```
#1
#Dataset downloaded
#Uploading the dataset

from google.colab import files
uploaded = files.upload()
```

Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

Saving abalone.csv to abalone (1).csv

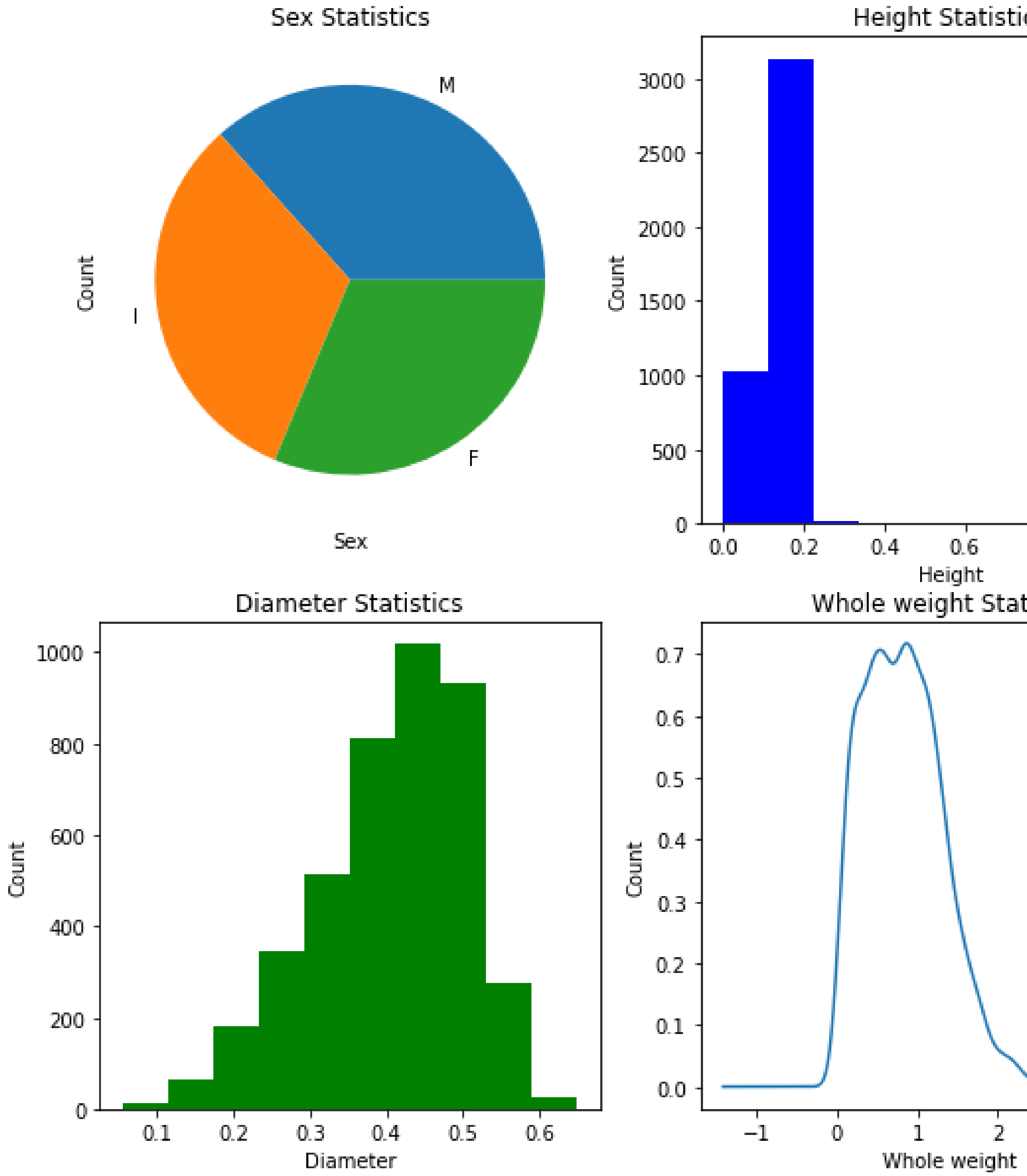
```
#2
#Loading the dataset

import pandas as pd
import numpy as np

df = pd.read_csv(r'abalone.csv')
df.head(3)
```

