```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

1.Import Libraries

2.Load Dataset

```
from google.colab import files
upload=files.upload()
df = pd.read_csv('/content/abalone.csv')
```

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.

```
df.describe()
```

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	
count	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	4177.000000	41
mean	0.523992	0.407881	0.139516	0.828742	0.359367	0.180594	
std	0.120093	0.099240	0.041827	0.490389	0.221963	0.109614	
min	0.075000	0.055000	0.000000	0.002000	0.001000	0.000500	
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	

```
df.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
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

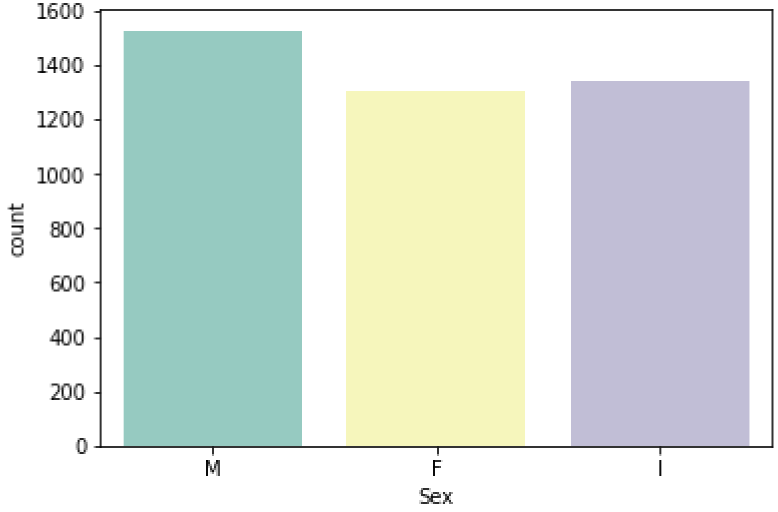
3. Perform Below Visualizations. · Univariate Analysis

```
sns.boxplot(df.Length)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword a
```

```
sns.countplot(x = 'Sex', data = df, palette = 'Set3')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe327a60490>
```



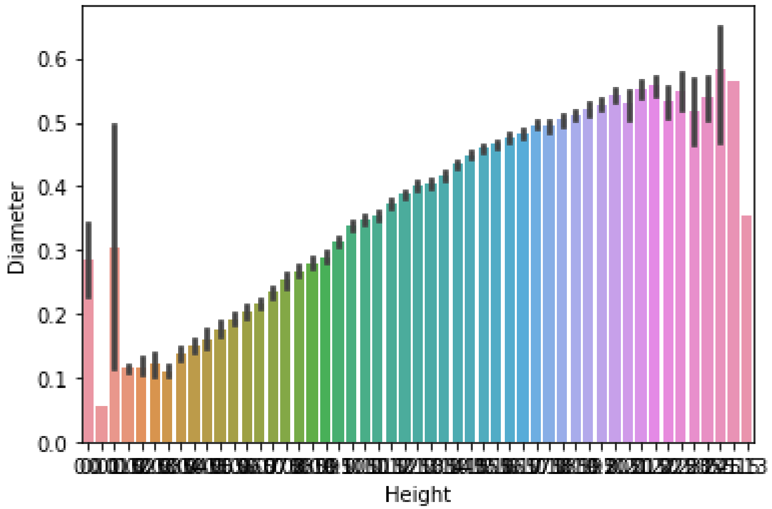

```
sns.heatmap(df.isnull())
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe327596750>
```

