IMPORTING LIBRARIES

In [ ]:

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns
from sklearn.linear_model import LinearRegression
```

2. Load the dataset into the Google Colab

In [ ]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

In [ ]:

```
df=pd.read_csv("/content/drive/MyDrive/IBM assignment 4/abalone.csv")
```

In [ ]:

```
df.size
```

Out[ ]:

```
37593
```

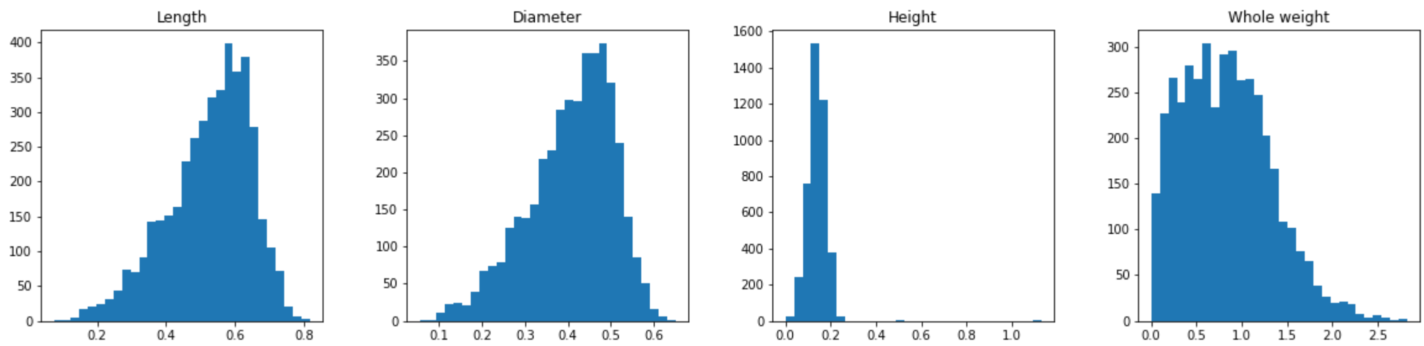
3. UNIVARIATE ANALYSIS

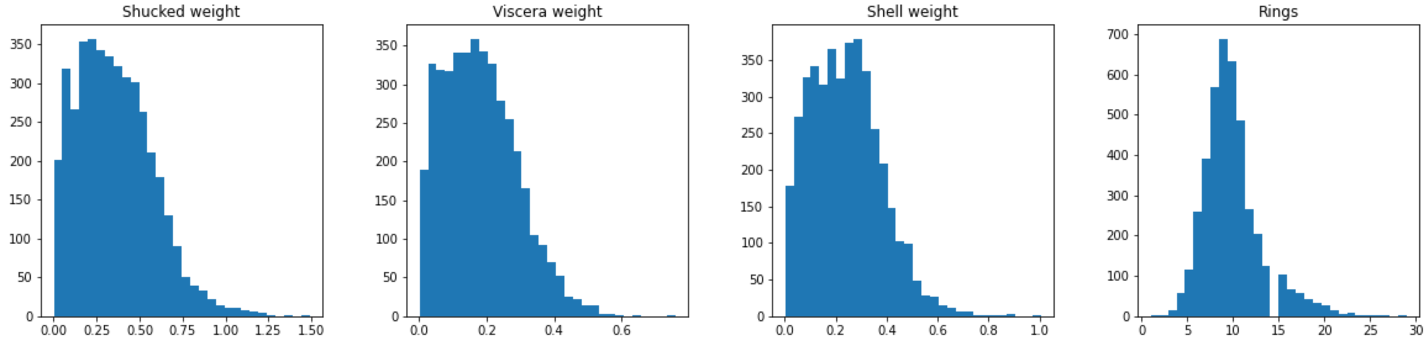
In [ ]:

```
df.hist(figsize=(20,10), grid=False, layout=(2, 4), bins = 30)
```

Out[ ]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7fb4229667d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb425475a90>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb422912110>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb4228c8710>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7fb42287fd10>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb422842350>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb4227f99d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7fb4227aef10>]],
      dtype=object)
```