	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	0.15	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.07	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.21	9

```
#3 Univariate analysis

import matplotlib.pyplot as plt

plt.figure(figsize=(10,10))
counts = df['Sex'].value_counts()
plt.subplot(221)
plt.pie(counts, labels = counts.index)
plt.title('Sex Statistics')
plt.xlabel('Sex')
plt.ylabel('Count')

plt.subplot(222)
plt.hist(df['Height'],color='blue')
plt.title('Height Statistics')
plt.xlabel('Height')
plt.ylabel('Count')

plt.subplot(223)
plt.hist(df['Diameter'],color='green')
plt.title('Diameter Statistics')
plt.xlabel('Diameter')
plt.ylabel('Count')

plt.subplot(224)
df['Whole weight'].plot(kind='density')
plt.title('Whole weight Statistics')
```

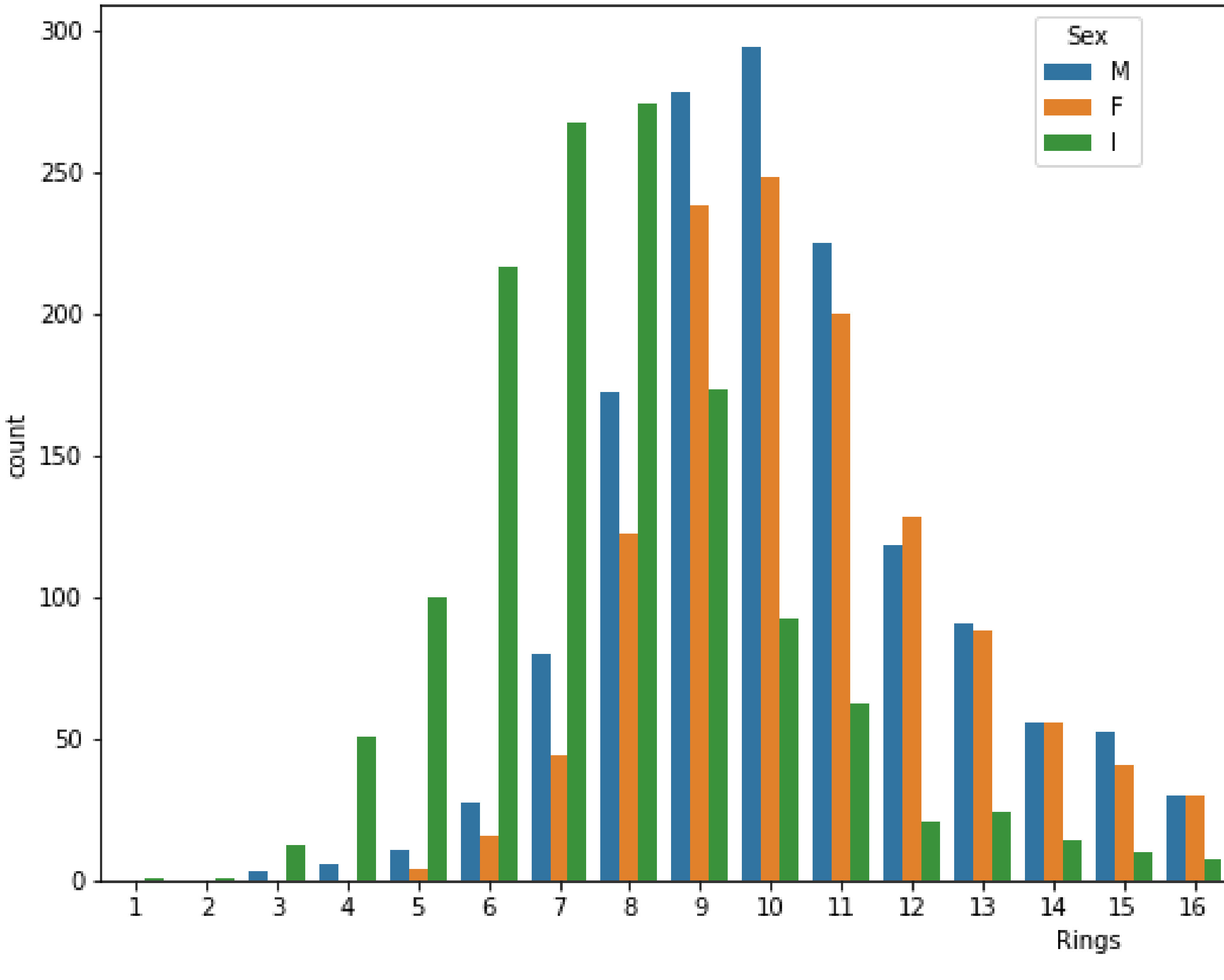
```
plt.xlabel('Whole weight')
plt.ylabel('Count')
```

