Abalone Age Prediction

Assignment -3

Assignment Date	03 October 2022
Team ID	PNT2022TMID27812
Project Name	Smart Lender-Application Credibility Prediction for loan Approval
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Maximum Marks	2 Marks

Question-1. Download dataset

Solution:

1	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
2	0.365	0.095	0.514	0.2245	0.101	0.15	15
3	0.265	0.09	0.2255	0.0995	0.0485	0.07	7
4	0.42	0.135	0.677	0.2565	0.1415	0.21	9
5	0.365	0.125	0.516	0.2155	0.114	0.155	10
6	0.255	0.08	0.205	0.0895	0.0395	0.055	7
7	0.3	0.095	0.3515	0.141	0.0775	0.12	8
8	0.415	0.15	0.7775	0.237	0.1415	0.33	20
9	0.425	0.125	0.768	0.294	0.1495	0.26	16
10	0.37	0.125	0.5095	0.2165	0.1125	0.165	9
11	0.44	0.15	0.8945	0.3145	0.151	0.32	19
12	0.38	0.14	0.6065	0.194	0.1475	0.21	14
13	0.35	0.11	0.406	0.1675	0.081	0.135	10
14	0.38	0.135	0.5415	0.2175	0.095	0.19	11
15	0.405	0.145	0.6845	0.2725	0.171	0.205	10
16	0.355	0.1	0.4755	0.1675	0.0805	0.185	10
17	0.4	0.13	0.6645	0.258	0.133	0.24	12
18	0.28	0.085	0.2905	0.095	0.0395	0.115	7
19	0.34	0.1	0.451	0.188	0.087	0.13	10
20	0.295	0.08	0.2555	0.097	0.043	0.1	7
21	0.32	0.1	0.381	0.1705	0.075	0.115	9
22	0.28	0.095	0.2455	0.0955	0.062	0.075	11
23	0.275	0.1	0.2255	0.08	0.049	0.085	10
24	0.44	0.155	0.9395	0.4275	0.214	0.27	12
25	0.415	0.135	0.7635	0.318	0.21	0.2	9

Question-2. Load the dataset

Solution:

import numpy as np

import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

import sklearn

data = pd.read_csv(r"abalone.csv")

data.head

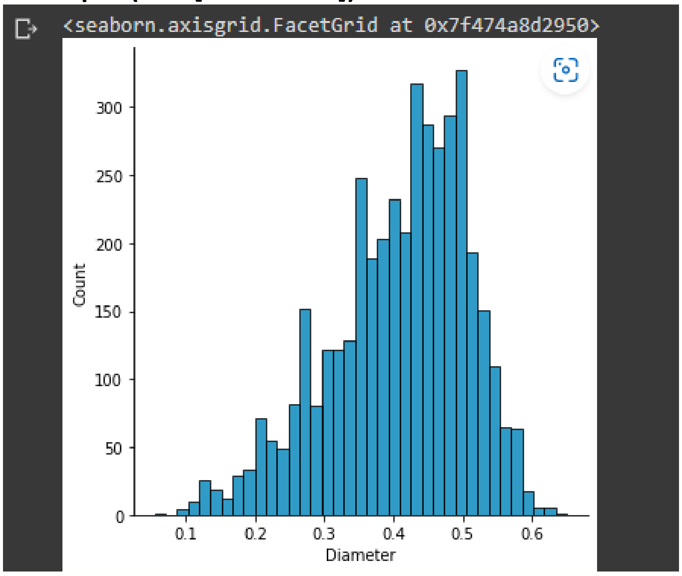
```
<bound method NDFrame.head of       Sex  Length  Diameter  Height  Whole weight  Shucked weight
0       M   0.455     0.365   0.095        0.5140          0.2245
1       M   0.350     0.265   0.090        0.2255          0.0995
2       F   0.530     0.420   0.135        0.6770          0.2565
3       M   0.440     0.365   0.125        0.5160          0.2155
4       I   0.330     0.255   0.080        0.2050          0.0895
...    ..     ...       ...     ...           ...             ...
4172    F   0.565     0.450   0.165        0.8870          0.3700
4173    M   0.590     0.440   0.135        0.9660          0.4390
4174    M   0.600     0.475   0.205        1.1760          0.5255
4175    F   0.625     0.485   0.150        1.0945          0.5310
4176    M   0.710     0.555   0.195        1.9485          0.9455

      Viscera weight  Shell weight  Rings
0             0.1010        0.1500     15
1             0.0485        0.0700      7
2             0.1415        0.2100      9
3             0.1140        0.1550     10
4             0.0395        0.0550      7
...              ...           ...    ...
4172          0.2390        0.2490     11
4173          0.2145        0.2605     10
4174          0.2875        0.3080      9
4175          0.2610        0.2960     10
4176          0.3765        0.4950     12
```

Question-3. Perform Below Visualizations.

