Assignment 3

1. import 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

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

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving abalone.xlsx to abalone (2).xlsx
```

```
age=pd.read_excel("abalone.xlsx")
```

3. Univariate Analysis

```
# display first 5 rows

age.head()
```

	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	15.0
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7.0
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9.0
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10.0
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7.0

```
# display last 5 rows

age.tail()
```

	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	11.0
4173	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10.0

```
# information of datatypes

age.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4177 entries, 0 to 4176
Data columns (total 10 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   00              4177 non-null   int64
 1   Sex             4177 non-null   object
 2   Length          4177 non-null   float64
 3   Diameter        4177 non-null   float64
 4   Height          4177 non-null   float64
 5   Whole weight    4177 non-null   float64
 6   Shucked weight  4177 non-null   float64
 7   Viscera weight  4177 non-null   float64
 8   Shell weight    4177 non-null   float64
 9   Rings           4177 non-null   float64
dtypes: float64(8), int64(1), object(1)
memory usage: 326.5+ KB
```

```
#calculate mean of 'Rings'
age['Rings'].mean()
```

```
9.933684462532918
```

```
#calculate median of 'Rings'
age['Rings'].median()
```

```
9.0
```

```
#calculate standard deviation of 'Rings'
age['Rings'].std()
```

```
3.2241690320681284
```

```
#create frequency table for 'Rings'
age['Rings'].value_counts()
```

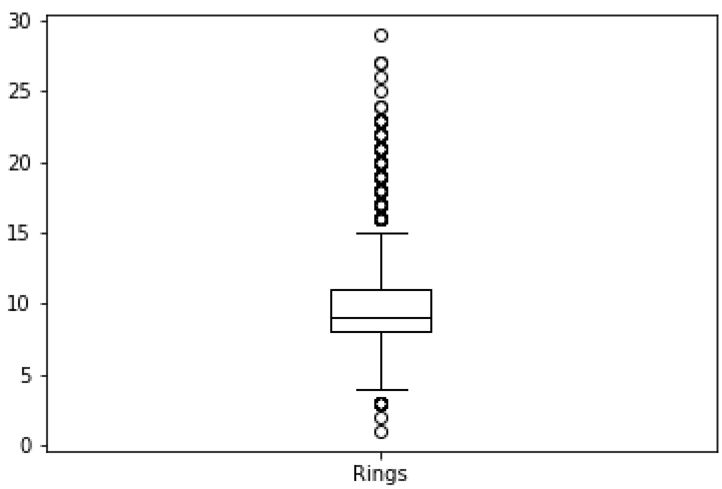
```
9.0     689
10.0    634
8.0     568
11.0    487
7.0     391
12.0    267
6.0     259
```

```
13.0    203
14.0    126
5.0     115
15.0    103
16.0     67
17.0     58
4.0      57
18.0     42
19.0     32
20.0     26
3.0      15
21.0     14
23.0      9
22.0      6
27.0      2
24.0      2
1.0       1
26.0      1
29.0      1
2.0       1
25.0      1
Name: Rings, dtype: int64
```

```
#create a boxplot for the 'Rings' variable
import matplotlib.pyplot as plt

age.boxplot(column=['Rings'], grid=False, color='black')
```

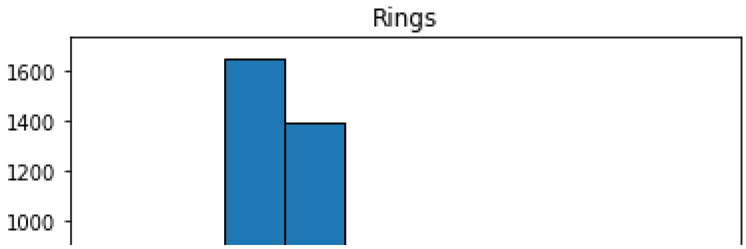
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90ffad0d50>
```




```
# to create a histogram for the 'Rings' variable
import matplotlib.pyplot as plt

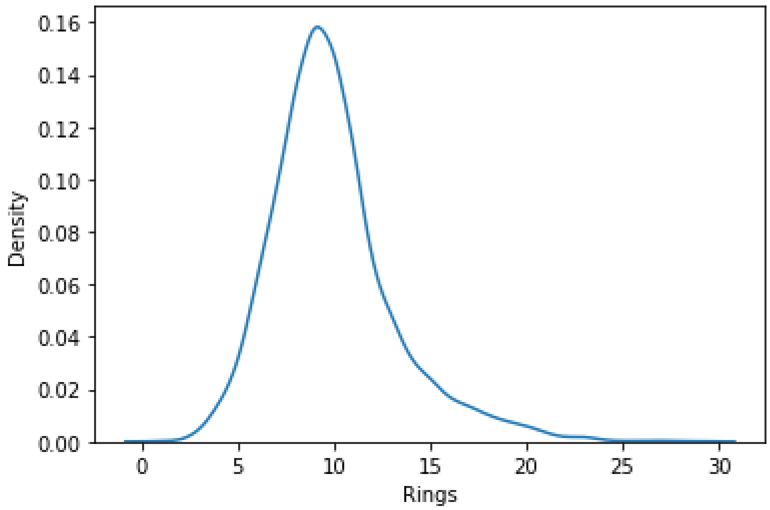
age.hist(column='Rings', grid=False, edgecolor='black')
```

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f90ffa5a8d0>]],
      dtype=object)
```