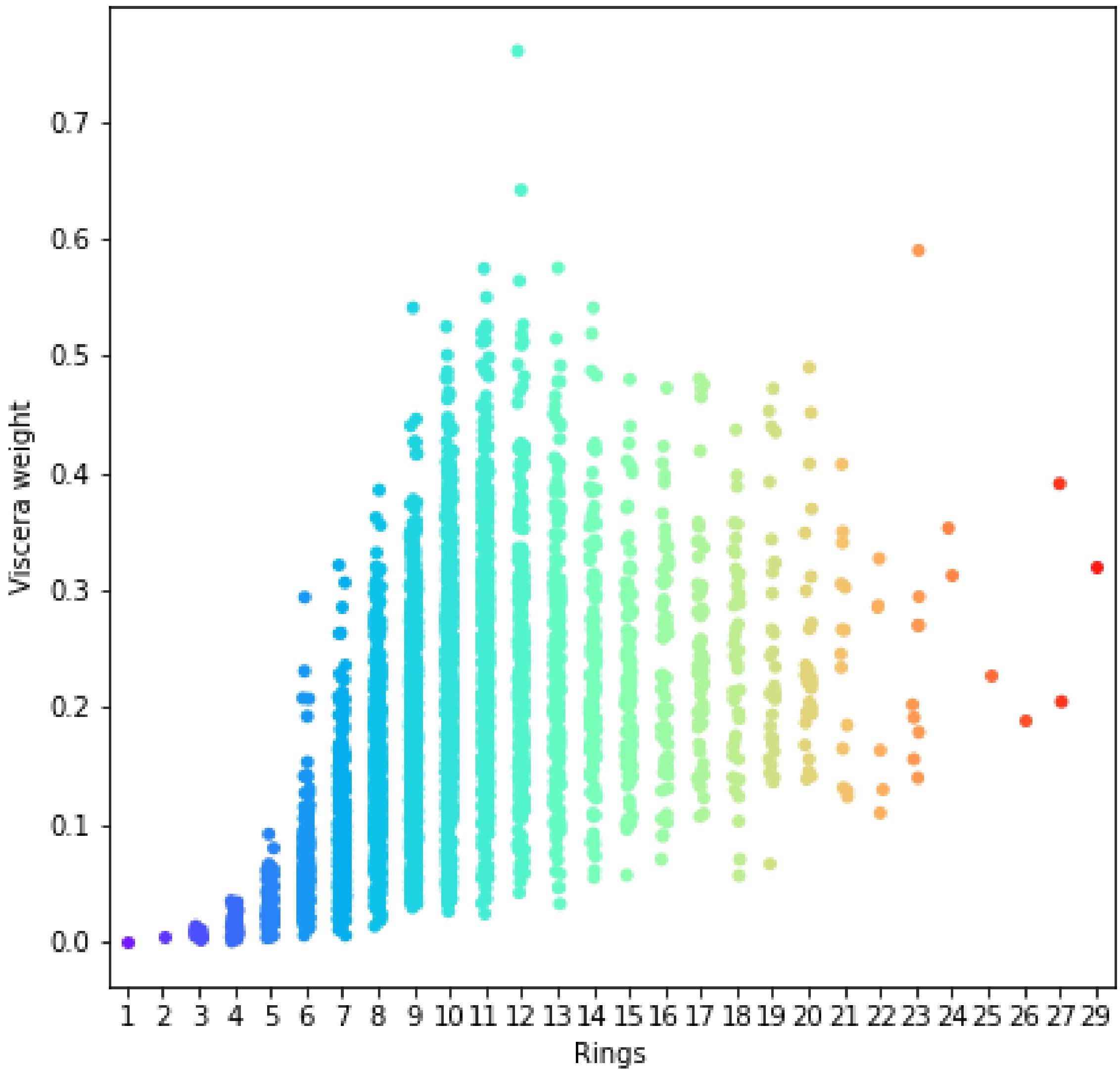
```
Text(0, 0.5, 'Count')
```

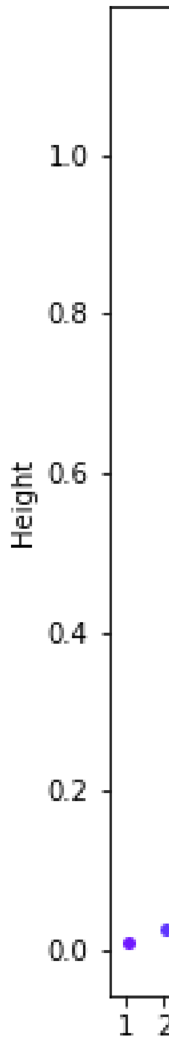


```
#3 Bivariate Analysis
import seaborn as sns

plt.figure(figsize=(15,15))

#Categorical vs Categorical
plt.subplot(2,1,1)
sns.countplot(data = df, x = 'Rings', hue = 'Sex')

plt.figure(figsize=(15,15))
#Continuous vs Continuous
plt.subplot(2,2,1)
sns.stripplot(x='Rings', y='Viscera weight', data=df, palette='rainbow')

plt.subplot(2,2,2)
sns.stripplot(x='Rings', y='Height', data=df, palette='rainbow')
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f68ceeb0d90>







#3 Multivariate Analysis

```
pd.plotting.scatter_matrix(df, alpha=0.2, figsize=(20,20))
```

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f68cec9cc50>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68ceca4690>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd3e8bd0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd3ad210>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd3e1810>,
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        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd35e450>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd313a50>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd31cf10>,
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        <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cd12ed50>,
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```

