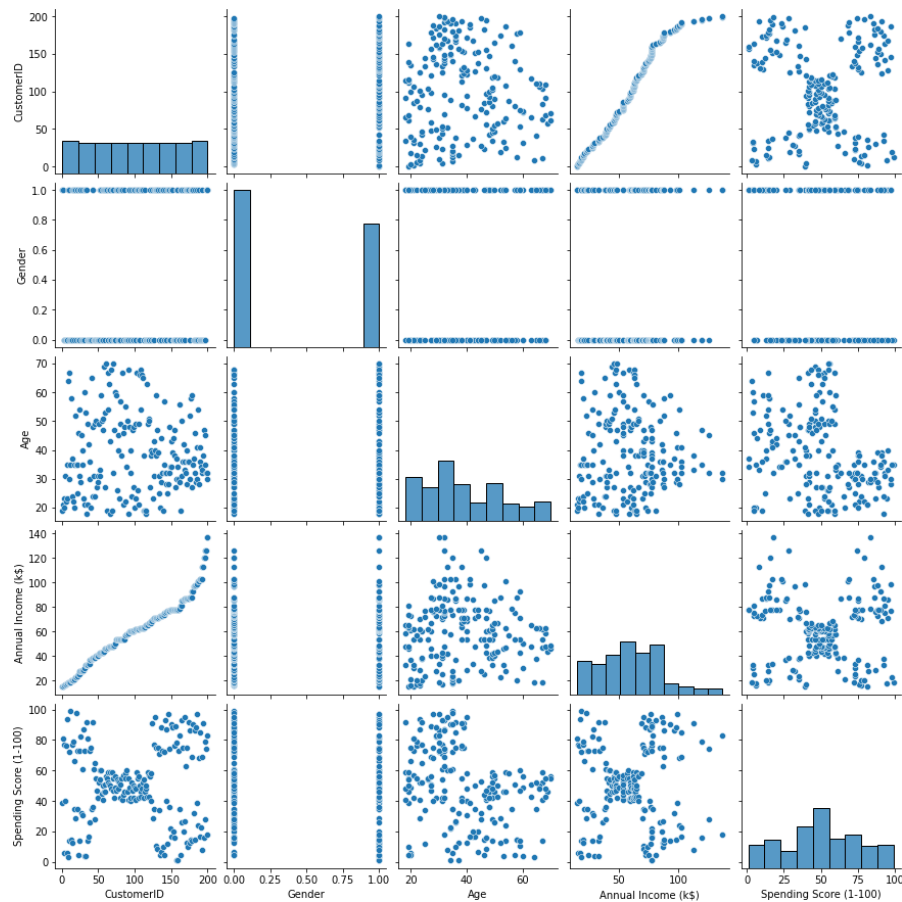
DescriptiveStatistics

Input:

df.info()

Output:

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

#	Column	Non-NullCountDtype	
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-	130.375
100)dtype:float64	

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-	-22.625
100)dtype:float64	

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:
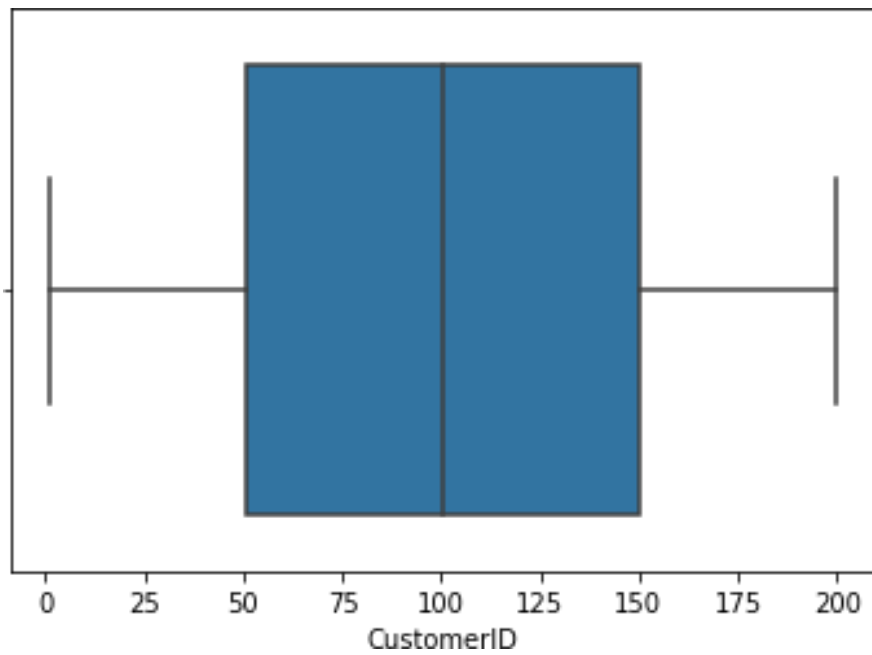
Input:
sns**.**boxplot(df['Gender'])