```
#to create a density curve for the ‘Rings’ variable
sns.kdeplot(age['Rings'])
```

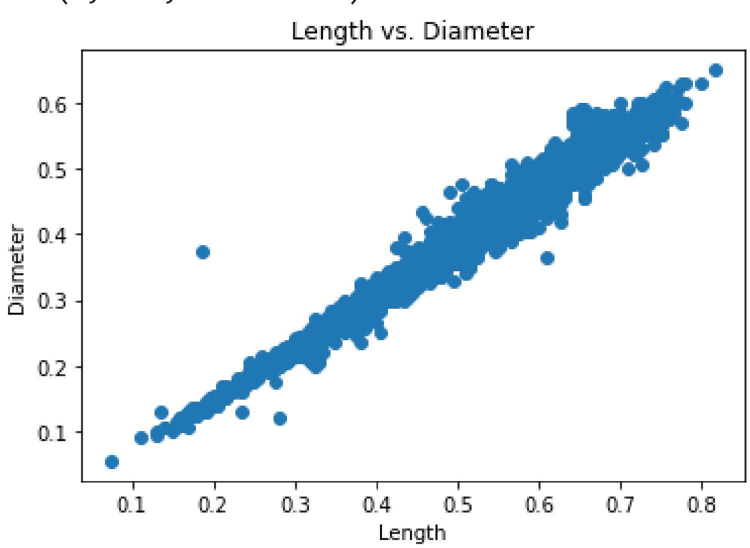
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90ffb2d1d0>
```



4. Bi-Variate Analysis

```
#create scatterplot of Length vs. Diameter
plt.scatter(age.Length, age.Diameter)
plt.title('Length vs. Diameter')
plt.xlabel('Length')
plt.ylabel('Diameter')
```

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



```
#create correlation matrix
age.corr()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
Length	1.000000	0.986812	0.827554	0.925261	0.897914	0.903018	0.897706	0.556720
Diameter	0.986812	1.000000	0.833684	0.925452	0.893162	0.899724	0.905330	0.574660
Height	0.827554	0.833684	1.000000	0.819221	0.774972	0.798319	0.817338	0.557467
Whole weight	0.925261	0.925452	0.819221	1.000000	0.969405	0.966375	0.955355	0.540390
Shucked weight	0.897914	0.893162	0.774972	0.969405	1.000000	0.931961	0.882617	0.420884
Viscera weight	0.903018	0.899724	0.798319	0.966375	0.931961	1.000000	0.907656	0.503819

```
import statsmodels.api as sm


#define response variable
y = age['Length']


#define explanatory variable
x = age[['Diameter']]


#add constant to predictor variables
x = sm.add_constant(x)


#fit linear regression model
model = sm.OLS(y, x).fit()




#view model summary
print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                 Length   R-squared:                       0.974
Model:                            OLS   Adj. R-squared:                  0.974
Method:                 Least Squares   F-statistic:                 1.552e+05
Date:                Tue, 04 Oct 2022   Prob (F-statistic):               0.00
Time:                        06:31:12   Log-Likelihood:                 10533.
No. Observations:                4177   AIC:                        -2.106e+04
Df Residuals:                    4175   BIC:                        -2.105e+04
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          0.0369      0.001     29.006      0.000       0.034       0.039
```

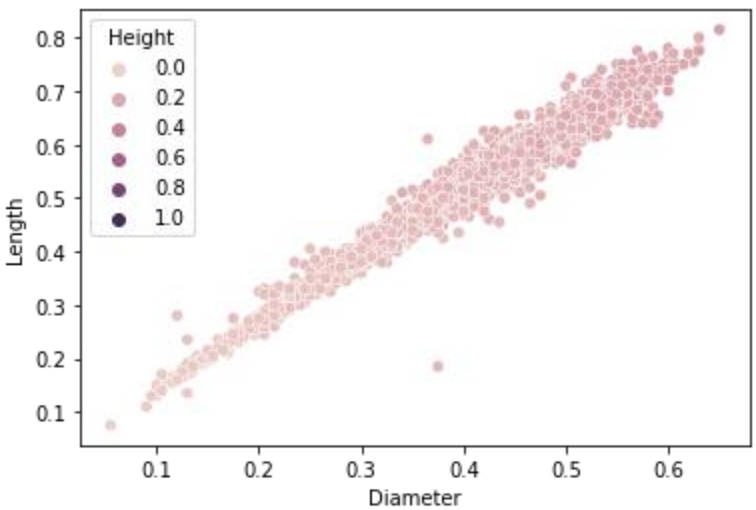
```
Diameter       1.1942      0.003    393.902      0.000       1.188       1.200
==============================================================================
Omnibus:                     1320.186   Durbin-Watson:                   1.740
Prob(Omnibus):                  0.000   Jarque-Bera (JB):            44409.185
Skew:                          -0.851   Prob(JB):                         0.00
Kurtosis:                      18.883   Cond. No.                         11.8
==============================================================================

Notes:
        [1] Standard Errors assume that the covariance matrix of the errors is correctly
            specified.
```

5. Multi-Variate Analysis

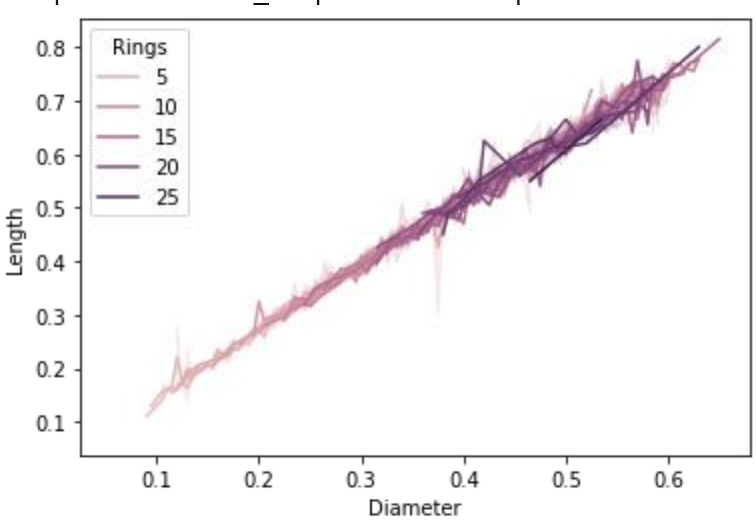
```
sns.scatterplot(age["Diameter"],age["Length"],hue=age["Height"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90f477ba90>
```



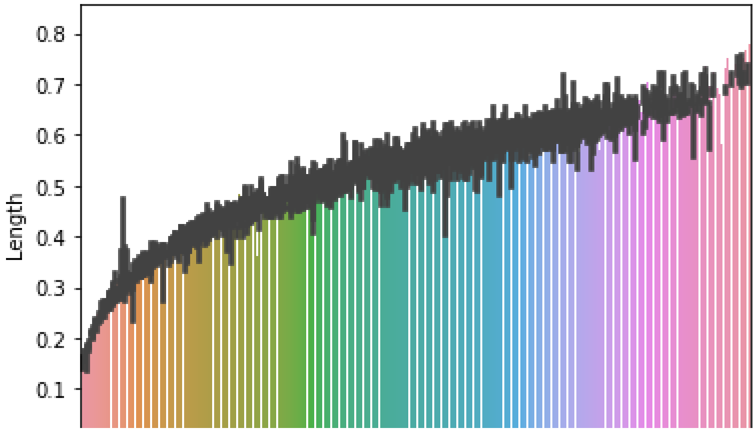