```
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 <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cc7f97d0>,
 <matplotlib.axes._subplots.AxesSubplot object at 0x7f68cc7aecd0>]],
dtype=object)
```
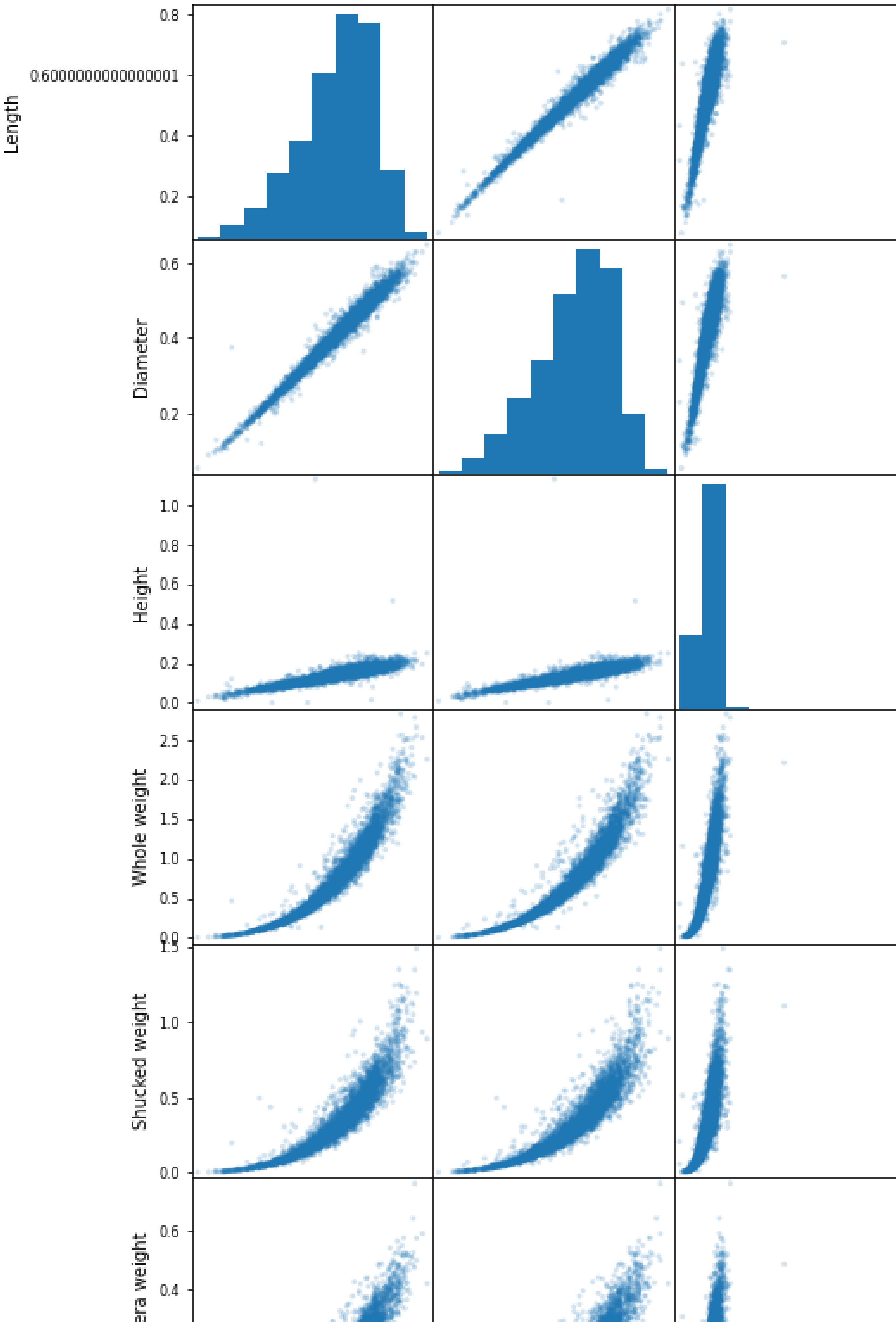



Length
0.8
0.6000000000000001
0.4
0.2
Diameter
0.6
0.4
0.2
Height
1.0
0.8
0.6
0.4
0.2
0.0
Whole weight
2.5
2.0
1.5
1.0
0.5
0.0
Shucked weight
1.5
1.0
0.5
0.0
era weight
0.6
0.4

#4
df.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

df.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
```

#5 Handling missing values

df.isnull().sum()

```
Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
```

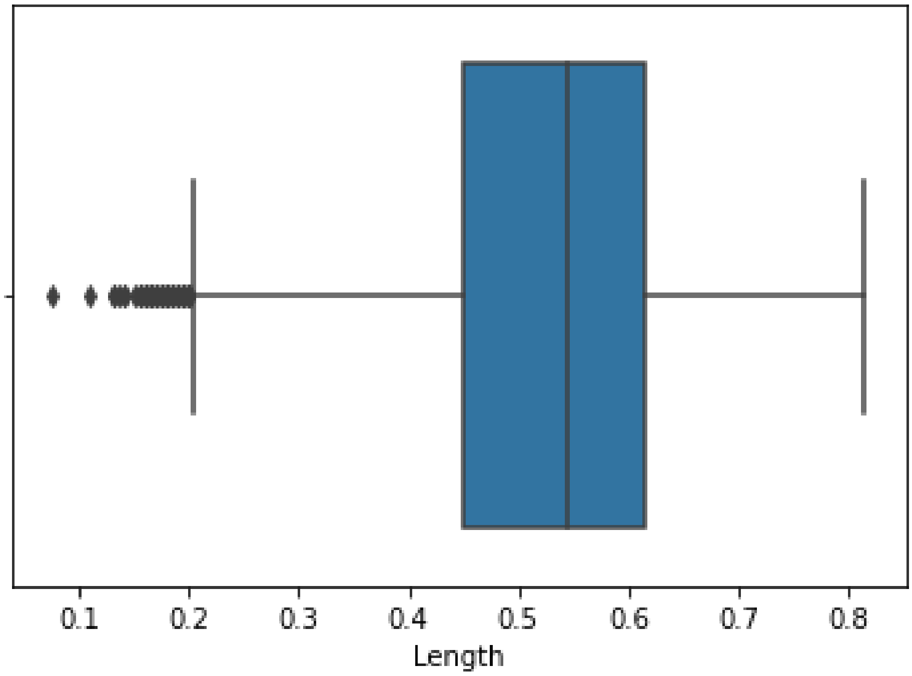
```
Viscera weight    0
Shell weight      0
Rings             0
dtype: int64
```

```python
#For Continuous variables
df['Length'].fillna(df['Length'].mean(), inplace=True)
df['Height'].fillna(df['Height'].mean(), inplace=True)
df['Diameter'].fillna(df['Diameter'].mean(), inplace=True)
df['Whole weight'].fillna(df['Whole weight'].mean(), inplace=True)
df['Shucked weight'].fillna(df['Shucked weight'].mean(), inplace=True)
df['Viscera weight'].fillna(df['Viscera weight'].mean(), inplace=True)
df['Shell weight'].fillna(df['Shell weight'].mean(), inplace=True)
df['Rings'].fillna(df['Rings'].mean(), inplace=True)

#For Categorical variables
df['Sex'].fillna(df['Sex'].mode(), inplace=True)

#Ensuring again
print(df.isnull().sum())

print('\n\Sex : ', df['Sex'].unique())
```