· Bi-Variate Analysis

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

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe322e03a10>
```

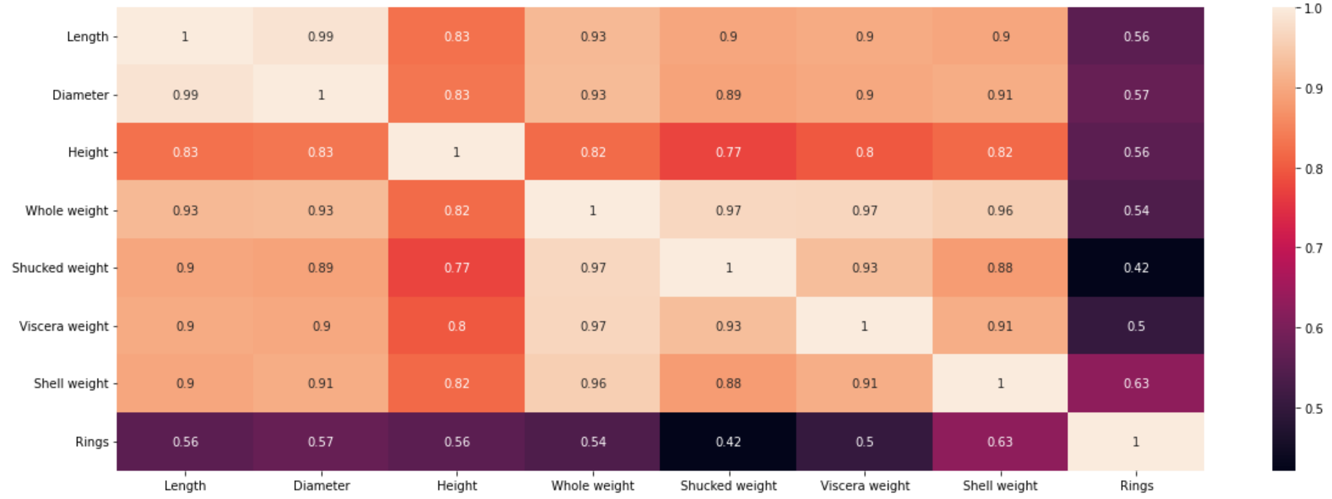



```
numerical_features = df.select_dtypes(include = [np.number]).columns
categorical_features = df.select_dtypes(include = [np.object]).columns
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: `np.object` is a deprecated alias for `
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
```