```
sns.lineplot(age["Diameter"],age["Length"],hue=age["Rings"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90f46ace90>
```




```
sns.barplot(age["Whole weight"],age["Length"])
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90f34f5e50>
```




```
age.skew()
```

```
00                  0.000000
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
```

```
plt.pie(age["Diameter"],labels=age["Length"],autopct="%0.0f%%")
```

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 Text(0.17235022141436254, 0.574713320863907, '0%'),
 Text(0.17185737492256908, 0.5748608898548617, '0%'),
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 Text(0.16939656138007528, 0.5755908312270153, '0%'),
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 Text(0.16831366821887514, 0.5759084207499543, '0%'),
 Text(0.1677826205111518, 0.5760633578473906, '0%'),
 Text(0.1672514301801977, 0.5762178052634944, '0%'),
 Text(0.16672009767755014, 0.5763717628669782, '0%'),
 Text(0.16617267705387745, 0.5765298269827397, '0%'),
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 Text(0.16497633475477222, 0.5768733040892786, '0%'),
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 Text(0.16380056956880423, 0.5772082582646711, '0%'),
```

```
Text(0.16318847674134043, 0.5773816078286881, '0%'),
Text(0.16253360050357527, 0.5775662981055458, '0%'),
Text(0.16187851524155666, 0.5777502456106697, '0%'),
Text(0.16119657946230412, 0.5779408817255041, '0%'),
Text(0.16050375866711178, 0.5781336726516882, '0%'),
Text(0.15982670339610852, 0.578321212546740б, '0%'),
Text(0.15912809394785923, 0.5785138284574719, '0%'),
Text(0.15842925236882868, 0.5787056004514334, '0%'),
Text(0.15774619159713046, 0.578892165292122, '0%'),
Text(0.1570522331493592, 0.5790808199748972, '0%'),
Text(0.15635804908343987, 0.5792686427615606, '0%'),
Text(0.15564761289351733, 0.5794599387365358, '0%'),
Text(0.1549155654878918, 0.5796560769711353, '0%'),
Text(0.15419930924978537, 0.5798470255393995, '0%'),
Text(0.15349351326419716, 0.580034258803576, '0%'),
Text(0.1527607421459518, 0.5802276757093012, '0%'),
Text(0.15200097034402293, 0.5804271746002899, '0%'),
Text(0.15123558476710305, 0.5806270729996599, '0%'),
Text(0.15048600156509323, 0.5808217999808123, '0%'),
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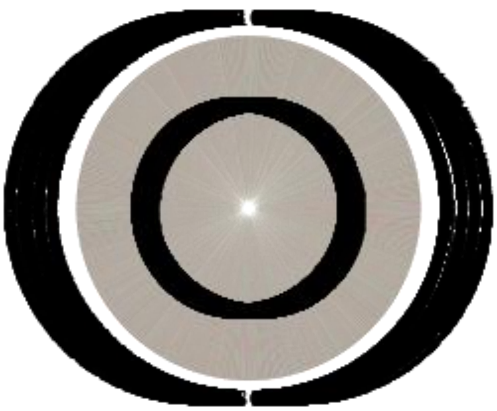
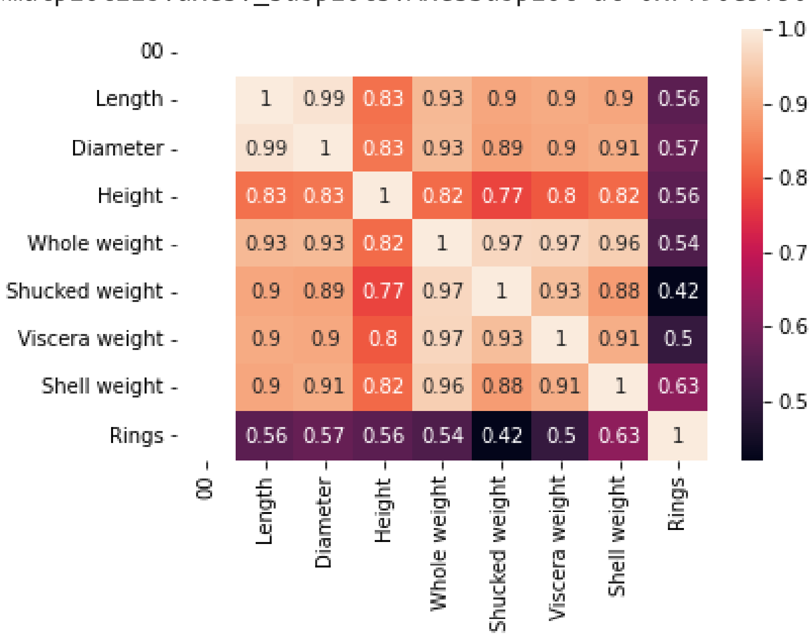
Text(0.14901823572402578, 0.5812001078989049, '0%'),
Text(0.1482357525612155, 0.5814001734284314, '0%'),
Text(0.14744763853257636, 0.581600544954324, '0%'),
Text(0.14669143792454872, 0.581791734248286, '0%'),
Text(0.14592962364032627, 0.5819832857945259, '0%'),
Text(0.14514072143127754, 0.582180531263635, '0%'),
Text(0.14437303013616506, 0.582371383370871, '0%'),
Text(0.143626572179807 9, 0.582559267262487, '0%'),
Text(0.1428583872408476, 0.5827447822116849, '0%'),
Text(0.14207383033346227, 0.5829365546389921, '0%'),