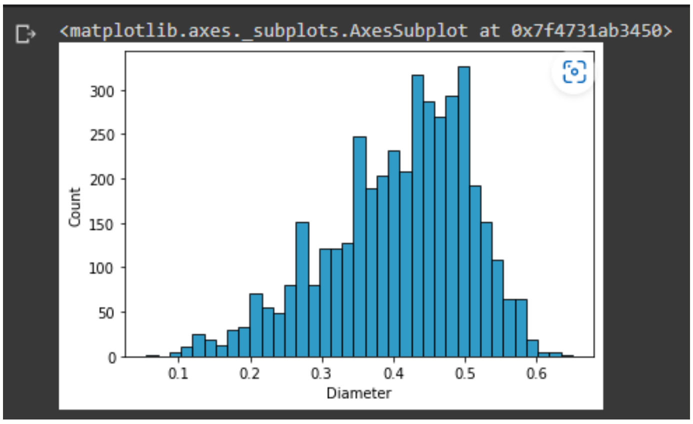
3.1 Univariate Analysis

Solution:

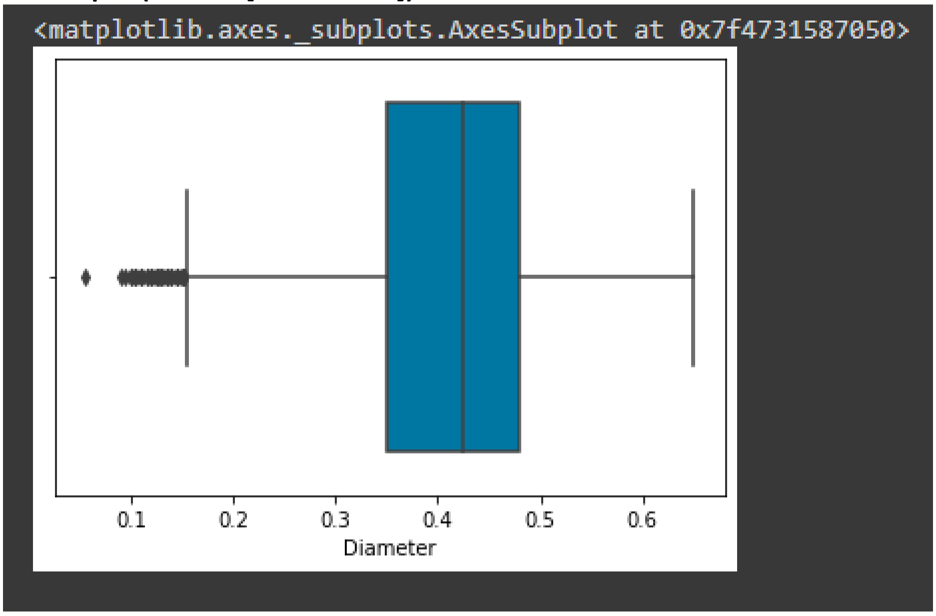
sns.displot(data[' Diameter'])



sns.histplot(data[' Diameter '])



