

## Assignment -3

### Python Programming

Assignment Date	05 October 2022
Student Name	Renuka G
Student Roll Number	211419104220
Maximum Marks	2 Marks

### 1. Download the dataset

```
In [1]: #importing the Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

### 2. Load the dataset into the tool.

```
In [16]: #Loading the dataset
d = pd.read_csv(r'C:\Users\DELL\Downloads\abalone.csv')
```

### 3. Perform Below Visualizations.

#### Univariate Analysis

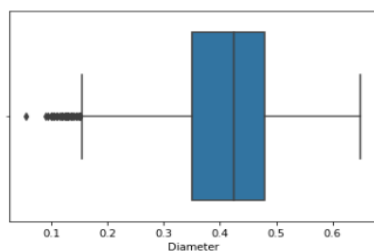
```
In [17]: d.head()
```

```
Out[17]:
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

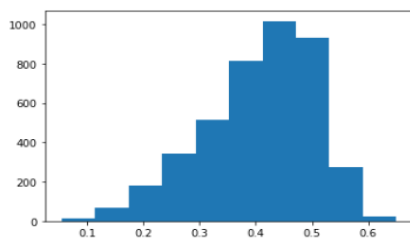
```
In [18]: #Boxplot
sns.boxplot(d['Diameter'])
```

```
Out[18]: <AxesSubplot:xlabel='Diameter'>
```



```
In [19]: #histogram
plt.hist(d['Diameter'])
```

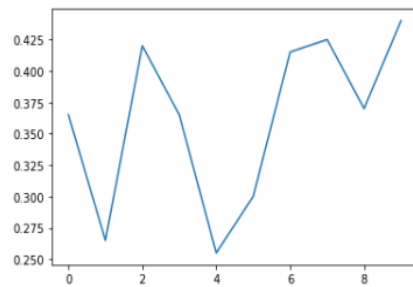
```
Out[19]: (array([ 13.,  66., 180., 344., 513., 812., 1017., 934., 275.,
        23.]),
 array([0.055, 0.1145, 0.174, 0.2335, 0.293, 0.3525, 0.412, 0.4715,
        0.531, 0.5905, 0.65 ]),
 <BarContainer object of 10 artists>)
```



In [20]: `#line plot`

```
plt.plot(d['Diameter'].head(10))
```

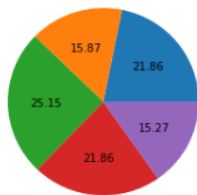
Out[20]: `[<matplotlib.lines.Line2D at 0x14a4516ca90>]`



In [21]: `#piechart`

```
plt.pie(d['Diameter'].head(), autopct='%2f')
```

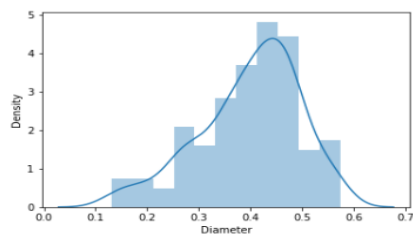
Out[21]: `([<matplotlib.patches.Wedge at 0x14a451c9b80>, <matplotlib.patches.Wedge at 0x14a451d62b0>, <matplotlib.patches.Wedge at 0x14a451d6940>, <matplotlib.patches.Wedge at 0x14a451d6fd0>, <matplotlib.patches.Wedge at 0x14a451e46a0>], [Text(0.8507215626110558, 0.6973326486753676, ''), Text(-0.32611344931648134, 1.0505474849691026, ''), Text(-1.0998053664078908, -0.02069193128747144, ''), Text(-0.08269436219656089, -1.096887251480709, ''), Text(0.9758446362287218, -0.5076684409569241, ''), Text(0.464029943242394, 0.3803632629138369, '21.86'), Text(-0.17788006326353525, 0.5730259008922377, '15.87'), Text(-0.5998938362224858, -0.011286507974984419, '25.15'), Text(-0.045106015743578656, -0.5983021371712958, '21.86'), Text(0.5322788924883937, -0.2769100587037768, '15.27')])`



In [22]: `#distplot`

```
sns.distplot(d['Diameter'].head(200))
```

Out[22]: `<AxesSubplot:xlabel='Diameter', ylabel='Density'>`

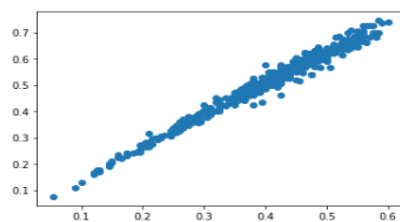


## ● BI - Variate Analysis

In [23]: `#scatter plot`

```
plt.scatter(d['Diameter'].head(500), d['Length'].head(500))
```

Out[23]: `<matplotlib.collections.PathCollection at 0x14a45309af0>`



```
Out[24]: Text(0, 0.5, 'Rings')
```



Sex	Rings
M	10.5
F	11
I	8

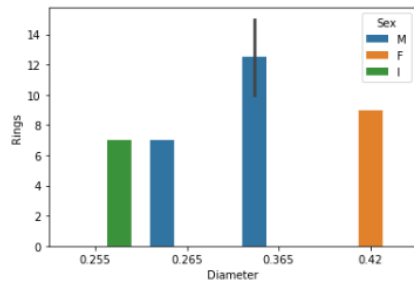
```
sns.jointplot(d['Diameter'].head(50),d['Rings'].head(50))
```

The scatter plot displays the relationship between Diameter (x-axis) and Rings (y-axis). The x-axis ranges from 0.1 to 0.6, and the y-axis ranges from 4 to 20. The plot includes a scatter of data points and marginal histograms on the top and right sides.