Text(0.14128363969022723, 0.5831285734346089, '0%'),
Text(0.1404985676183064, 0.5833182257543511, '0%'),
Text(0.1397078611388945, 0.5835081092289938, '0%'),
Text(0.13888999005918976, 0.5837033241822066, '0%'),
Text(0.1380879964006262, 0.5838935735646186, '0%'),
Text(0.1373072825298653, 0.5840776576485902, '0%'),
Text(0.13651554971525562, 0.5842632152428745, '0%'),
Text(0.13570201210765834, 0.5844527045963025, '0%'),
Text(0.13486125993483683, 0.5846472787662561, '0%'),
Text(0.13400405236308816, 0.5848443501909467, '0%'),
Text(0.13315195079767594, 0.5850389371646756, '0%'),
Text(0.1323157538213296, 0.5852286230958746, '0%'),
Text(0.13148468405505753, 0.585415901610933, '0%'),
Text(0.13063715174714943, 0.5856056135176577, '0%'),
Text(0.12978394480019861, 0.5857952950238666, '0%'),
Text(0.12894126774259934, 0.5859813559089839, '0%'),
Text(0.12807670651674738, 0.5861709283543691, '0%'),
Text(0.12724970914389008, 0.5863510139181097, '0%'),
Text(0.126444089231350 1, 0.58652526995727 5, '0%'),
Text(0.12561659361134167, 0.58670305215627, '0%'),
Text(0.12477261522043685, 0.5868831182535862, '0%'),
Text(0.12389590294451223, 0.5870688249545908, '0%'),
Text(0.12301349993051133, 0.5872543561650659, '0%'),
Text(0.12210373859453974, 0.5874441905587596, '0%'),
Text(0.1212153556515232, 0.5876281456450795, '0%'),
Text(0.12034295407122267, 0.5878074288450356, '0%'),
Text(0.11945944507522323, 0.5879876197525928, '0%'),
Text(0.11856482069142209, 0.5881686690860122, '0%'),
Text(0.11764279951229009, 0.5883537810900098, '0%'),
Text(0.11674219404109389, 0.5885331427629812, '0%'),
Text(0.1158684539953205, 0.588705785064776, '0%'),
```

```
Text(0.11496731183787579, 0.5888824307183672, '0%'),
Text(0.11402788316030463, 0.5890650574104527, '0%'),
Text(0.11307186620284365, 0.589249313171773, '0%'),
Text(0.1121209859360694, 0.5894309836721545, '0%'),
Text(0.11115894150713083, 0.5896131695637524, '0%'),
Text(0.11022922760967162, 0.5897876883935228, '0%'),
Text(0.10930467907357289, 0.589959733484094, '0%'),
Text(0.10832545269835814, 0.5901403191595163, '0%'),
Text(0.10734048531346353, 0.5903202691867103, '0%'),
Text(0.10636066331107161, 0.5904975946606632, '0%'),
Text(0.10537510250046105, 0.5906742653722247, '0%'),
Text(0.10435656295878454, 0.5908550649418427, '0%'),
Text(0.10333771321395398, 0.591034108176263, '0%'),
Text(0.10233490880318162, 0.5912085642480532, '0%'),
Text(0.1013318098806126, 0.5913813188682234, '0%'),
Text(0.10033387330379583, 0.5915514465098177, '0%'),
Text(0.09934656218020747, 0.5917180583546306, '0%'),
Text(0.09832077491471071, 0.5918893690717639, '0%'),
Text(0.09727831622695936, 0.5920615923973178, '0%'),
Text(0.09625739682538649, 0.5922284302162469, '0%'),
Text(0.09524711473959695, 0.5923917514059274, '0%'),
Text(0.09423655555251315, 0.5925533491573548, '0%'),
...])
```



```
sns.heatmap(age.corr(),annot=True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f90e5f50dd0>
```