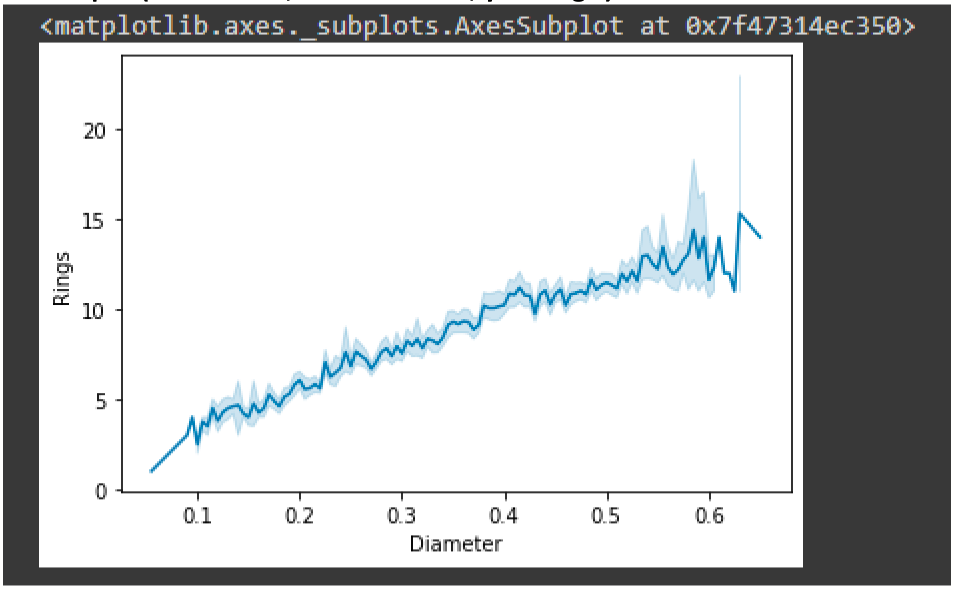
```
sns.boxplot(x = data[' Diameter '])
```



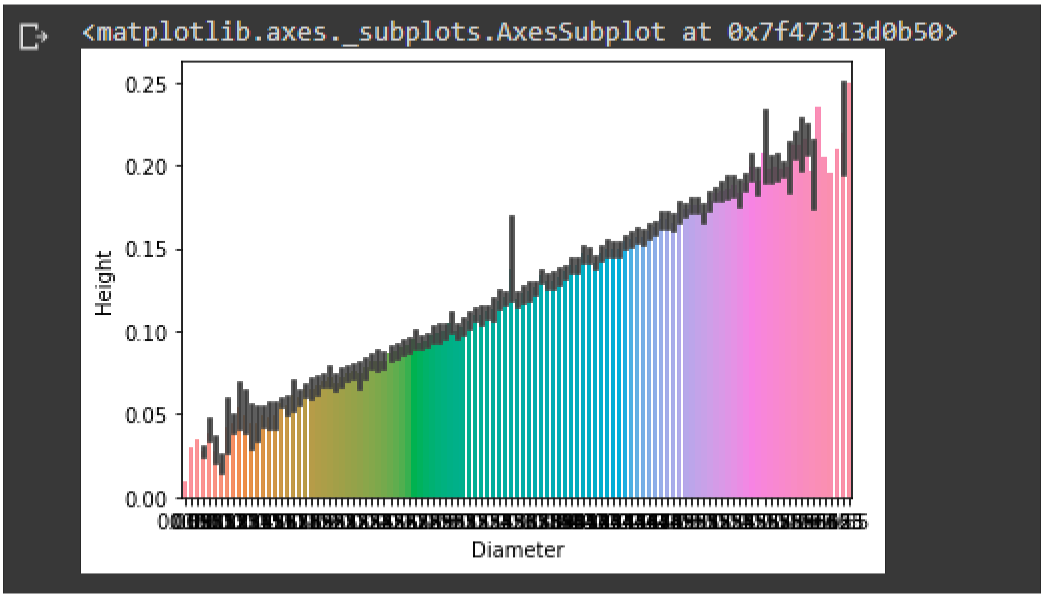
3.2 Bivariate Analysis

Solution:

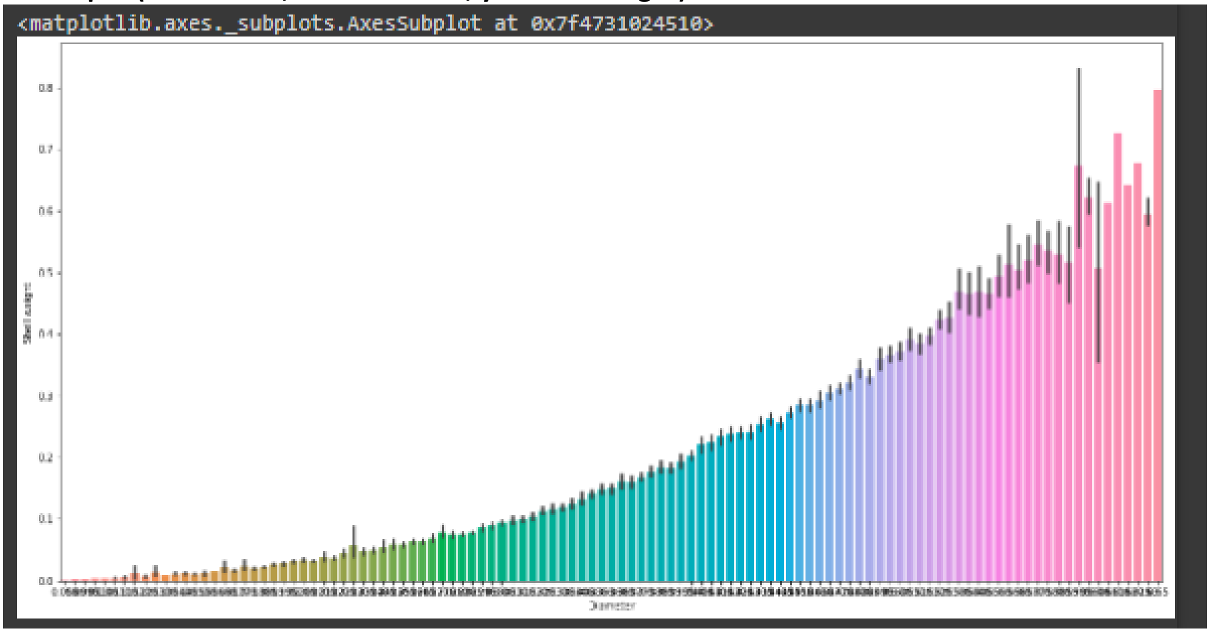
```
sns.lineplot(data = data, x = 'Diameter', y = 'Rings')
```



```
sns.barplot(data = data, x = 'Diameter',y = 'Height')
```




```
plt.figure(figsize=(20,20))
sns.barplot(data = data, x = 'Diameter', y = 'Shell weight)
```