 Output:
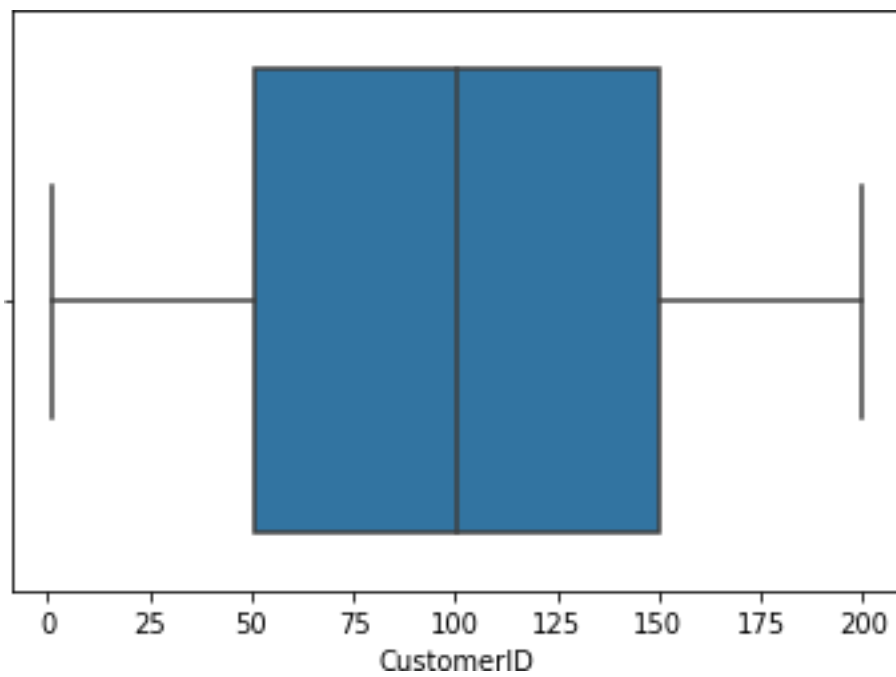
Input:
sns**.**boxplot(df['Age'])
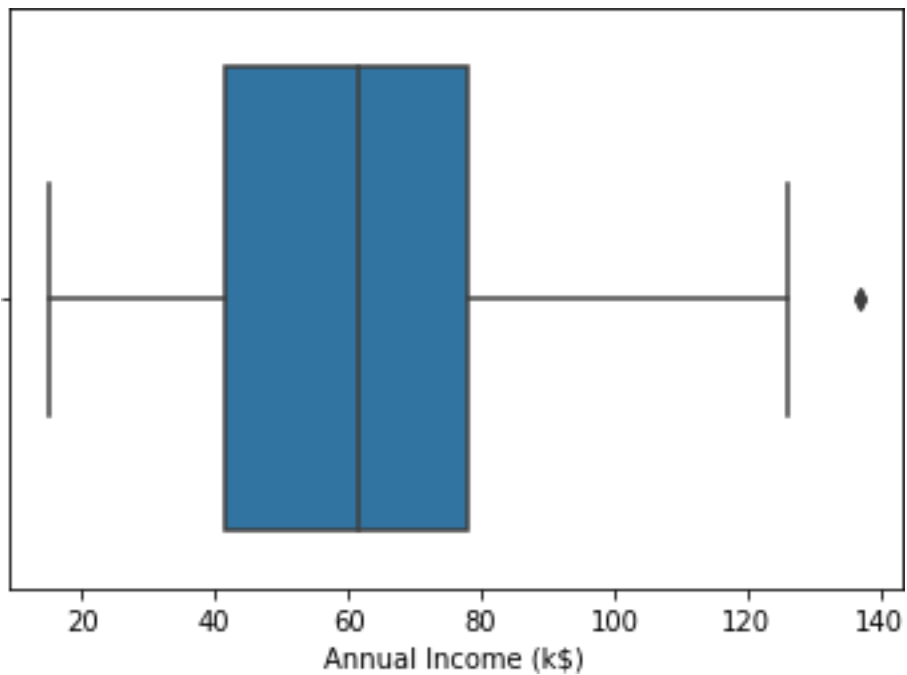
 Output:
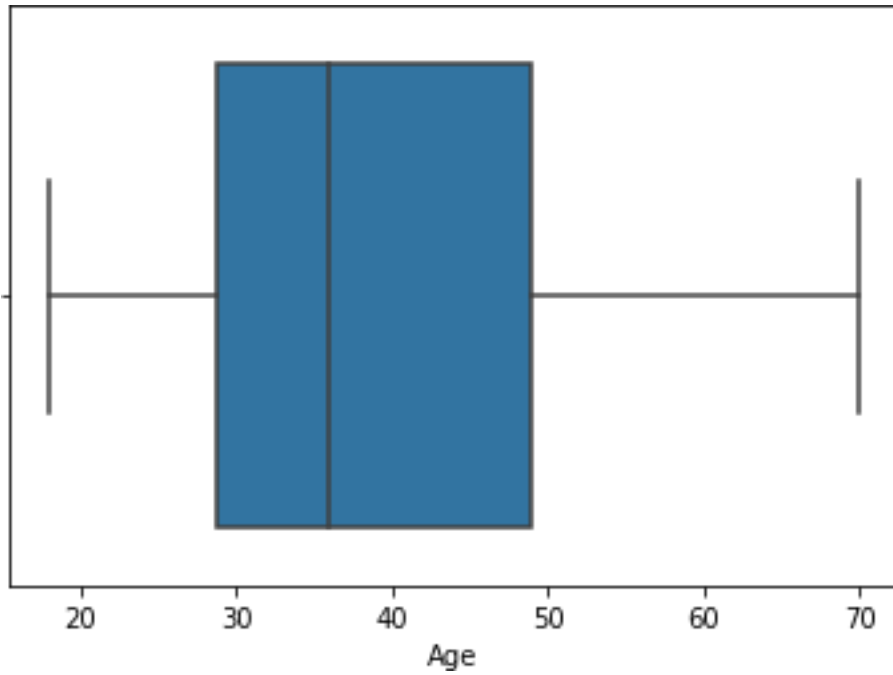
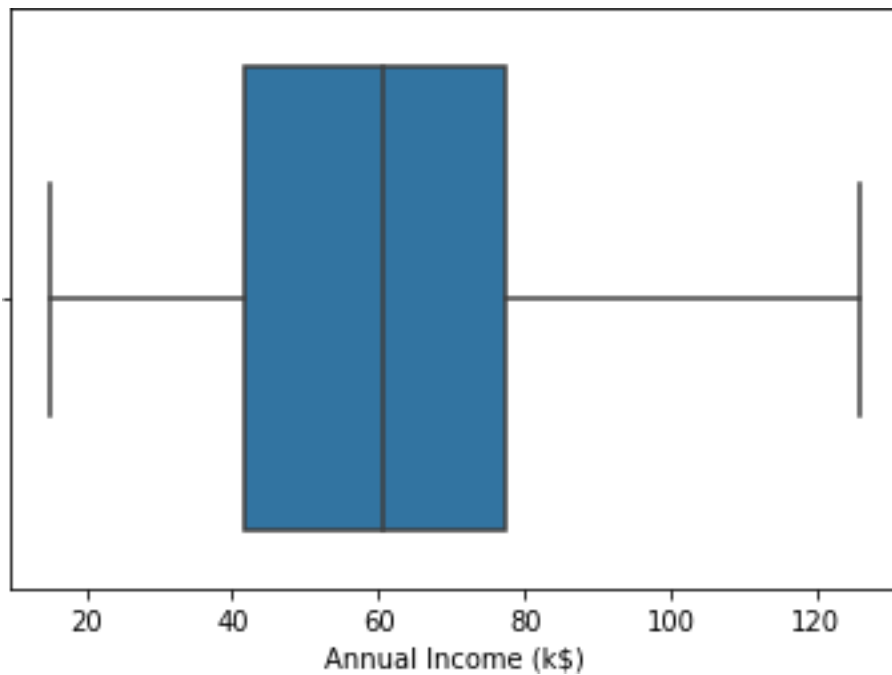**Input:**