In [27]: #bar plot

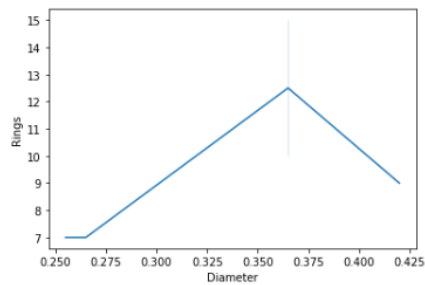
```
sns.barplot('Diameter', 'Rings', hue='Sex', data=d.head())
```

Out[27]: <AxesSubplot:xlabel='Diameter', ylabel='Rings'>



In [28]: sns.lineplot(d['Diameter'], d['Rings']).head()

Out[28]: <AxesSubplot:xlabel='Diameter', ylabel='Rings'>

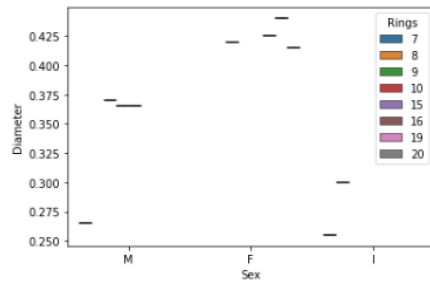


## • Multi - Variate Analysis

In [29]: #boxplot

```
sns.boxplot(d['Sex'], d['Diameter'], d['Rings']).head(10)
```

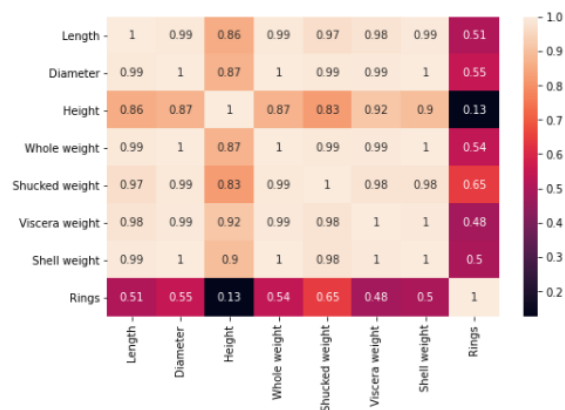
Out[29]: <AxesSubplot:xlabel='Sex', ylabel='Diameter'>



In [30]: #heat map

```
fig=plt.figure(figsize=(8,5))
sns.heatmap(d.head().corr(),annot=True)
```