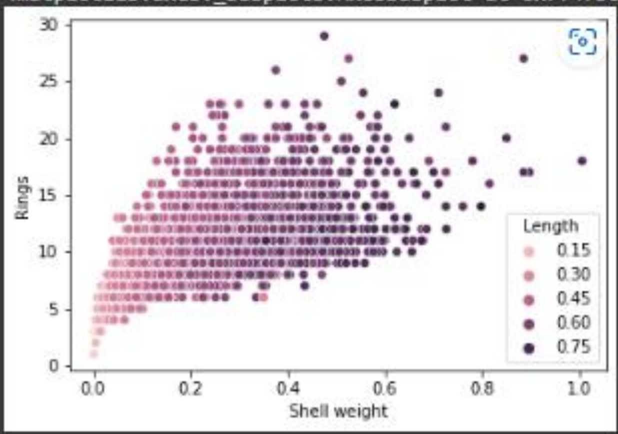


3.3 Multivariate Analysis

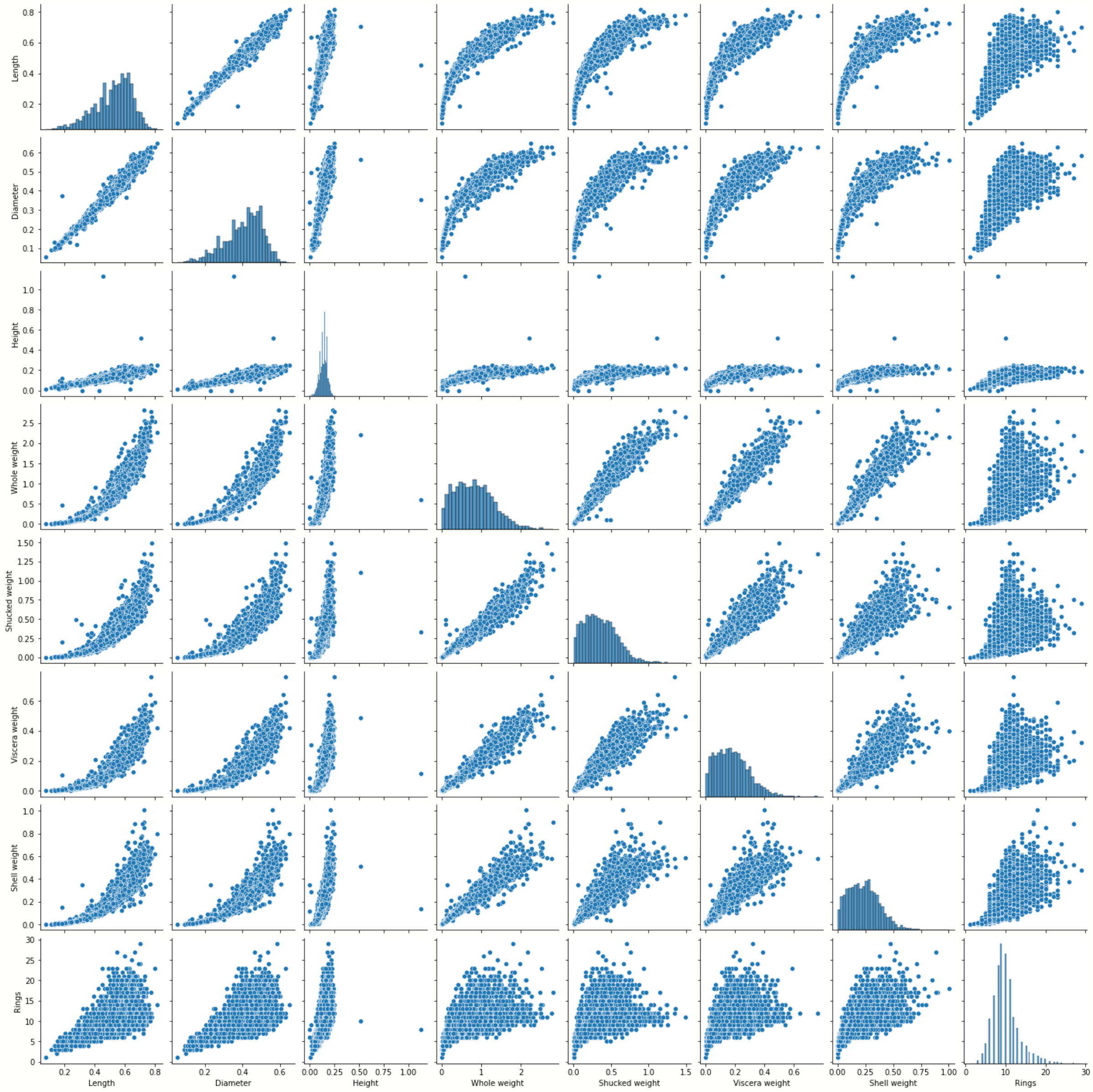
Solution:

sns.scatterplot(data = data x = 'Shell weight', y = 'Rings', hue = 'Length')

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f4730b25210>
```



sns.pairplot(data)



Question-4. Perform descriptive statistics on the dataset.

Solution:

data.mean(numeric_only = True)

```
Length            0.523992
Diameter          0.407881
Height            0.139516
Whole weight      0.828742
Shucked weight    0.359367
Viscera weight    0.180594
Shell weight      0.238831
Rings             9.933684
dtype: float64
```

data.median(numeric_only = True)

```
Length            0.5450
Diameter          0.4250
Height            0.1400
Whole weight      0.7995
Shucked weight    0.3360
Viscera weight    0.1710
Shell weight      0.2340
Rings             9.0000
dtype: float64
```

data['Whole weight'].mode()

```
0 0.2225 dtype: float64
```

data['Length'].mode()

```
0 0.550 1 0.625 dtype: float64
```

data['Rings'].unique()

```
array([15, 7, 9, 10, 8, 20, 16, 19, 14, 11, 12, 18, 13, 5, 4, 6, 21,
17, 22, 1, 3, 26, 23, 29, 2, 27, 25, 24])
```

data.std(numeric_only=True)

```
Length            0.120093
Diameter          0.099240
Height            0.041827
Whole weight      0.490389
Shucked weight    0.221963
Viscera weight    0.109614
Shell weight      0.139203
Rings             3.224169
dtype: float64
```

data.describe()

	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

data['Whole weight'].value_counts()

```
0.2225    8
1.1345    7
0.9700    7
0.4775    7
0.1960    7
         ..
0.0475    1
1.8930    1
1.8725    1
2.1055    1
1.9485    1
Name: Whole weight, Length: 2429, dtype: int64
```

Question-5. Handle the Missing values.

Solution:

data.isnull().any()