```
plt.figure(figsize = (20,7))
sns.heatmap(df[numerical_features].corr(),annot = True)
```

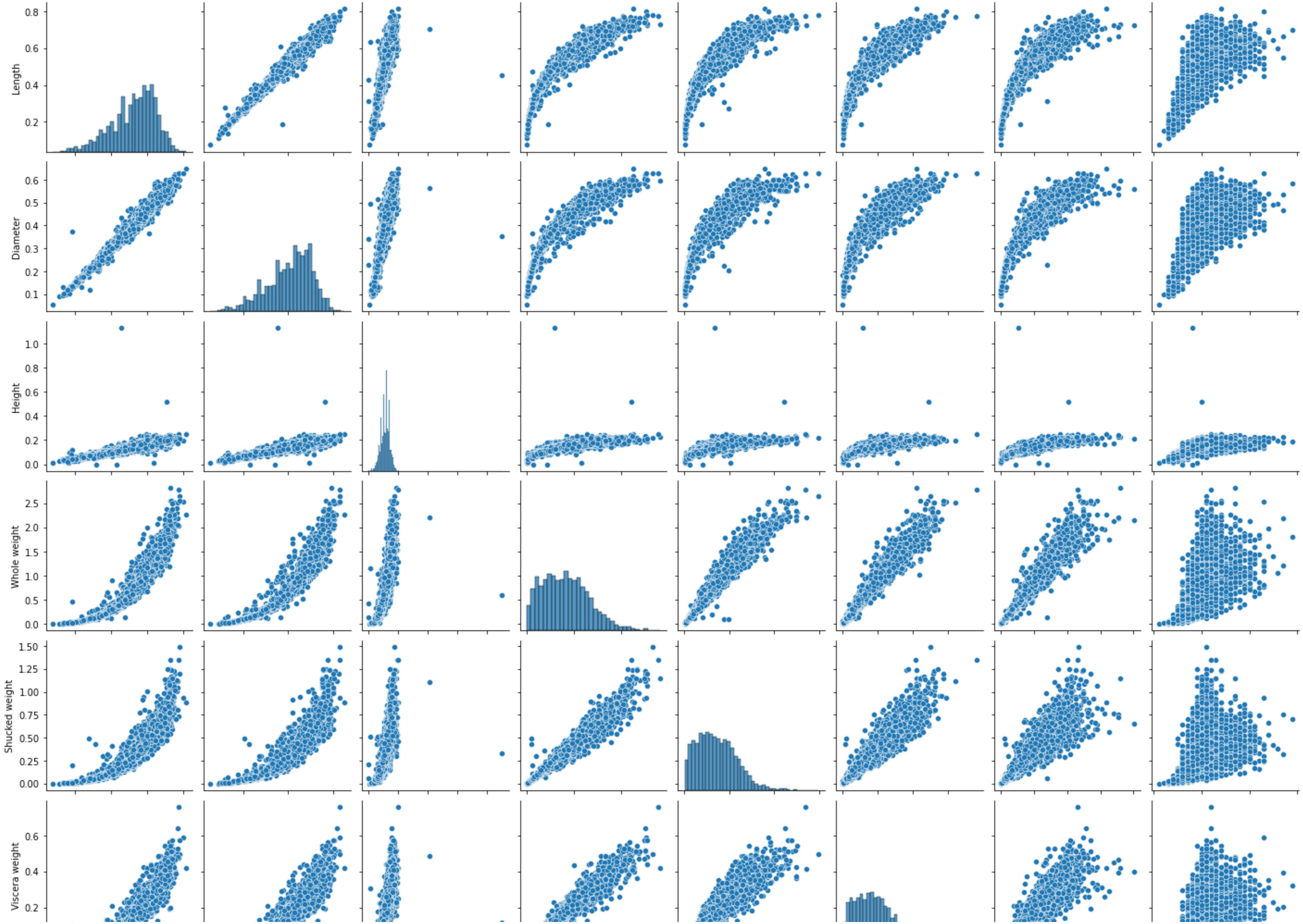
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe3211e2bd0>
```

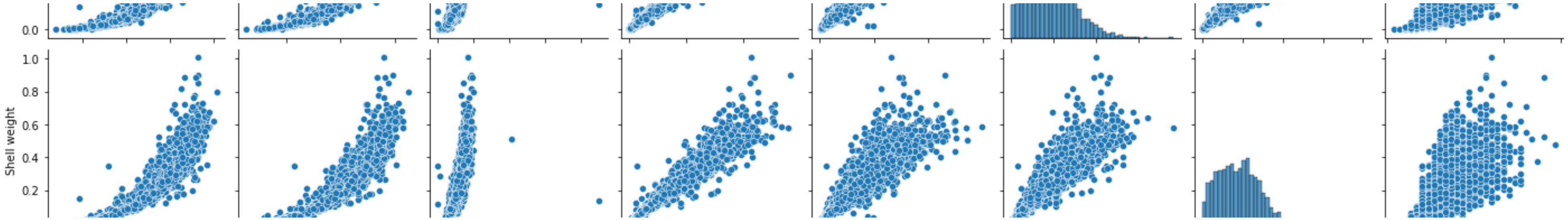


· Multi-Variate Analysis

```
sns.pairplot(df)
```

<seaborn.axisgrid.PairGrid at 0x7fe321073150>





4. Perform descriptive statistics on the dataset.

```
df['Height'].describe()
```

```
count    4177.000000
mean        0.139516
std         0.041827
min         0.000000
25%         0.115000
50%         0.140000
75%         0.165000
max         1.130000
Name: Height, dtype: float64
```

```
df['Height'].mean()
```

```
0.13951639932966242
```

```
df.max()
```

```
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
dtype: object
```

```
df['Sex'].value_counts()
```

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

```
df[df.Height == 0]
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
1257	I	0.430	0.34	0.0	0.428	0.2065	0.0860	0.1150	8
3996	I	0.315	0.23	0.0	0.134	0.0575	0.0285	0.3505	6

```
df['Shucked weight'].kurtosis()
```

```
0.5951236783694207
```

```
df['Diameter'].median()
```

```
0.425
```

```
df['Shucked weight'].skew()
```

```
0.7190979217612694
```

5. Check for Missing values and deal with them.