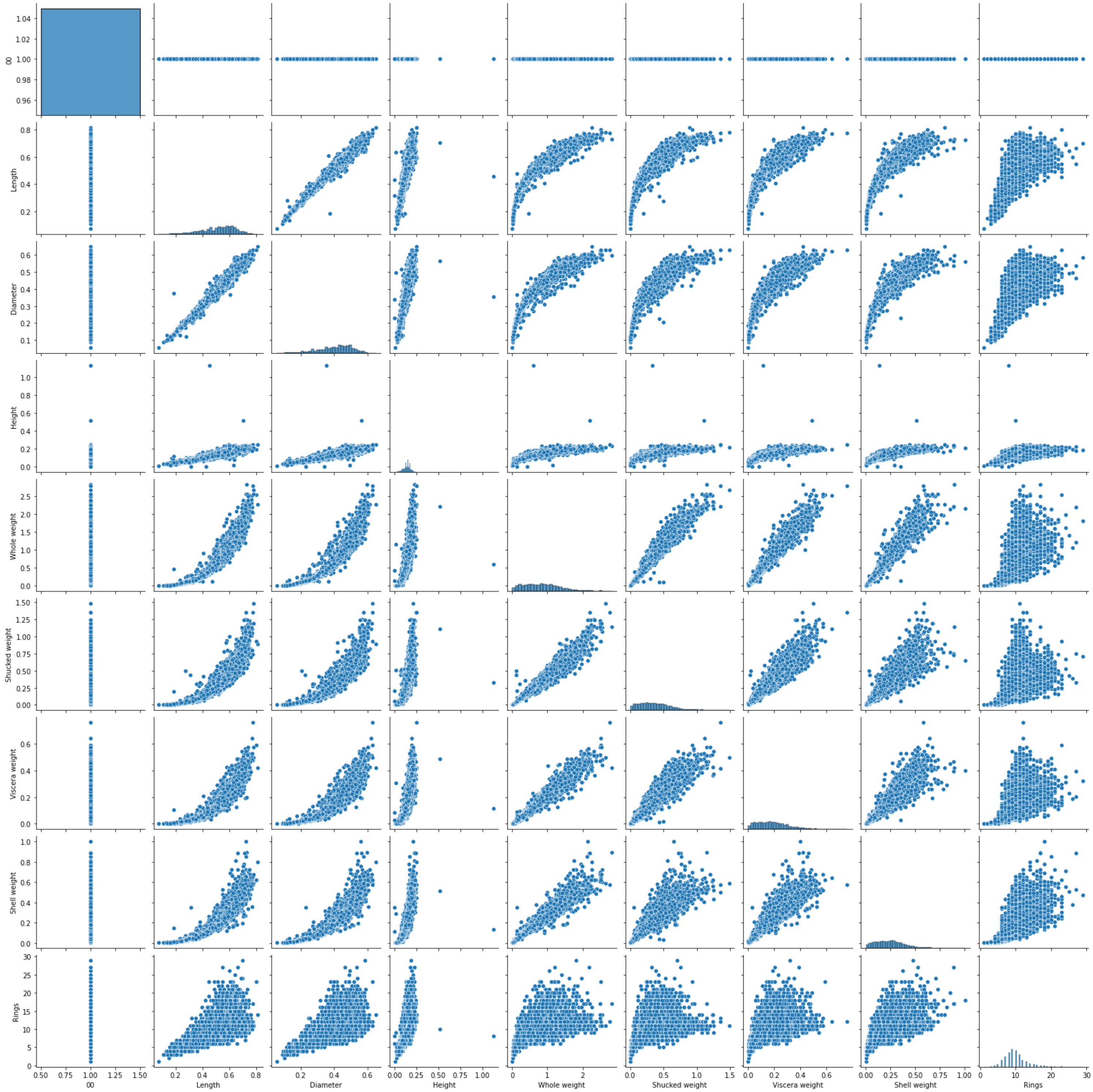


```
age.corr().Length.sort_values()
```

```
Rings             0.556720
Height            0.827554
Shell weight      0.897706
Shucked weight    0.897914
Viscera weight    0.903018
Whole weight      0.925261
Diameter          0.986812
Length            1.000000
00                     NaN
Name: Length, dtype: float64
```

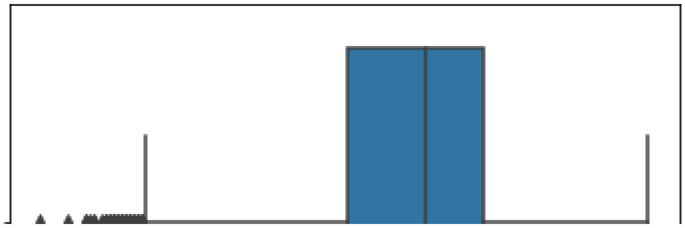
```
sns.pairplot(age)
```

```
<seaborn.axisgrid.PairGrid at 0x7f90e6191b90>
```




```
sns.boxplot(age["Length"])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f90e1532790>



```
age.corr()
```

	00	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
00	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Length	NaN	1.000000	0.986812	0.827554	0.925261	0.897914	0.903018	0.897706	0.556720
Diameter	NaN	0.986812	1.000000	0.833684	0.925452	0.893162	0.899724	0.905330	0.574660
Height	NaN	0.827554	0.833684	1.000000	0.819221	0.774972	0.798319	0.817338	0.557467
Whole weight	NaN	0.925261	0.925452	0.819221	1.000000	0.969405	0.966375	0.955355	0.540390
Shucked weight	NaN	0.897914	0.893162	0.774972	0.969405	1.000000	0.931961	0.882617	0.420884
Viscera weight	NaN	0.903018	0.899724	0.798319	0.966375	0.931961	1.000000	0.907656	0.503819

6. Performing descriptive statistics on the dataset

```
#Create a DataFrame
df=pd.DataFrame(age)
```

```
df.sum()
```

```
00                                                             4177
Sex               MMFMIIFFMFFMMFFMIFMMMIFFFFFMMMMFMFFMFFFMFFIIII...
Length                                                     2188.715
Diameter                                                    1703.72
Height                                                       582.76
Whole weight                                               3461.656
Shucked weight                                             1501.078
Viscera weight                                             754.3395
Shell weight                                               997.5965
Rings                                                       41493.0
dtype: object
```

```
df.sum(1)
```

```
0       17.9045
1        9.1485
2       12.3700
3       12.9305
4        9.0540
```

```
        ...
4172    14.9250
4173    14.0450
4174    13.5770
4175    14.4425
4176    18.2255
Length: 4177, dtype: float64
```

df.mean()

```
00                1.000000
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
```

df.std()

```
00                0.000000
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
```

df.min()

```
00                     1
Sex                    F
Length             0.075
Diameter           0.055
Height               0.0
Whole weight       0.002
Shucked weight     0.001
Viscera weight    0.0005
Shell weight      0.0015
Rings                1.0
dtype: object
```

df.max()

```
00                     1
Sex                    M
Length             0.815
Diameter            0.65
Height              1.13
Whole weight      2.8255
Shucked weight     1.488
```