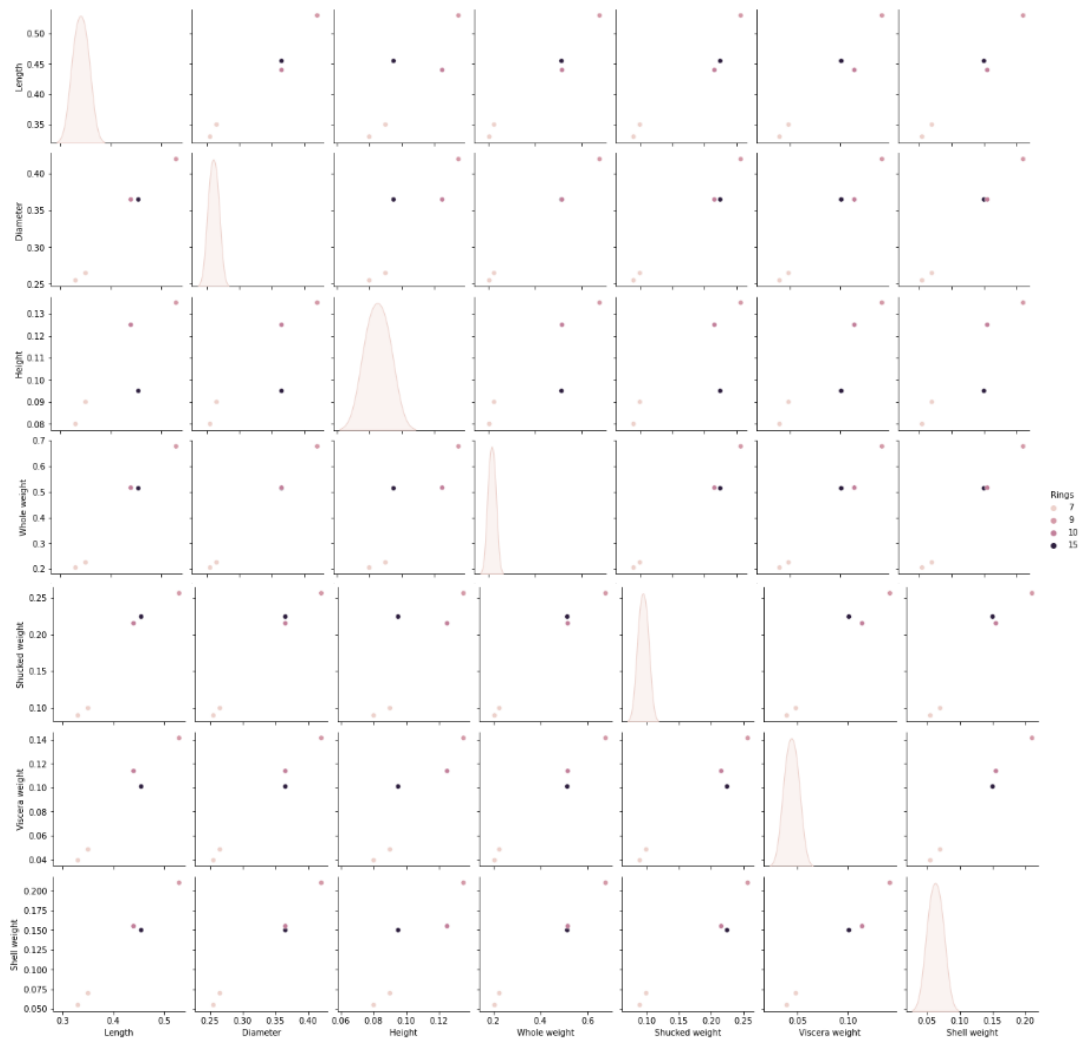
Out[30]: <AxesSubplot:>



```
In [32]: #pair plot
```

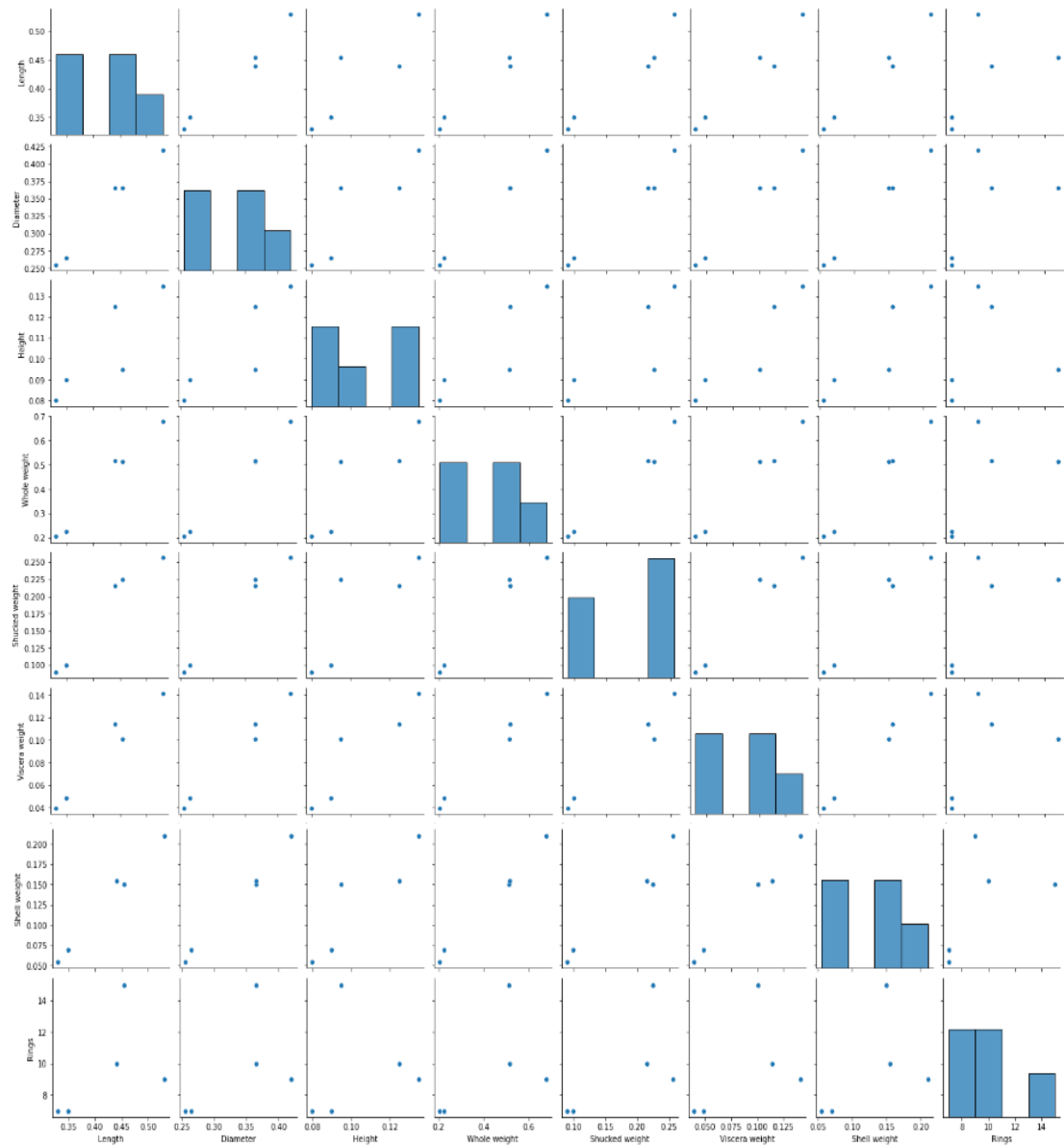
```
sns.pairplot(d.head(),hue='Rings')
```

```
Out[32]: <seaborn.axisgrid.PairGrid at 0x14a47f90a90>
```



```
In [33]: sns.pairplot(d.head())
```

```
Out[33]: <seaborn.axisgrid.PairGrid at 0x14a49002250>
```