```
df.isna().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
```

```
missing_values = df.isnull().sum().sort_values(ascending = False)
percentage_missing_values = (missing_values/len(df))*100
pd.concat([missing_values, percentage_missing_values], axis = 1, keys= ['Missing values', '% Missing'])
```

	Missing values	% Missing
Sex	0	0.0
Length	0	0.0
Diameter	0	0.0
Height	0	0.0
Whole weight	0	0.0
Shucked weight	0	0.0
Viscera weight	0	0.0
Shell weight	0	0.0
Rings	0	0.0

6. Find the outliers and replace them outliers

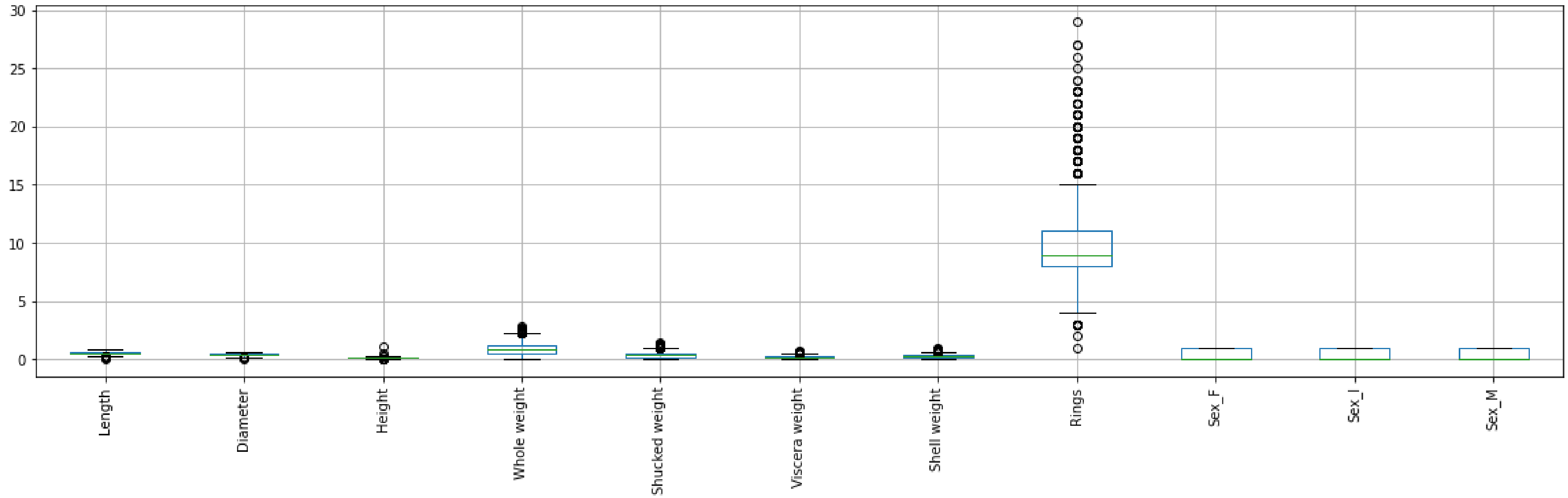
```
q1=df.Rings.quantile(0.25)
```