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

\Sex :  ['M' 'F' 'I']
```

```python
#6 Outlier detection - box plot
import seaborn as sns
sns.boxplot(df['Length'])
print('No. of Outliers : ', (df['Length'] < 0.2).sum())
```

```
No. of Outliers :  43
```

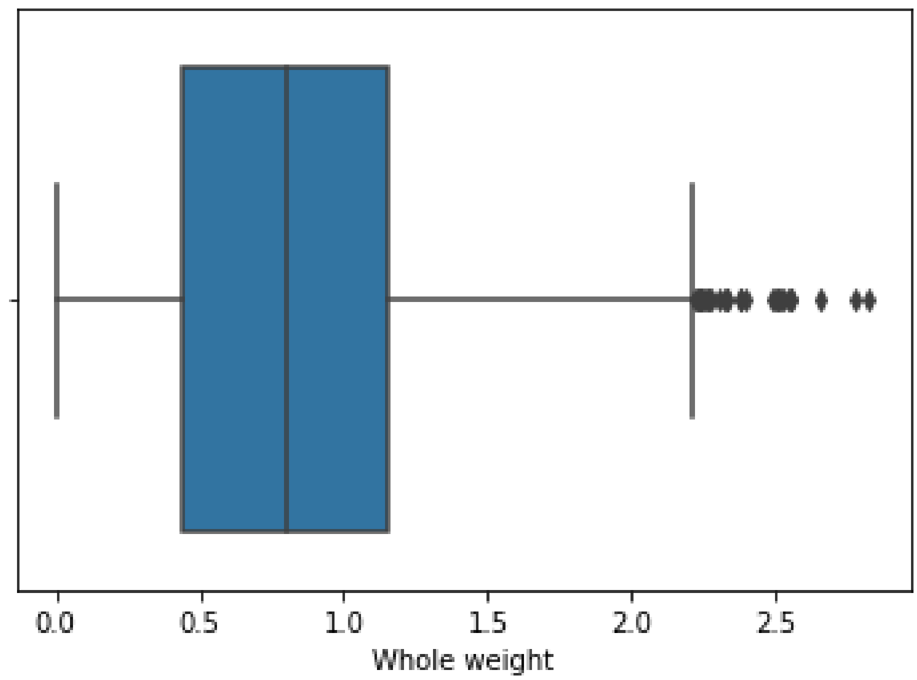


#6 Outlier detection - zscore
from scipy **import** stats
zscore = np**.**abs(stats**.**zscore(df['Diameter']))
print(zscore)
print('No. of Outliers : ', np**.**shape(np**.**where(zscore>3)))

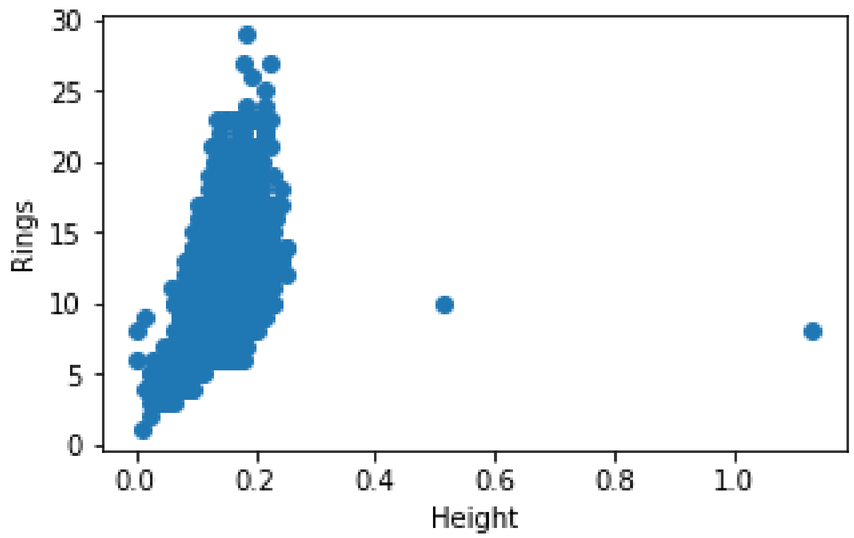
```
0       0.432149
1       1.439929
2       0.122130
3       0.432149
4       1.540707
          ...
4172    0.424464
4173    0.323686
4174    0.676409
4175    0.777187
4176    1.482634
Name: Diameter, Length: 4177, dtype: float64
No. of Outliers :  (1, 13)
```

#6 Outlier detection - box plot
sns**.**boxplot(df['Whole weight'])
print('No. of Outliers : ', (df['Whole weight'] > 2.2)**.**sum())

No. of Outliers : 33