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$)'])
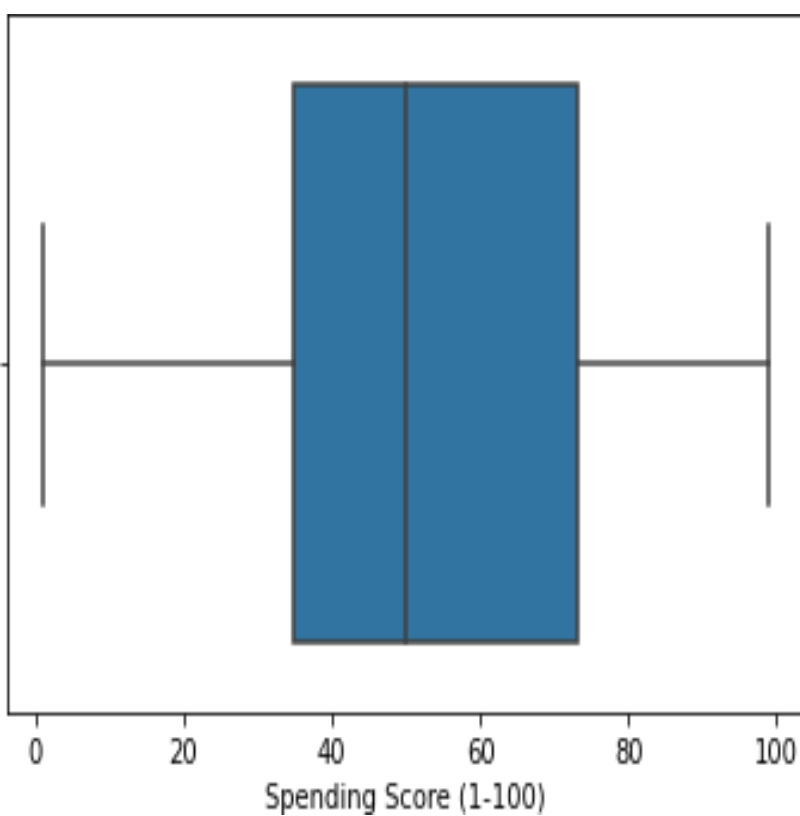
Output:

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

Output:
126.0

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

Output:

Scaling the data

Input:
from sklearn.preprocessing
import StandardScaler ss=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],
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[-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],
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[-0.4589992,     -0.88640526,    1.51786549,   -0.39107884,      0.22516505],
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[-0.33775413,     1.12815215,    1.30256542,   -0.23138149,      0.03105725],
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[-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],
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[-0.21650906,    -0.88640526,   -1.20926872,   -0.11160848,      0.18634349],
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[-0.18186761,    -0.88640526,    0.80019859,   -0.07168415,     -0.16305055],
[-0.16454688,    -0.88640526,    2.091999,     -0.03175981,      0.18634349],
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[-0.11258471,    -0.88640526,    0.08253169,    0.00816453,     -0.39597992],
[-0.09526399,    -0.88640526,   -0.49160182,    0.00816453,      -0.3183368],
[-0.07794326,     1.12815215,   -1.06573534,    0.00816453,      0.06987881],
[-0.06062254,    -0.88640526,    0.58489852,    0.00816453,     -0.12422899],
[-0.04330181,    -0.88640526,   -0.85043527,    0.00816453,     -0.00776431],
[-0.02598109,     1.12815215,    0.65666521,    0.04808886,      -0.3183368],
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```

ClusteringAlgorithm

Input:

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

TWSS
```
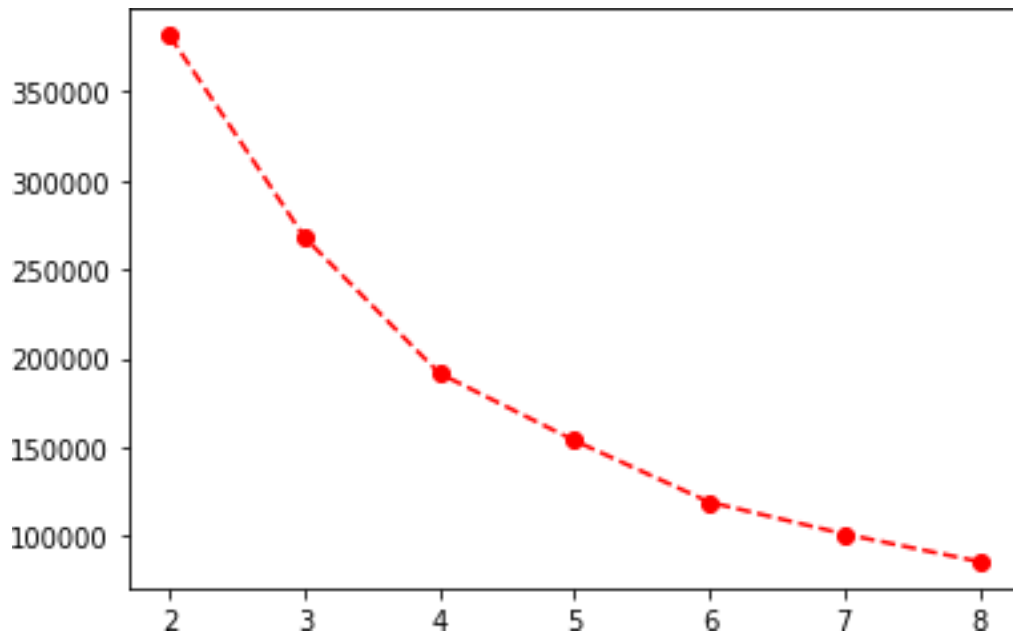
Output:

```
[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