```
q2=df.Rings.quantile(0.75)
iqr=q2-q1
print(iqr)
```

```
3.0
```

```
df = pd.get_dummies(df)
dummy_df = df
df.boxplot( rot = 90, figsize=(20,5))
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe31f20fe90>
```

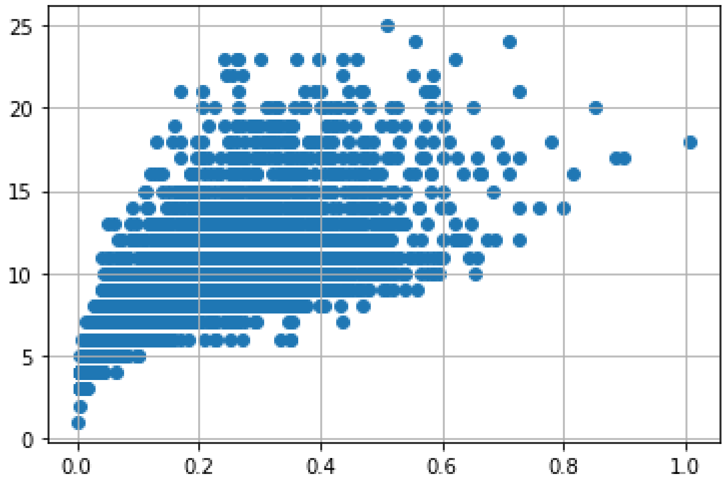



```
df['age'] = df['Rings']
df = df.drop('Rings', axis = 1)
```

```
df.drop(df[(df['Viscera weight']> 0.5) & (df['age'] < 20)].index, inplace=True)
```

```
df.drop(df[(df['Viscera weight']<0.5) & (df['age'] > 25)].index, inplace=True)
```

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



7. Check for Categorical columns and perform encoding.

```
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.object` is a deprecated alias for 
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
```

```
numerical_features
categorical_features
```

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

```
abalone_numeric = df[['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight','Viscera weight', 'Shell weight', 'age',
```

```
abalone_numeric.head()
```

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

8. Split the data into dependent and independent variables.

```
x = df.iloc[:, 0:1].values
y = df.iloc[:, 1]
y
```

```
0       0.365
1       0.265
2       0.420
3       0.365
4       0.255
        ...
4172    0.450
4173    0.440
4174    0.475
4175    0.485
4176    0.555
Name: Diameter, Length: 4150, dtype: float64
```

9. Scale the independent variables

```
print ("\n ORIGINAL VALUES: \n\n", x,y)
```

```
 ORIGINAL VALUES: 

 [[0.455]
 [0.35 ]
 [0.53 ]
 ...
 [0.6  ]
 [0.625]
 [0.71 ]] 0       0.365
1       0.265
2       0.420
3       0.365
4       0.255
        ...  
4172    0.450
4173    0.440
4174    0.475
4175    0.485
4176    0.555
Name: Diameter, Length: 4150, dtype: float64
```

```
from sklearn import preprocessing
min_max_scaler = preprocessing.MinMaxScaler(feature_range =(0, 1))
new_y= min_max_scaler.fit_transform(x,y)
print ("\n VALUES AFTER MIN MAX SCALING: \n\n", new_y)
```

```
 VALUES AFTER MIN MAX SCALING: 

 [[0.51351351]
 [0.37162162]
```

```
 [0.61486486]
 ...
 [0.70945946]
 [0.74324324]
 [0.85810811]]
```

10. Split the data into training and testing

```
X = df.drop('age', axis = 1)
y = df['age']

from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.feature_selection import SelectKBest
standardScale = StandardScaler()
standardScale.fit_transform(X)

selectkBest = SelectKBest()
X_new = selectkBest.fit_transform(X, y)

X_train, X_test, y_train, y_test = train_test_split(X_new, y, test_size = 0.25)
X_train
```