## 4. Perform descriptive statistics on the dataset.

In [34]: `#head`

```
d.head()
```

Out[34]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7

In [35]: `#tail`

```
d.tail()
```

Out[35]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
4172	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11
4173	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10
4174	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9
4175	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10
4176	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12

In [36]: `d.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4177 entries, 0 to 4176
Data columns (total 9 columns):
#   Column          Non-Null Count  Dtype
---  -
0   Sex              4177 non-null   object
1   Length           4177 non-null   float64
2   Diameter         4177 non-null   float64
3   Height           4177 non-null   float64
4   Whole weight     4177 non-null   float64
5   Shucked weight   4177 non-null   float64
6   Viscera weight   4177 non-null   float64
7   Shell weight     4177 non-null   float64
8   Rings            4177 non-null   int64
dtypes: float64(7), int64(1), object(1)
memory usage: 293.8+ KB
```

In [37]: `d.describe()`

Out[37]:

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	0.238831	9.933684
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	0.139203	3.224169
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	0.001500	1.000000
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130000	8.000000
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234000	9.000000
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	0.329000	11.000000
max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000	1.005000	29.000000

In [38]: `#mode`

```
d.mode().T
```

Out[38]:

	0	1
Sex	M	NaN
Length	0.55	0.625
Diameter	0.45	NaN
Height	0.15	NaN
Whole weight	0.2225	NaN
Shucked weight	0.175	NaN
Viscera weight	0.1715	NaN
Shell weight	0.275	NaN
Rings	9.0	NaN

In [39]: `d.shape`

Out[39]: (4177, 9)

```

In [40]: #kurtosis
d.kurt()

Out[40]: Length      0.064621
Diameter    -0.045476
Height      76.025509
Whole weight -0.023644
Shucked weight 0.595124
Viscera weight 0.084012
Shell weight 0.531926
Rings       2.330687
dtype: float64

In [41]: #skewness
d.skew()

Out[41]: Length      -0.639873
Diameter    -0.609198
Height      3.128817
Whole weight 0.530959
Shucked weight 0.719098
Viscera weight 0.591852
Shell weight 0.620927
Rings       1.114102
dtype: float64

In [42]: #variance
d.var()

Out[42]: Length      0.014422
Diameter    0.009849
Height      0.001750
Whole weight 0.240481
Shucked weight 0.049268
Viscera weight 0.012015
Shell weight 0.019377
Rings      10.395266
dtype: float64

In [43]: #finding unique values for columns
d.nunique()

Out[43]: Sex          3
Length      134
Diameter     111
Height       51
Whole weight 2429
Shucked weight 1515
Viscera weight 880
Shell weight 926
Rings        28
dtype: int64

```

## 5. Check for Missing values and deal with them.

```

In [44]: #finding missing values
d.isna()

Out[44]:

```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False
...	...	...	...	...	...	...	...	...	...
4172	False	False	False	False	False	False	False	False	False
4173	False	False	False	False	False	False	False	False	False
4174	False	False	False	False	False	False	False	False	False
4175	False	False	False	False	False	False	False	False	False
4176	False	False	False	False	False	False	False	False	False

4177 rows × 9 columns



```
In [45]: d.isna().any()
```

```
Out[45]: Sex                False
Length                False
Diameter              False
Height                False
Whole weight          False
Shucked weight        False
Viscera weight        False
Shell weight          False
Rings                 False
dtype: bool
```

```
In [46]: d.isna().sum()
```

```
Out[46]: Sex                0
Length                0
Diameter              0
Height                0
Whole weight          0
Shucked weight        0
Viscera weight        0
Shell weight          0
Rings                 0
dtype: int64
```