```
Viscera weight      0.76
Shell weight       1.005
Rings               29.0
dtype: object
```

```
df[min]-df[max]
```

```
0       0.4860
1       0.7745
2       0.3230
3       0.4840
4       0.7950
         ...
4172    0.1130
4173    0.0340
4174   -0.1760
4175   -0.0945
4176   -0.9485
Length: 4177, dtype: float64
```

```
df.describe()
```

	00	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	S we
count	4177.0	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000
mean	1.0	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	0.238
std	0.0	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	0.139
min	1.0	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	0.001
25%	1.0	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130
50%	1.0	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234
75%	1.0	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	0.329

```
df.describe(include=['object'])
```

	Sex
count	4177
unique	3
top	M
freq	1528

7. Check for Missing value and deal with them

```
# missing value
```

```
df.fillna(value = 100)
```

	00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500	15.0
1	1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700	7.0
2	1	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100	9.0
3	1	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10.0
4	1	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550	7.0
...	...	...	...	...	...	...	...	...	...	...
4172	1	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11.0
4173	1	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10.0
4174	1	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9.0
4175	1	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10.0
4176	1	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12.0

4177 rows × 10 columns

```
df
```

	00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500	15.0
1	1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700	7.0
2	1	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100	9.0
3	1	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10.0
4	1	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550	7.0
...	...	...	...	...	...	...	...	...	...	...
4172	1	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11.0
4173	1	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10.0
4174	1	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9.0
4175	1	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10.0
4176	1	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12.0

4177 rows × 10 columns

```
df["Length"].mean()
```

```
0.5239920995930094
```

```
df["Length"].median()
```

```
0.545
```

```
df["Length"].fillna(df["Length"].mean(),inplace = True)
```

```
df
```

	00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500	15.0
1	1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700	7.0
2	1	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100	9.0
3	1	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10.0
4	1	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550	7.0
...	...	...	...	...	...	...	...	...	...	...
4172	1	F	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11.0
4173	1	M	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10.0
4174	1	M	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9.0
4175	1	F	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10.0
4176	1	M	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12.0

4177 rows × 10 columns

```
df["Diameter"].fillna(df["Diameter"].median(),inplace = True)
```

```
df
```

00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
3	1	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10.0

```
data = {"Name":["rahul","azhar","rachana"],
        "Age":[20,21,23],
        "Degree":["BE","BE","BCA"],
        "Percentage":[60,70,80]}
```

```
data = pd.DataFrame(data = data,index = ["row1","row2","row3"])
data
```

	Name	Age	Degree	Percentage
row1	rahul	20	BE	60
row2	azhar	21	BE	70
row3	rachana	23	BCA	80

```
data = data.replace("BCA",np.nan)
data
```

	Name	Age	Degree	Percentage
row1	rahul	20	BE	60
row2	azhar	21	BE	70
row3	rachana	23	NaN	80

```
data["Degree"] = data["Degree"].fillna(data["Degree"].mode()[0])
```

```
data
```

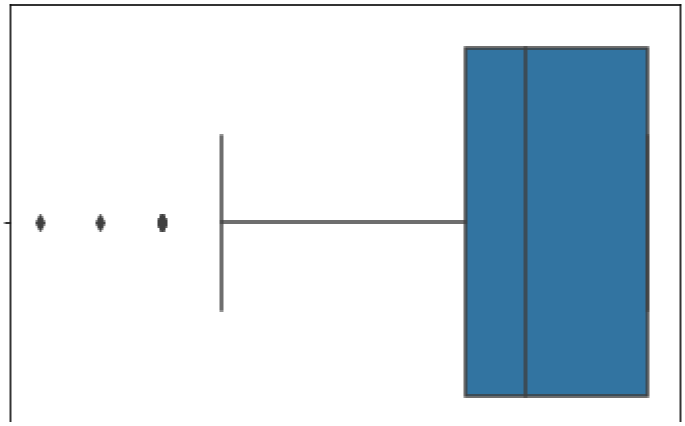
	Name	Age	Degree	Percentage
row1	rahul	20	BE	60
row2	azhar	21	BE	70
row3	rachana	23	BE	80

8. Find outlier and replace them outlier

```
df["Rings"] = np.where(df["Rings"] > 10,11,df["Rings"])
```

```
sns.boxplot(df["Rings"])
```

<matplotlib.axes._subplots.AxesSubplot at 0x7f90df625e10>



9.Check for categorical columns and perform encoding

```
df.head(2)
```

	00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.15	11.0
1	1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.07	7.0

```
df["Sex"].replace({"F":0, "M":1},inplace = True)
```

```
df.head(10)
```

	00	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	1	1	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	11.0
1	1	1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7.0
2	1	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9.0
3	1	1	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10.0
4	1	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7.0
5	1	I	0.425	0.300	0.095	0.3515	0.1410	0.0775	0.120	8.0
6	1	0	0.530	0.415	0.150	0.7775	0.2370	0.1415	0.330	11.0
7	1	0	0.545	0.425	0.125	0.7680	0.2940	0.1495	0.260	11.0
8	1	1	0.475	0.370	0.125	0.5095	0.2165	0.1125	0.165	9.0
9	1	0	0.550	0.440	0.150	0.8945	0.3145	0.1510	0.320	11.0

```
df["Length"].unique()
```

```
array([0.455, 0.35 , 0.53 , 0.44 , 0.33 , 0.425, 0.545, 0.475, 0.55 ,
       0.525, 0.43 , 0.49 , 0.535, 0.47 , 0.5  , 0.355, 0.365, 0.45 ,
       0.38 , 0.565, 0.615, 0.56 , 0.58 , 0.59 , 0.605, 0.575, 0.68 ,
```