```
#6 Outlier detection - Scatter plot
import matplotlib.pyplot as plt

fig, ax = plt.subplots(figsize = (5,3))
ax.scatter(df['Height'], df['Rings'])

# x-axis label
ax.set_xlabel('Height')

# y-axis label
ax.set_ylabel('Rings')
plt.show()
```



```
#6 Outlier detection - IQR
Q1 = df['Shucked weight'].quantile(0.25)
Q3 = df['Shucked weight'].quantile(0.75)
IQR = Q3 - Q1
print(IQR)
upper=Q3 + 1.5 * IQR
lower=Q1 - 1.5 * IQR
count = np.size(np.where(df['Shucked weight'] >upper))
count = count + np.size(np.where(df['Shucked weight'] <lower))
print('No. of outliers : ', count)
```

```
0.316
No. of outliers :  48
0.316
No. of outliers :  48
```

```
#6 Outlier detection - 3 sigma

upper = df['Viscera weight'].mean() + (3 * df['Viscera weight'].std())
lower = df['Viscera weight'].mean() - (3 * df['Viscera weight'].std())
columns = df[ ( df['Viscera weight'] > upper ) | ( df['Viscera weight']<lower ) ]
print('Upper range : ', upper)
print('Lower range : ', lower)
print('No. of Outliers : ', len(columns))
```

```
Upper range :  0.5094363586315791
Lower range :  -0.1482491429265277
No. of Outliers :  22
```

```
#6 Outlier detection - 3 sigma

upper = df['Shell weight'].mean() + (3 * df['Shell weight'].std())
lower = df['Shell weight'].mean() - (3 * df['Shell weight'].std())
columns = df[ ( df['Shell weight'] > upper ) | ( df['Shell weight']<lower ) ]
print('Upper range : ', upper)
print('Lower range : ', lower)
print('No. of Outliers : ', len(columns))
```

```
Upper range :  0.6564388680356763
Lower range :  -0.17877714909864026
No. of Outliers :  27
```

```
#6 Removing Outliers
columns = ['Diameter', 'Length', 'Whole weight',  'Height', 'Shucked weight', 'Viscera weight', 'Shell weight']

for i in columns:
    Q1=df[i].quantile(0.25)
    Q3=df[i].quantile(0.75)
    IQR=Q3-Q1
    upper=Q3+1.5*IQR
    lower=Q1-1.5*IQR
    df[i]=np.where(df[i] >upper, upper, df[i])
    df[i]=np.where(df[i] <lower, lower, df[i])
```