```
In [47]: d.isna().any().sum()
#no missing values
```

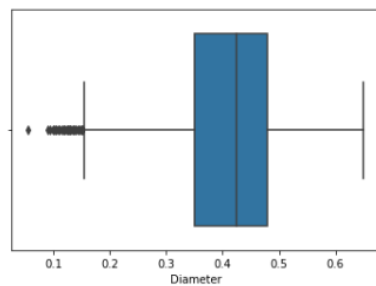
```
Out[47]: 0
```

## 6. Find the outliers and replace them outliers

```
In [48]: #finding outliers
```

```
sns.boxplot(d['Diameter'])
```

```
Out[48]: <AxesSubplot:xlabel='Diameter'>
```



```
In [49]: #handling outliers
```

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

```
Out[49]:
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0.25	0.450	0.35	0.115	0.4415	0.186	0.0935	0.130	8.0
0.75	0.615	0.48	0.165	1.1530	0.502	0.2530	0.329	11.0

```
In [50]: iqr=qnt.loc[0.75]-qnt.loc[0.25]
```

```
iqr
```

```
Out[50]: Length                0.1650
Diameter                0.1300
Height                0.0500
Whole weight            0.7115
Shucked weight          0.3160
Viscera weight          0.1595
Shell weight            0.1990
Rings                   3.0000
dtype: float64
```

```
In [51]: lower=qnt.loc[0.25]-(1.5*iqr)
lower
```

```
Out[51]: Length      0.20250
Diameter    0.15500
Height      0.04000
Whole weight -0.62575
Shucked weight -0.28800
Viscera weight -0.14575
Shell weight -0.16850
Rings       3.50000
dtype: float64
```

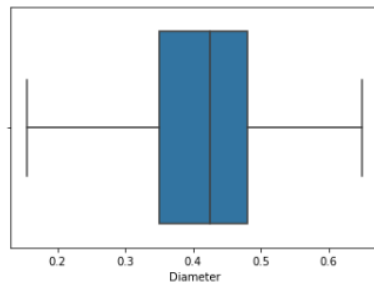
```
In [52]: upper=qnt.loc[0.75]+(1.5*iqr)
upper
```

```
Out[52]: Length      0.86250
Diameter    0.67500
Height      0.24000
Whole weight 2.22025
Shucked weight 0.97600
Viscera weight 0.49225
Shell weight 0.62750
Rings      15.50000
dtype: float64
```

```
In [53]: # replacing outliers

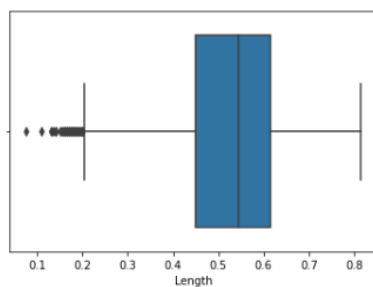
##Diameter
d['Diameter']=np.where(d['Diameter']<0.155,0.4078,d['Diameter'])
sns.boxplot(d['Diameter'])
```

```
Out[53]: <AxesSubplot:xlabel='Diameter'>
```



```
In [54]: ## Length
sns.boxplot(d['Length'])
```

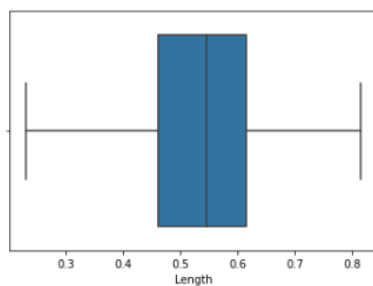
```
Out[54]: <AxesSubplot:xlabel='Length'>
```



```
In [55]: d['Length']=np.where(d['Length']<0.23,0.52, d['Length'])
```

```
In [56]: sns.boxplot(d['Length'])
```

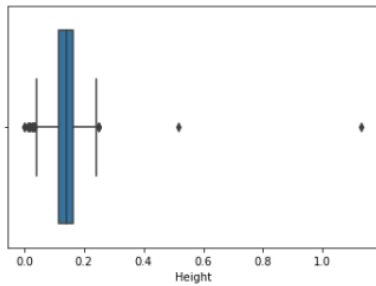
```
Out[56]: <AxesSubplot:xlabel='Length'>
```



```
In [57]: ## Height
```

```
sns.boxplot(d['Height'])
```

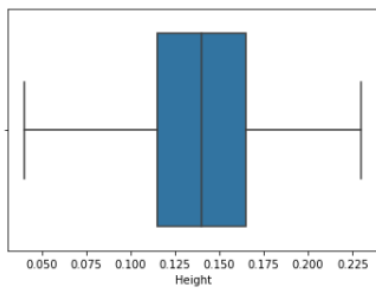
```
Out[57]: <AxesSubplot:xlabel='Height'>
```



```
In [58]: d['Height']=np.where(d['Height']<0.04,0.139, d['Height'])  
d['Height']=np.where(d['Height']>0.23,0.139, d['Height'])
```

```
In [59]: sns.boxplot(d['Height'])
```