```
       0.665, 0.705, 0.465, 0.54 , 0.24 , 0.205, 0.21 , 0.39 , 0.46 ,
       0.325, 0.52 , 0.4  , 0.485, 0.405, 0.445, 0.245, 0.505, 0.595,
       0.31 , 0.555, 0.57 , 0.6  , 0.62 , 0.625, 0.695, 0.36 , 0.51 ,
       0.435, 0.495, 0.385, 0.515, 0.37 , 0.27 , 0.375, 0.7  , 0.71 ,
       0.265, 0.305, 0.345, 0.65 , 0.28 , 0.175, 0.17 , 0.635, 0.645,
       0.61 , 0.725, 0.235, 0.315, 0.225, 0.64 , 0.63 , 0.585, 0.42 ,
       0.335, 0.415, 0.275, 0.295, 0.075, 0.13 , 0.11 , 0.16 , 0.23 ,
       0.3  , 0.32 , 0.655, 0.66 , 0.2  , 0.165, 0.19 , 0.74 , 0.34 ,
       0.675, 0.745, 0.685, 0.69 , 0.67 , 0.29 , 0.26 , 0.395, 0.41 ,
       0.22 , 0.255, 0.735, 0.155, 0.48 , 0.195, 0.25 , 0.18 , 0.15 ,
       0.215, 0.73 , 0.715, 0.765, 0.185, 0.285, 0.72 , 0.75 , 0.755,
       0.78 , 0.815, 0.14 , 0.77 , 0.775, 0.76 , 0.135, 0.8  ])
```

```
data_main = pd.get_dummies(df,columns=["Length"])
```

```
data_main.head(10)
```

	00	Sex	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings	Length_0.075	...	Length_
0	1	1	0.365	0.095	0.5140	0.2245	0.1010	0.150	11.0	0	...	
1	1	1	0.265	0.090	0.2255	0.0995	0.0485	0.070	7.0	0	...	
2	1	0	0.420	0.135	0.6770	0.2565	0.1415	0.210	9.0	0	...	
3	1	1	0.365	0.125	0.5160	0.2155	0.1140	0.155	10.0	0	...	
4	1	I	0.255	0.080	0.2050	0.0895	0.0395	0.055	7.0	0	...	
5	1	I	0.300	0.095	0.3515	0.1410	0.0775	0.120	8.0	0	...	
6	1	0	0.415	0.150	0.7775	0.2370	0.1415	0.330	11.0	0	...	
7	1	0	0.425	0.125	0.7680	0.2940	0.1495	0.260	11.0	0	...	
8	1	1	0.370	0.125	0.5095	0.2165	0.1125	0.165	9.0	0	...	
9	1	0	0.440	0.150	0.8945	0.3145	0.1510	0.320	11.0	0	...	

10 rows × 143 columns

10. Split the data dependent and independent variables

```
df.head(0)
```

Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings

```
x = df.iloc[:,1:2]
x
```

	Length
0	0.455
1	0.350
2	0.530
3	0.440
4	0.330
...	...
4172	0.565
4173	0.590
4174	0.600
4175	0.625
4176	0.710

```
y = df.iloc[:,1:]
```

```
y
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.1500	15.0
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.0700	7.0
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.2100	9.0
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.1550	10.0
4	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.0550	7.0
...	...	...	...	...	...	...	...	...
4172	0.565	0.450	0.165	0.8870	0.3700	0.2390	0.2490	11.0
4173	0.590	0.440	0.135	0.9660	0.4390	0.2145	0.2605	10.0
4174	0.600	0.475	0.205	1.1760	0.5255	0.2875	0.3080	9.0
4175	0.625	0.485	0.150	1.0945	0.5310	0.2610	0.2960	10.0
4176	0.710	0.555	0.195	1.9485	0.9455	0.3765	0.4950	12.0

4177 rows × 8 columns

11. Split the data into training and testing

```
from sklearn.model_selection import train_test_split
```

```
df = df.rename(columns = {'fit': 'fit_feature'})
```

```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size = 0.2,random_state = 0)
```

```
x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