```
#After outlier removal
columns = ['Diameter', 'Length', 'Whole weight',  'Height', 'Shucked weight', 'Viscera weight', 'Shell weight']

for i in columns:
  Q1 = df[i].quantile(0.25)
  Q3 = df[i].quantile(0.75)
```

```
  IQR = Q3 - Q1
  upper=Q3 + 1.5 * IQR
  lower=Q1 - 1.5 * IQR
  count = np.size(np.where(df[i] >upper))
  count = count + np.size(np.where(df[i] <lower))
  print('No. of outliers in ', i, ' : ', count)
```

```
No. of outliers in  Diameter  :  0
No. of outliers in  Length  :  0
No. of outliers in  Whole weight  :  0
No. of outliers in  Height  :  0
No. of outliers in  Shucked weight  :  0
No. of outliers in  Viscera weight  :  0
No. of outliers in  Shell weight  :  0
```

```
#7  Label Encoding
print('Before encoding : ', df['Sex'][0])
df['Sex'] = df['Sex'].astype('category')

df['Sex'] = df['Sex'].cat.codes
print('After encoding : ', df['Sex'][0])

df['Sex'].dtype
```

```
Before encoding :  M
After encoding :  2
dtype('int8')
```

```
df.dtypes
```

```
Sex               int8
Length            float64
Diameter          float64
Height            float64
Whole weight      float64
Shucked weight    float64
Viscera weight    float64
Shell weight      float64
Rings             int64
dtype: object
```

```
#Changing target column(Exited) as the last column

Exit = df['Rings']
df = df.drop('Rings', axis=1)
df = df.join(Exit)
```

```
df.head(1)
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	2	0.455	0.365	0.095	0.514	0.2245	0.101	0.15	15

```
#8 Splitting dependent and independent variables
X = df.iloc[:, :-1]
print('Independent : \n', X.head(2))

Y = df.iloc[:, -1]
print('Dependent : \n', Y.head(2))
```

```
Independent :
```

```
   Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
0    2   0.455     0.365   0.095        0.5140          0.2245
1    2   0.350     0.265   0.090        0.2255          0.0995

   Viscera weight  Shell weight
0          0.1010          0.15
1          0.0485          0.07
Dependent :
 0    15
1     7
Name: Rings, dtype: int64
```

```
#9 Scaling
from sklearn.preprocessing import RobustScaler
scaler=RobustScaler()

print('Before scaling : \n', X[1:3])
X = scaler.fit_transform(X)
print('\n\nAfter scaling : \n', X[1:3])
```

```
Before scaling :
   Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
1    2    0.35     0.265   0.090        0.2255          0.0995
2    0    0.53     0.420   0.135        0.6770          0.2565

   Viscera weight  Shell weight
1          0.0485          0.07
2          0.1415          0.21


After scaling :
 [[ 0.5        -1.18181818 -1.23076923 -1.         -0.80674631 -0.74841772
  -0.76802508 -0.8241206 ]
 [-0.5        -0.09090909 -0.03846154 -0.1        -0.17217147 -0.25158228
  -0.18495298 -0.12060302]]
```

```
#10 Splitting data into training and test set
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)
print(X_train.shape, X_test.shape, Y_train.shape, Y_test.shape)
```

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

```
#11 Build the model
from sklearn import linear_model as lin_mod
model = lin_mod.LinearRegression()
```

```
#12 Training the model
LinearRegression = model.fit(X_train, Y_train)
r_sq = model.score(X_train, Y_train)
print(f"Determination coeeficient: {r_sq}")
```

```
Determination coeeficient: 0.5394019894190405
```

```
#13 Testing the model
Y_pred = model.predict(X_test)
```

```
print('Predicted values : ', Y_pred[:5])
```

```
Predicted values :  [13.18842068 14.21223424  8.63255896  5.61492745  9.05210334]
```

```
#Metrics
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
```

```
r2 = r2_score(Y_test, Y_pred)
mean_squared_error = mean_squared_error(Y_test, Y_pred)
rmse = (np.sqrt(mean_squared_error))

print('R2 score : ', r2)
print('Mean squared error : ', mean_squared_error)
print('Root Mean squared error : ', rmse)
```

```
R2 score :  0.5244781220124035
Mean squared error :  4.597226769271034
Root Mean squared error :  2.144114448734263
```