```
Sex               False
Length            False
Diameter          False
Height            False
Whole weight      False
Shucked weight    False
Viscera weight    False
Shell weight      False
Rings             False
dtype: bool
```

data.isnull().sum()

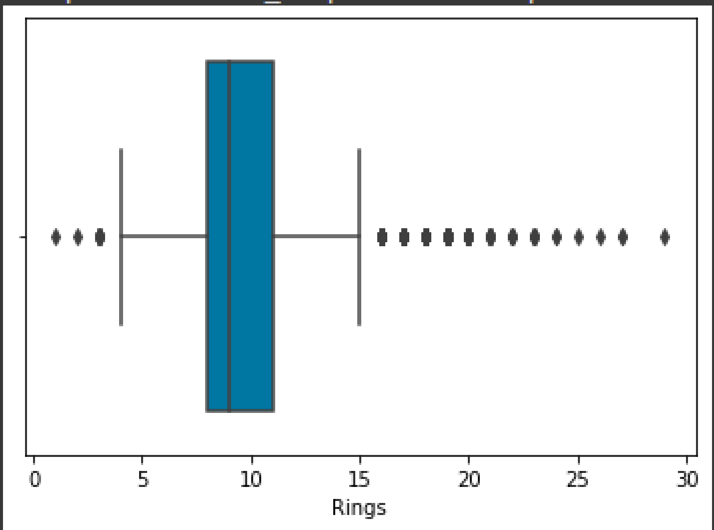
```
Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
Viscera weight    0
Shell weight      0
Rings             0
dtype: int64
```

Question-6. Find the outliers and replace the outliers

Solution:

sns.boxplot(x = data['Rings'])

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f472d3e1090>
```



q = data.quantile([0.75,0.25])
q

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

iqr = q.iloc[0] - q.iloc[1]
iqr

```
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
```

u = q.iloc[0] + (1.5*iqr)
u

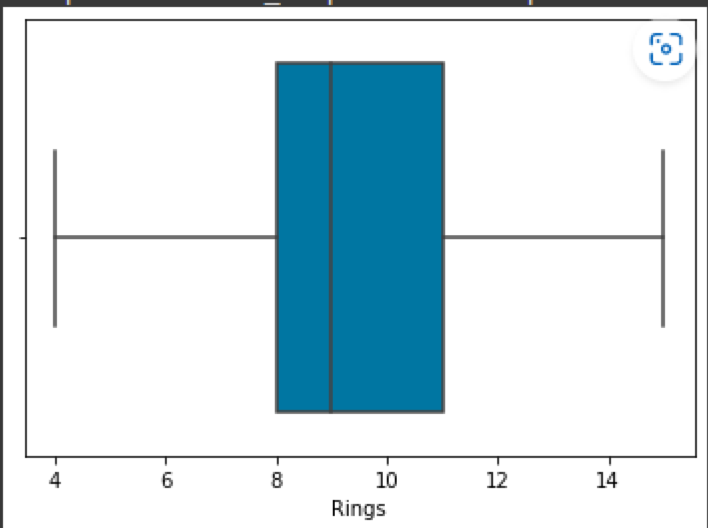
```
Length            0.86250
Diameter          0.67500
Height            0.24000
Whole weight      2.22025
Shucked weight    0.97600
Viscera weight    0.49225
Shell weight      0.62750
Rings            15.50000
dtype: float64
```

l = q.iloc[1] - (1.5*iqr)
l

```
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
```

data['Rings'] = np.where(np.logical_or(data['Rings']>15, data['Rings']<4), 9, data['Rings'])
sns.boxplot(x = data['Rings'])

```
&lt;matplotlib.axes._subplots.AxesSubplot at 0x7f472d26c310&gt;
```



Question-7. Check for Categorical columns and perform encoding

Solution:

data['Age'] = data['Rings'] + 1.5
data['Sex'].value_counts()

```
M    1528
I    1342
F    1307
Name: Sex, dtype: int64
```

from sklearn.preprocessing import LabelEncoder, OneHotEncoder
le = LabelEncoder()
data = pd.get_dummies(data)
data.head()

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Age	Sex_F	Sex_I	Sex_M
0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	16.5	0	0	1
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	8.5	0	0	1
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	10.5	1	0	0
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	11.5	0	0	1
4	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	8.5	0	1	0

Question-8. Split the data into dependent and independent variables split the data in X and Y

Solution:

y = data['Age']
data = data.drop(['Rings','Age'], axis=1)
x = data
data.head

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Sex_F	Sex_I	Sex_M
0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	0	0	1
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	0	0	1
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	1	0	0
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	0	0	1
4	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	0	1	0

y

```
0       16.5
1        8.5
2       10.5
3       11.5
4        8.5
        ...
4172    12.5
4173    11.5
4174    10.5
4175    11.5
4176    13.5
Name: Age, Length: 4177, dtype: float64
```