```
((3341, 1), (836, 1), (3341, 8), (836, 8))
```

```
x_test
```

	Length
668	0.550
1580	0.500
3784	0.620
463	0.220
2615	0.645
...	...
575	0.610
3231	0.410
1084	0.445
290	0.540
2713	0.250

836 rows × 1 columns

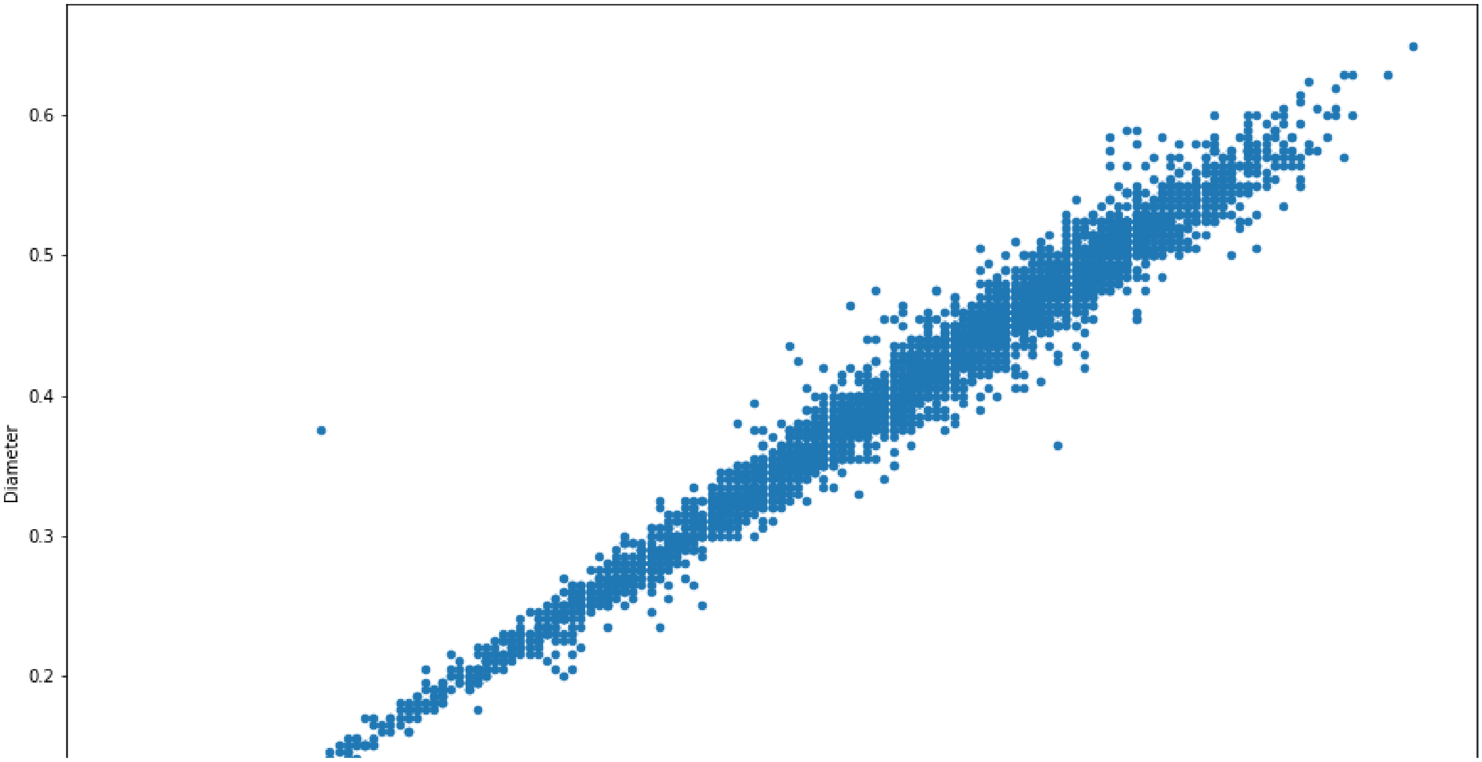
Build the Model

```
from sklearn.linear_model import LinearRegression
```

```
lr = LinearRegression()
```

```
df.plot.scatter("Length","Diameter", figsize=(15,10))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fc33e0a5290>
```




```
from sklearn.linear_model import LinearRegression
```

```
model = LinearRegression()
```

```
model.fit(x,y)
```

```
LinearRegression()
```

```
predict = model.predict(x)
predict
```

```
array([[ 0.455     ,  0.35162091,  0.11963095, ...,  0.12372858,
         0.16704094,  8.90250019],
       [ 0.35      ,  0.26599754,  0.08936702, ...,  0.03718493,
         0.0577829 ,  7.33312705],
       [ 0.53      ,  0.41278046,  0.14124804, ...,  0.18554547,
         0.2450824 , 10.02348101],
       ...,
       [ 0.6       ,  0.46986271,  0.161424  , ...,  0.24324124,
         0.31792109, 11.06972977],
       [ 0.625     ,  0.49024923,  0.1686297 , ...,  0.26384687,
         0.34393491, 11.44339005],
       [ 0.71      ,  0.55956339,  0.19312907, ...,  0.33390601,
         0.43238189, 12.71383498]])
```

Train the model

```
# Using DataFrame.sample() Method by random_state arg.
train=df.sample(frac=0.8,random_state=200)
```

```
train
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
3384	F	0.305	0.225	0.070	0.1485	0.0585	0.0335	0.0450	7.0
8	M	0.475	0.370	0.125	0.5095	0.2165	0.1125	0.1650	9.0
2639	I	0.460	0.370	0.120	0.5335	0.2645	0.1080	0.1345	6.0
2589	M	0.575	0.450	0.155	0.9480	0.4290	0.2060	0.2590	7.0
1270	I	0.470	0.355	0.180	0.4800	0.2055	0.1050	0.1505	8.0
...	...	...	...	...	...	...	...	...	...
2288	I	0.330	0.265	0.090	0.1800	0.0680	0.0360	0.0600	6.0
1236	I	0.375	0.275	0.090	0.2180	0.0930	0.0405	0.0755	6.0
3753	I	0.475	0.360	0.110	0.4520	0.1910	0.0990	0.1300	8.0
3461	F	0.625	0.495	0.160	1.1115	0.4495	0.2825	0.3450	11.0
79	F	0.615	0.475	0.170	1.1025	0.4695	0.2355	0.3450	14.0

3342 rows × 9 columns

Test the Model

```
np.random.seed(2)
from sklearn.metrics import r2_score

x = np.random.normal(3, 1, 100)
y = np.random.normal(150, 40, 100) / x

train_x = x[:80]
train_y = y[:80]

test_x = x[80:]
test_y = y[80:]

mymodel = np.poly1d(np.polyfit(train_x, train_y, 4))

r2 = r2_score(test_y, mymodel(test_x))

print(r2)
```

```
0.8086921460343566
```

Measure the performance using Metrics

```
import tracemalloc
import pandas as pd
```

```
import dask.dataframe as dd
import time

def tracing_start():
    tracemalloc.stop()
    print("nTracing Status : ", tracemalloc.is_tracing())
    tracemalloc.start()
    print("Tracing Status : ", tracemalloc.is_tracing())
def tracing_mem():
    first_size, first_peak = tracemalloc.get_traced_memory()
    peak = first_peak/(1024*1024)
    print("Peak Size in MB - ", peak)


tracing_start()
start = time.time()
sq_list1 = [elem + elem**2 for elem in range(1,1000)]
#print(sq_list1)
end = time.time()
print("time elapsed {} milli seconds".format((end-start)*1000))
tracing_mem()
```

```
nTracing Status :  False
Tracing Status :  True
time elapsed 3.298521041870117 milli seconds
Peak Size in MB -  0.04827404022216797
```