```
array([[0.58 , 0.445, 0.125, ..., 0.   , 1.   , 0.   ],
       [0.39 , 0.3  , 0.105, ..., 0.   , 1.   , 0.   ],
       [0.63 , 0.48 , 0.16 , ..., 1.   , 0.   , 0.   ],
       ...,
       [0.42 , 0.305, 0.1  , ..., 0.   , 1.   , 0.   ],
       [0.475, 0.365, 0.14 , ..., 0.   , 0.   , 1.   ],
       [0.28 , 0.12 , 0.075, ..., 0.   , 1.   , 0.   ]])
```

```
y_train
```

```
1646     9
3334     8
188     11
```

```
4030     7
2552     6
        ..
825      7
318     18
4107     7
3947    16
898      4
Name: age, Length: 3112, dtype: int64
```

11. Build the Model

```
from sklearn import linear_model as lm
from sklearn.linear_model import LinearRegression
model=lm.LinearRegression()
results=model.fit(X_train,y_train)

accuracy = model.score(X_train, y_train)
print('Accuracy of the model:', accuracy)
```

```
Accuracy of the model: 0.5389556158765662
```

12. Train the Model

```
lm = LinearRegression()
lm.fit(X_train, y_train)
y_train_pred = lm.predict(X_train)
y_train_pred
```

```
array([10.04940492,  8.17381188, 10.17705726, ...,  7.13014778,
       11.1651245 ,  5.25270011])
```

```
X_train
```

```
array([[0.58 , 0.445, 0.125, ..., 0.   , 1.   , 0.   ],
       [0.39 , 0.3  , 0.105, ..., 0.   , 1.   , 0.   ],
       [0.63 , 0.48 , 0.16 , ..., 1.   , 0.   , 0.   ],
       ...,
       [0.42 , 0.305, 0.1  , ..., 0.   , 1.   , 0.   ],
       [0.475, 0.365, 0.14 , ..., 0.   , 0.   , 1.   ],
       [0.28 , 0.12 , 0.075, ..., 0.   , 1.   , 0.   ]])
```

```
y_train
```

```
1646     9
3334     8
188     11
4030     7
2552     6
        ..
825      7
318     18
4107     7
3947    16
898      4
Name: age, Length: 3112, dtype: int64
```

```
from sklearn.metrics import mean_absolute_error, mean_squared_error
s = mean_squared_error(y_train, y_train_pred)
print('Mean Squared error of training set :%2f'%s)
```

```
Mean Squared error of training set :4.753595
```

13. Test the Model

```
y_train_pred = lm.predict(X_train)
y_test_pred = lm.predict(X_test)
y_test_pred
```

```
array([ 5.76375739, 10.86128032, 11.4225637 , ...,  4.84179968,
        9.79104261,  8.3178401 ])
```

```
X_test
```

```
array([[0.255, 0.19 , 0.05 , ..., 0.   , 1.   , 0.   ],
       [0.64 , 0.5  , 0.17 , ..., 1.   , 0.   , 0.   ],
       [0.625, 0.47 , 0.18 , ..., 0.   , 0.   , 1.   ],
       ...,
       [0.165, 0.12 , 0.05 , ..., 0.   , 1.   , 0.   ],
       [0.5  , 0.385, 0.115, ..., 1.   , 0.   , 0.   ],
       [0.42 , 0.32 , 0.11 , ..., 0.   , 1.   , 0.   ]])
```

```
y_test
```

```
895      6
1022    11
1498    11
3673    10
2603     9
        ..
2381     5
2889     8
3472     3
622     12
3015     6
Name: age, Length: 1038, dtype: int64
```

```
p = mean_squared_error(y_test, y_test_pred)
print('Mean Squared error of testing set :%2f'%p)
```

```
Mean Squared error of testing set :4.620467
```

14. Measure the performance using Metrics.

```
from sklearn.metrics import r2_score
s = r2_score(y_train, y_train_pred)
print('R2 Score of training set:%.2f'%s)
```

```
R2 Score of training set:0.54
```

```
from sklearn.metrics import r2_score
p = r2_score(y_test, y_test_pred)
print('R2 Score of testing set:%.2f'%p)
```

```
R2 Score of testing set:0.52
```