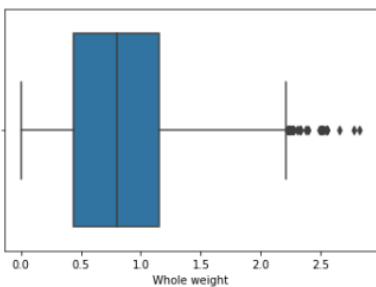
```
Out[59]: <AxesSubplot:xlabel='Height'>
```



```
In [60]: ## Whole weight
```

```
sns.boxplot(d['Whole weight'])
```

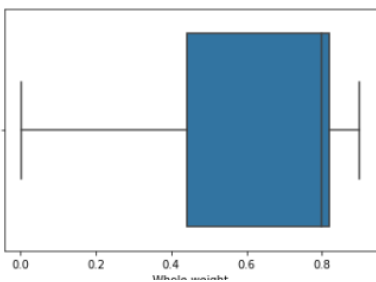
```
Out[60]: <AxesSubplot:xlabel='Whole weight'>
```



```
In [61]: d['Whole weight']=np.where(d['Whole weight']>0.9,0.82, d['Whole weight'])
```

```
In [62]: sns.boxplot(d['Whole weight'])
```

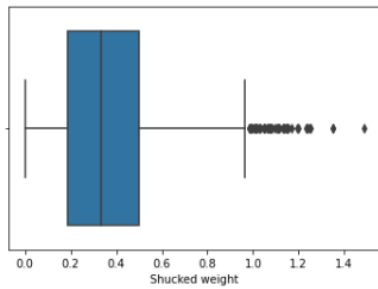
```
Out[62]: <AxesSubplot:xlabel='Whole weight'>
```



```
In [63]: ## Shucked weight
```

```
sns.boxplot(d['Shucked weight'])
```

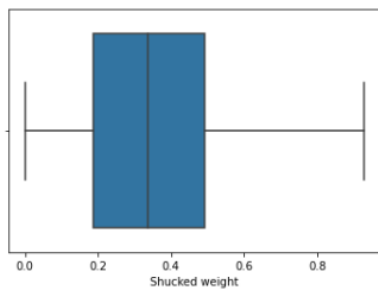
```
Out[63]: <AxesSubplot:xlabel='Shucked weight'>
```



```
In [64]: d['Shucked weight']=np.where(d['Shucked weight']>0.93,0.35, d['Shucked weight'])
```

```
In [65]: sns.boxplot(d['Shucked weight'])
```

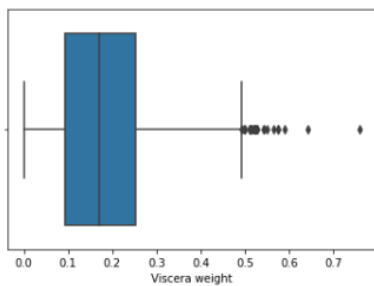
```
Out[65]: <AxesSubplot:xlabel='Shucked weight'>
```



```
In [66]: ## Viscera weight
```

```
sns.boxplot(d['Viscera weight'])
```

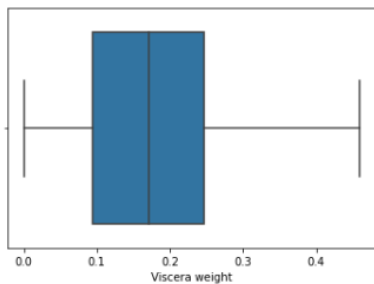
```
Out[66]: <AxesSubplot:xlabel='Viscera weight'>
```



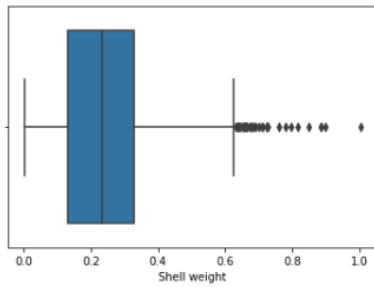
```
In [67]: d['Viscera weight']=np.where(d['Viscera weight']>0.46,0.18, d['Viscera weight'])
```

```
In [68]: sns.boxplot(d['Viscera weight'])
```

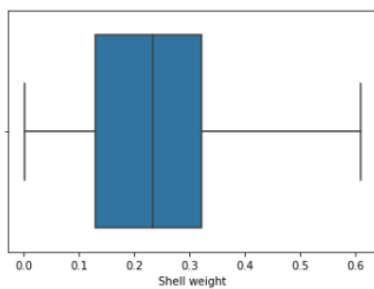
```
Out[68]: <AxesSubplot:xlabel='Viscera weight'>
```



```
In [69]: ## Shell weight
sns.boxplot(d['Shell weight'])
Out[69]: <AxesSubplot:xlabel='Shell weight'>
```



```
In [70]: d['Shell weight']=np.where(d['Shell weight']>0.61,0.2388, d['Shell weight'])
In [71]: sns.boxplot(d['Shell weight'])
Out[71]: <AxesSubplot:xlabel='Shell weight'>
```