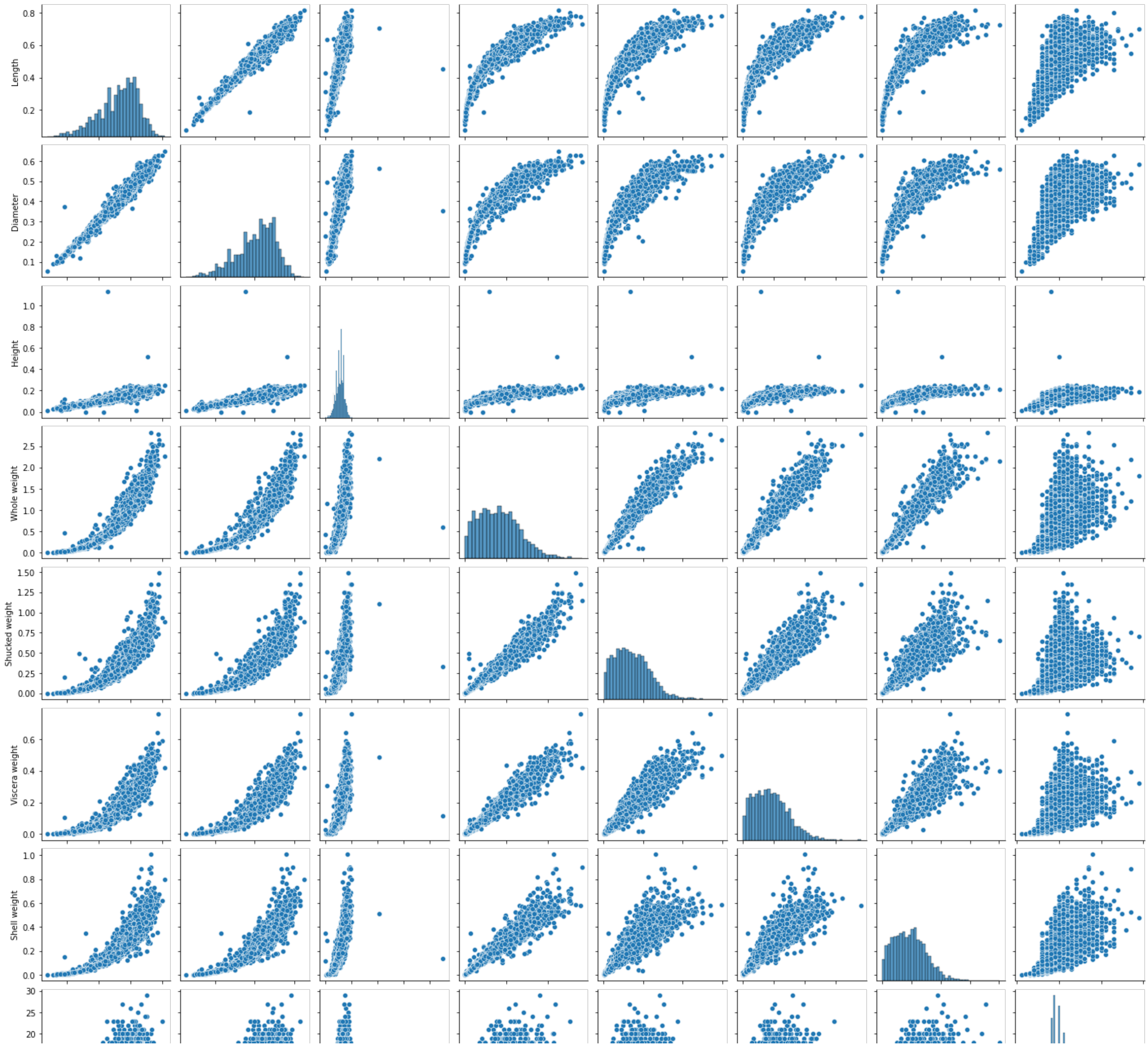
3. BIVARIATE ANALYSIS & MULTIVARIATE ANALYSIS

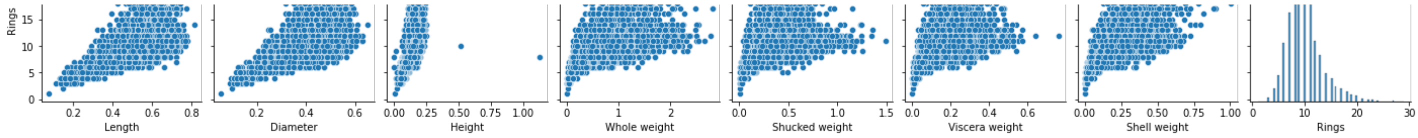
In [ ]:

```
numerical_features = df.select_dtypes(include = [np.number]).columns
sns.pairplot(df[numerical_features])
```