Question-9. Scale the independent variables

Solution:

from sklearn.preprocessing import StandardScaler, MinMaxScaler
sc = StandardScaler()
x_scaled = sc.fit_transform(x)
x_scaled

```
array([[-0.57455813, -0.43214879, -1.06442415, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [-1.44898585, -1.439929  , -1.18397831, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.05003309,  0.12213032, -0.10799087, ...,  1.48184628,
        -0.68801788, -0.75948762],
       ...,
       [ 0.6329849 ,  0.67640943,  1.56576738, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.84118198,  0.77718745,  0.25067161, ...,  1.48184628,
        -0.68801788, -0.75948762],
       [ 1.54905203,  1.48263359,  1.32665906, ..., -0.67483383,
        -0.68801788,  1.31667716]])
```

Question-10. Split data into Training and Testing

Solution:

from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x_scaled, y, test_size = 0.3, random_state = 0)
x_train

```
array([[ 0.79954256,  1.0291325 ,  0.84844242, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [-1.49062526, -1.54070702, -1.30353247, ..., -0.67483383,
         1.45345059, -0.75948762],
       [-1.24078877, -1.33915098, -1.06442415, ..., -0.67483383,
         1.45345059, -0.75948762],
       ...,
       [ 0.59134549,  0.42446438,  0.13111745, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.84118198,  0.82757646,  0.6093341 , ...,  1.48184628,
        -0.68801788, -0.75948762],
       [-0.94931287, -0.83526087, -0.70576167, ..., -0.67483383,
         1.45345059, -0.75948762]])
```

x_train.shape

```
(2923, 10)
```

x_test

```
array([[ 0.21659075,  0.17251933,  0.37022577, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [-0.1998034 , -0.07942572, -0.46665335, ..., -0.67483383,
         1.45345059, -0.75948762],
       [ 0.79954256,  0.72679844,  0.37022577, ..., -0.67483383,
        -0.68801788,  1.31667716],
       ...,
       [ 0.92446081,  0.87796547, -2.97729071, ...,  1.48184628,
        -0.68801788, -0.75948762],
       [ 1.13265788,  0.97874349,  1.44621322, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.79954256,  0.77718745,  0.72888826, ..., -0.67483383,
         1.45345059, -0.75948762]])
```

x_test.shape

```
(1254, 10)
```

y_train

```
1376    11.5
1225     6.5
2722     8.5
3387    10.5
2773    12.5
        ...
1033    11.5
3264    13.5
1653    11.5
2607    10.5
2732     9.5
Name: Age, Length: 2923, dtype: float64
```

y_test

```
668     14.5
1580     9.5
3784    12.5
463      6.5
2615    13.5
        ...
1052    13.5
3439     9.5
1174    10.5
2210    10.5
2408    16.5
Name: Age, Length: 1254, dtype: float64
```

Question-11. Build the model

Solution:

from sklearn.linear_model import LinearRegression
lr = LinearRegression()
lr.fit(x_train,y_train)

```
LinearRegression()
```

predict = lr.predict(x_test)
predict

```
array([12.32892845, 10.26905996, 11.99728864, ..., 11.36906433,
       13.83936664, 11.45100404])
```

Question-12. Train the model

Solution:

y_train

```
1376    11.5
1225     6.5
2722     8.5
3387    10.5
2773    12.5
        ...
1033    11.5
3264    13.5
1653    11.5
2607    10.5
2732     9.5
Name: Age, Length: 2923, dtype: float64
```

Question-13. Test the model

Solution:

y_test

```
668     14.5
1580     9.5
3784    12.5
463      6.5
2615    13.5
        ...
1052    13.5
3439     9.5
1174    10.5
2210    10.5
2408    16.5
Name: Age, Length: 1254, dtype: float64
```

Question-14. Measure the performance using Metrics

Solution:

```
from sklearn.metrics import r2_score, mean_squared_error
mse = mean_squared_error(y_test, predict)
rmse = np.sqrt(mse)
print("mse = ", mse)
print("rmse = ", rmse)
r2_score(y_test,predict)
```

```
mse =  2.9684942599827626
rmse =  1.7229318790894672
0.4607933491755676
```