## 7. Check for Categorical columns and perform encoding.

```
In [72]: #one hot encoding
d['Sex'].replace({'M':1,'F':0,'I':2},inplace=True)
d
```

```
Out[72]:
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500	15
1	1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700	7
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100	9
3	1	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10
4	2	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550	7
...	...	...	...	...	...	...	...	...	...
4172	0	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11
4173	1	0.590	0.440	0.135	0.8200	0.4390	0.2145	0.2605	10
4174	1	0.600	0.475	0.205	0.8200	0.5255	0.2875	0.3080	9
4175	0	0.625	0.485	0.150	0.8200	0.5310	0.2610	0.2960	10
4176	1	0.710	0.555	0.195	0.8200	0.3500	0.3765	0.4950	12

4177 rows × 9 columns

## 8. Split the data into dependent and independent variables.

```
In [73]: x=d.drop(columns= ['Rings'])
y=d['Rings']
x
```

Out[73]:

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight
0	1	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500
1	1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100
3	1	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550
4	2	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550
...	...	...	...	...	...	...	...	...
4172	0	0.585	0.450	0.165	0.8870	0.3700	0.2390	0.2490
4173	1	0.590	0.440	0.135	0.8200	0.4390	0.2145	0.2605
4174	1	0.600	0.475	0.205	0.8200	0.5255	0.2875	0.3080
4175	0	0.625	0.485	0.150	0.8200	0.5310	0.2610	0.2960
4176	1	0.710	0.555	0.195	0.8200	0.3500	0.3765	0.4950

4177 rows × 8 columns

```
In [74]: y
```

```
Out[74]: 0      15
         1       7
         2       9
         3      10
         4       7
         ..
        4172    11
        4173    10
        4174     9
        4175    10
        4176    12
        Name: Rings, Length: 4177, dtype: int64
```

## 9. Scale the independent variables

```
In [75]: from sklearn.preprocessing import scale #StandardScaler
```

```
In [76]: #Scaling the independent variables
```

```
x = scale(x)
x
```

```
Out[76]: array([[ -0.0105225 , -0.67088921, -0.50179694, ..., -0.61037964,
        -0.7328165 , -0.64358742],
        [ -0.0105225 , -1.61376082, -1.57304487, ..., -1.22513334,
        -1.24343929, -1.25742181],
        [ -1.26630752,  0.00259051,  0.08738942, ..., -0.45300269,
        -0.33890749, -0.18321163],
        ...,
        [ -0.0105225 ,  0.63117159,  0.67657577, ...,  0.86994729,
         1.08111018,  0.56873549],
        [ -1.26630752,  0.85566483,  0.78370057, ...,  0.89699645,
         0.82336724,  0.47666033],
        [ -0.0105225 ,  1.61894185,  1.53357412, ...,  0.00683308,
         1.94673739,  2.00357336]])
```

## 10. Split the data into training and testing

```
In [77]: from sklearn.model_selection import train_test_split
```

```
In [78]: #splitting data to train and test
```

```
x_train, x_test, y_train, y_test = train_test_split(x,y, test_size = 0.2)
print(x_train.shape, x_test.shape)

(3341, 8) (836, 8)
```

## 11. Build the Model

```
In [79]: #Multiple Regression
```

```
from sklearn.linear_model import LinearRegression

MLR=LinearRegression()
```

## 12. Train the Model

```
In [80]: MLR.fit(x_train,y_train)
```

```
Out[80]: LinearRegression()
```

## 13. Test the Model

```
In [81]: #prediction on the test data
y_pred=MLR.predict(x_test)
y_pred
```

```
Out[81]: array([[11.76767605, 10.7605264 , 7.36112121, 11.04217663, 11.21897117,
      8.15973048, 7.25414807, 10.78696492, 7.22309556, 16.69423335,
      9.29445516, 10.36747092, 13.58044944, 4.32283549, 12.36513011,
      13.12087452, 6.92315165, 11.29511876, 11.40972723, 12.07493336,
      7.03723427, 11.07624784, 9.54265036, 10.57946038, 11.00048059,
      8.53726163, 7.98586508, 10.47524197, 9.80758656, 7.19126081,
      6.4186663 , 11.00806356, 11.94898485, 10.13997077, 10.79009275,
      6.84334539, 6.7382521 , 14.54411933, 9.40201498, 9.18176234,
      8.10790902, 8.46549622, 9.83893778, 6.91045795, 10.58918059,
      9.88307874, 10.5931039 , 11.73655364, 8.91359244, 10.79975179,
      12.37506807, 11.90541353, 10.24231129, 11.95477954, 8.68950738,
      9.28405489, 9.83331573, 11.69182375, 6.79419808, 8.76087891,
      8.94997121, 9.67376957, 6.74192327, 13.37150506, 10.5749546 ,
      14.36893316, 6.60800631, 8.31379831, 7.5189568 , 8.83101738,
      12.34107965, 6.54395417, 12.93984219, 6.24267147, 10.57398242,
      9.78726805, 11.16565551, 8.65901452, 7.3833213 , 6.46574965,
      11.14100018, 9.31045889, 10.37717716, 7.38866014, 9.39473253,
      8.97591858, 9.43562538, 7.22107142, 11.20187259, 10.58836199,
      10.24942864, 10.17733052, 7.87852627, 8.10213064, 13.67473637,
```