Out[ ]:

```
<seaborn.axisgrid.PairGrid at 0x7fb421da3d10>
```





4. Descriptive statistics

In [ ]:

```
df.describe()
```

Out[ ]:

	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

5. Check for Missing Values

In [ ]:

```
df.isnull().sum()
```

Out[ ]:

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

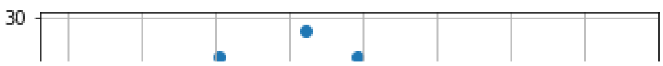
6. OUTLIER HANDLING

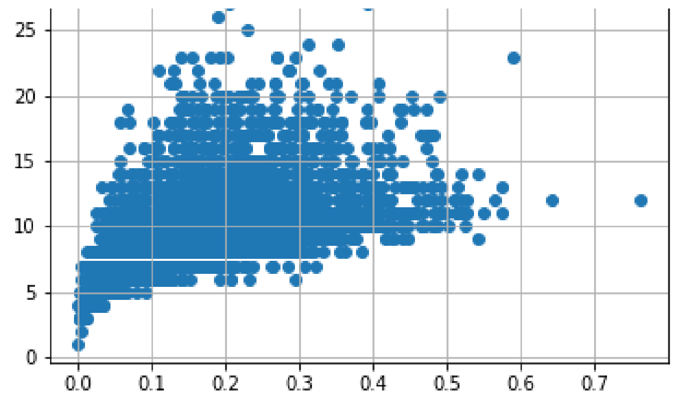
In [ ]:

```
df = pd.get_dummies(df)
dummy_data = df.copy()
```

In [ ]:

```
var = 'Viscera weight'
plt.scatter(x = df[var], y = df['Rings'],)
plt.grid(True)
```



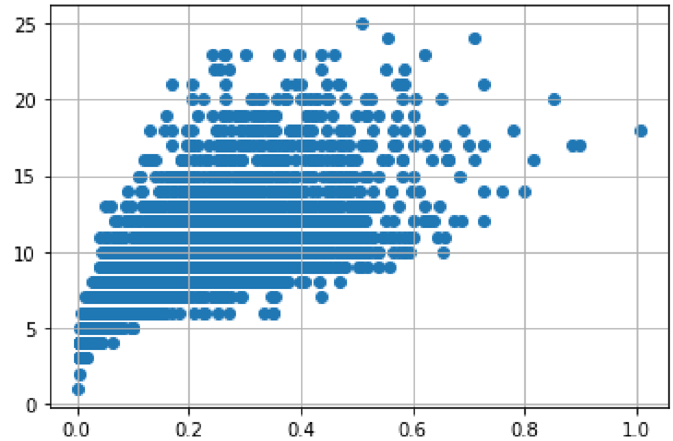


In [ ]:

```
# outliers removal
df.drop(df[(df['Viscera weight']> 0.5) & (df['Rings'] < 20)].index, inplace=True)
df.drop(df[(df['Viscera weight']<0.5) & (df['Rings'] > 25)].index, inplace=True)
```

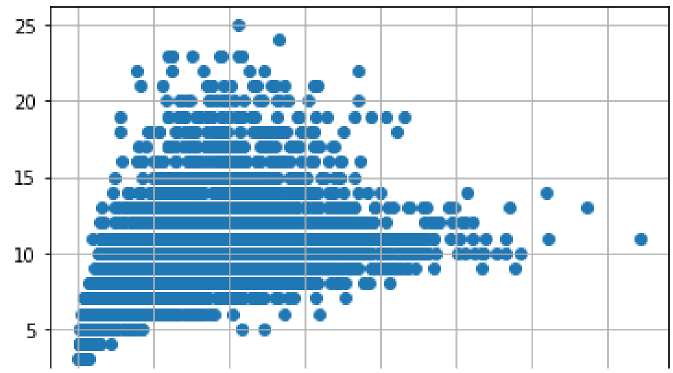
In [ ]:

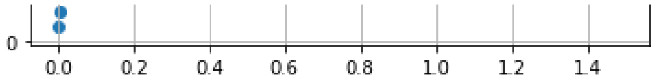
```
var = 'Shell weight'
plt.scatter(x = df[var], y = df['Rings'],)
plt.grid(True)
#Outliers removal
df.drop(df[(df['Shell weight']> 0.6) & (df['Rings'] < 25)].index, inplace=True)
df.drop(df[(df['Shell weight']<0.8) & (df['Rings'] > 25)].index, inplace=True)
```



In [ ]:

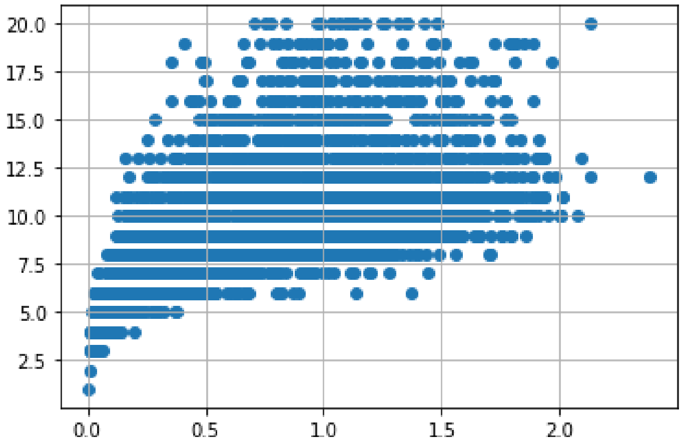
```
var = 'Shucked weight'
plt.scatter(x = df[var], y = df['Rings'],)
plt.grid(True)

#Outlier removal
df.drop(df[(df['Shucked weight']>= 1) & (df['Rings'] < 20)].index, inplace=True)
df.drop(df[(df['Shucked weight']<1) & (df['Rings'] > 20)].index, inplace=True)
```





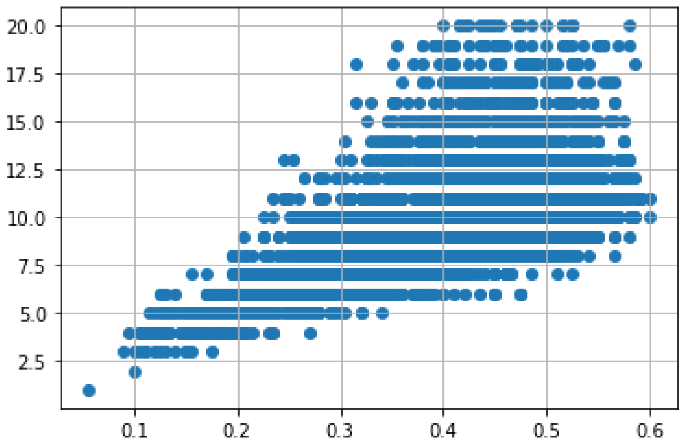
In [ ]:

```
var = 'Whole weight'
plt.scatter(x = df[var], y = df['Rings'])
plt.grid(True)

df.drop(df[(df['Whole weight'] >= 2.5) &
           (df['Rings'] < 25)].index, inplace = True)
df.drop(df[(df['Whole weight']<2.5) & (
df['Rings'] > 25)].index, inplace = True)
```



In [ ]:

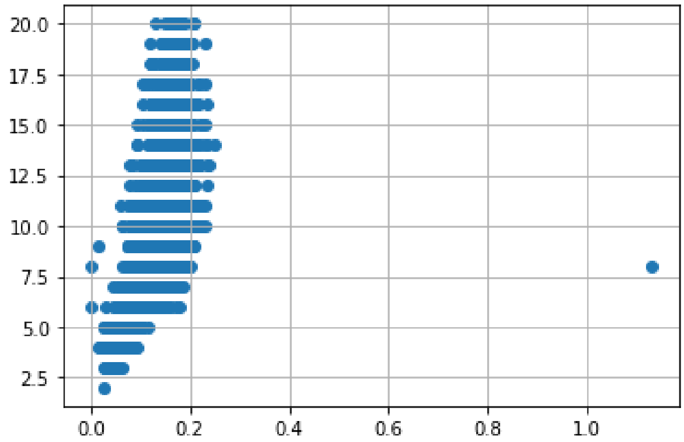
```
var = 'Diameter'
plt.scatter(x = df[var], y = df['Rings'])
plt.grid(True)

df.drop(df[(df['Diameter'] <0.1) &
           (df['Rings'] < 5)].index, inplace = True)
df.drop(df[(df['Diameter']<0.6) & (
df['Rings'] > 25)].index, inplace = True)
df.drop(df[(df['Diameter']>=0.6) & (
df['Rings'] < 25)].index, inplace = True)
```



In [ ]:

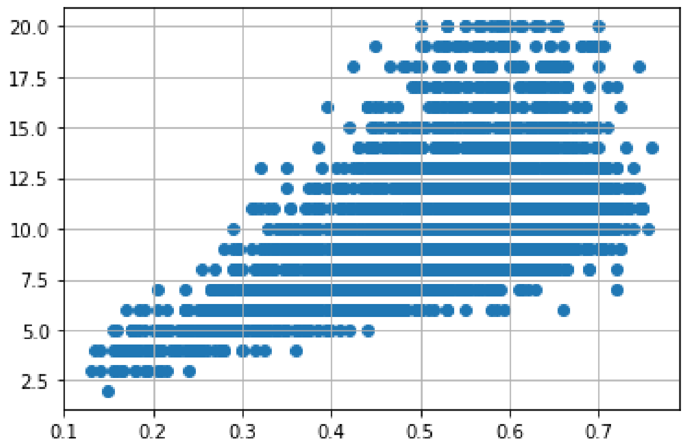
```
var = 'Height'
plt.scatter(x = df[var], y = df['Rings'])
plt.grid(True)
df.drop(df[(df['Height'] > 0.4) &
           (df['Rings'] < 15)].index, inplace = True)
```

```
df.drop(df[(df['Height']<0.4) & (
df['Rings'] > 25)].index, inplace = True)
```



In [ ]:

```
var = 'Length'
plt.scatter(x = df[var], y = df['Rings'])
plt.grid(True)

df.drop(df[(df['Length'] <0.1) &
          (df['Rings'] < 5)].index, inplace = True)
df.drop(df[(df['Length']<0.8) & (
df['Rings'] > 25)].index, inplace = True)
df.drop(df[(df['Length']>=0.8) & (
df['Rings'] < 25)].index, inplace = True)
```



7. Categorical columns

In [ ]:

```
numerical_features = df.select_dtypes(include = [np.number]).columns
categorical_features = df.select_dtypes(include = [np.object]).columns
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: `np.o
bject` is a deprecated alias for the builtin `object`. To silence this warning, use `obje
ct` by itself. Doing this will not modify any behavior and is safe.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/releas
e/1.20.0-notes.html#deprecations
```

In [ ]:

```
numerical_features
```

Out[ ]:

```
Index(['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight',
       'Viscera weight', 'Shell weight', 'Rings', 'Sex_F', 'Sex_I', 'Sex_M'],
      dtype='object')
```

In [ ]:

```
categorical_features
```

Out[ ]:

```
Index([], dtype='object')
```

ENCODING

In [ ]:

```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()
print(df.Length.value_counts())
```

```
0.575    93
0.580    92
0.550    92
0.625    91
0.600    85
         ..
0.135     1
0.130     1
0.755     1
0.150     1
0.760     1
Name: Length, Length: 126, dtype: int64
```

8. Split the dependent and independent variables

In [ ]:

```
x=df.iloc[:,:5]
x
```

Out[ ]:

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

4049 rows × 5 columns

In [ ]:

```
y=df.iloc[:,5:]
y
```

Out[ ]:

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

4049 rows × 6 columns

9. Feature Scaling

In [ ]:

```
from sklearn.preprocessing import StandardScaler
ss=StandardScaler()
x=ss.fit_transform(x)
```

10. Train , Test , Split

In [ ]:

```
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)
```

11. Model building

In [ ]:

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

Out[ ]:

```
LinearRegression()
```

12 & 13. Train and Test the model

In [ ]:

```
x_test[0:5]
```

Out[ ]:

```
array([[-0.37788262,  0.16558561,  0.60524821, -0.19359254,  0.01792632],
       [ 0.56053466,  0.68167841,  0.87373904,  0.66715894,  0.2500104 ],
       [-0.33522728, -0.24728862, -0.20022426, -0.39690227, -0.22637271],
       [-0.20726129, -0.24728862, -0.46871509, -0.63004548, -0.55373341],
       [-0.67646993, -0.66016286, -0.87145133, -1.00130671, -1.09119127]])
```

In [ ]:

```
y_test[0:5]
```

Out[ ]:

	Viscera weight	Shell weight	Rings	Sex_F	Sex_I	Sex_M
3484	0.1505	0.1845	8	0	1	0
2459	0.2325	0.3580	20	1	0	0
3252	0.1420	0.1750	12	0	0	1
2646	0.1205	0.1360	7	0	1	0
3638	0.0810	0.1250	8	0	1	0

14. Measure the performance using metrics

In [ ]:

```
from sklearn.metrics import r2_score
r2_score(mlr.predict(x_test),y_test)
```

Out[ ]:

```
-3.0610852112635683
```