```
In [82]: #prediction in the train data
pred=MLR.predict(x_train)
pred
```

```
Out[82]: array([[15.73106364, 10.22173474, 11.22220104, ..., 10.31652733,
      11.22647627, 11.64587986]])
```

```
In [83]: from sklearn.metrics import r2_score
```

```
acc=r2_score(y_test,y_pred)
```

```
acc
```

```
Out[83]: 0.465565333858498
```

```
In [84]: #test this model
```

```
MLR.predict([[1,0.455,0.365,0.095,0.5140,0.2245,0.1010,0.150]])
```

```
Out[84]: array([9.84387382])
```

## 14. Measure the performance using Metrics.¶

```
In [85]: from sklearn import metrics
from sklearn.metrics import mean_squared_error
```

```
In [86]: np.sqrt(mean_squared_error(y_test,y_pred))
```

```
Out[86]: 2.377410175738852
```

## LASSO

```
In [87]: from sklearn.linear_model import Lasso, Ridge
```

```
In [88]: #initialising model
```

```
lso=Lasso(alpha=0.01,normalize=True)
```

```
In [89]: #fit the model
```

```
lso.fit(x_train,y_train)
```

```
Out[89]: Lasso(alpha=0.01, normalize=True)
```

```
In [90]: #prediction on test data
```

```
lso_pred=lso.predict(x_test)
```

```
In [91]: #coef
coef=lso.coef_
coef
```

```
Out[91]: array([-0.01823327, 0.          , 0.          , 0.44300061, 0.18222695,
      0.          , 0.          , 0.80821881])
```

```
In [92]: #accuracy
from sklearn import metrics
from sklearn.metrics import mean_squared_error
metrics.r2_score(y_test,lso_pred)
```

Out[92]: 0.3496421174873602

```
In [93]: #error
np.sqrt(mean_squared_error(y_test,lso_pred))
```

Out[93]: 2.622606496432917

## RIDGE

```
In [94]: rg=Ridge(alpha=0.01,normalize=True)
```

```
In [95]: #fit
rg.fit(x_train,y_train)
```

Out[95]: Ridge(alpha=0.01, normalize=True)

```
In [96]: #predcition
rg_pred=rg.predict(x_test)
rg_pred
```

```
9.33019722, 10.45273238, 13.44157693, 4.42421952, 12.32024796,
13.02827554, 6.89187517, 11.28029144, 11.41795106, 12.07484036,
7.08031507, 11.12362859, 9.64015352, 10.52475617, 11.03276176,
8.54365779, 7.96122079, 10.50946616, 9.87573987, 7.22982477,
6.40997889, 10.96274599, 12.01024275, 10.20450221, 10.83379253,
6.83975613, 6.7437838 , 14.39392028, 9.39408316, 9.18714566,
8.09740446, 8.51777322, 9.88608117, 6.88996082, 10.60910131,
9.87464022, 10.6092613 , 11.64404255, 9.02328979, 10.95454186,
12.23784835, 11.89292487, 10.19971241, 11.92882751, 8.73918132,
9.29648965, 9.8921988 , 11.69325462, 6.79991487, 8.73369548,
8.98570807, 9.68230734, 6.72734854, 13.22789314, 10.54769569,
14.16675805, 6.64836580, 8.36249628, 7.53072715, 8.81920601,
12.32648178, 6.56482464, 12.94238083, 6.25549034, 10.52693591,
9.7761059 , 11.11126017, 8.65939996, 7.46135235, 6.46351466,
11.16378327, 9.29353648, 10.39330421, 7.38074956, 9.4303916 ,
8.93831752, 9.45992644, 7.22758174, 11.26487139, 10.64202092,
10.3140396 , 10.20221439, 7.95930328, 8.14421732, 13.60170416,
10.33962702, 15.37399841, 12.88873193, 12.64458371, 13.59928474,
13.79286805, 12.18825294, 14.21181952, 10.18973102, 8.35922611,
10.1075832 , 8.669865 , 9.90671908, 7.70972481, 7.26507408,
```

```
In [97]: #coef
rg.coef_
```

Out[97]: array([-0.35426427, -0.79776254, 0.42580671, 0.87428934, 0.90530896,  
-1.42139186, 0.13430778, 1.63353253])

```
In [98]: #accuracy
metrics.r2_score(y_test,rg_pred)
```

Out[98]: 0.46360137504539234

```
In [99]: #error
np.sqrt(mean_squared_error(y_test,rg_pred))
```

Out[99]: 2.381775131511989