# Import Libraries

```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
```

# Import Dataset

```
data = pd.read_csv('abalone.csv')
data
```

| | 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 | 0.1500 | 15 |
| **1** | M | 0.350 | 0.265 | 0.090 | 0.2255 | 0.0995 | 0.0485 | 0.0700 | 7 |
| **2** | F | 0.530 | 0.420 | 0.135 | 0.6770 | 0.2565 | 0.1415 | 0.2100 | 9 |
| **3** | M | 0.440 | 0.365 | 0.125 | 0.5160 | 0.2155 | 0.1140 | 0.1550 | 10 |
| **4** | I | 0.330 | 0.255 | 0.080 | 0.2050 | 0.0895 | 0.0395 | 0.0550 | 7 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **4172** | F | 0.565 | 0.450 | 0.165 | 0.8870 | 0.3700 | 0.2390 | 0.2490 | 11 |
| **4173** | M | 0.590 | 0.440 | 0.135 | 0.9660 | 0.4390 | 0.2145 | 0.2605 | 10 |
| **4174** | M | 0.600 | 0.475 | 0.205 | 1.1760 | 0.5255 | 0.2875 | 0.3080 | 9 |
| **4175** | F | 0.625 | 0.485 | 0.150 | 1.0945 | 0.5310 | 0.2610 | 0.2960 | 10 |
| **4176** | M | 0.710 | 0.555 | 0.195 | 1.9485 | 0.9455 | 0.3765 | 0.4950 | 12 |

4177 rows × 9 columns

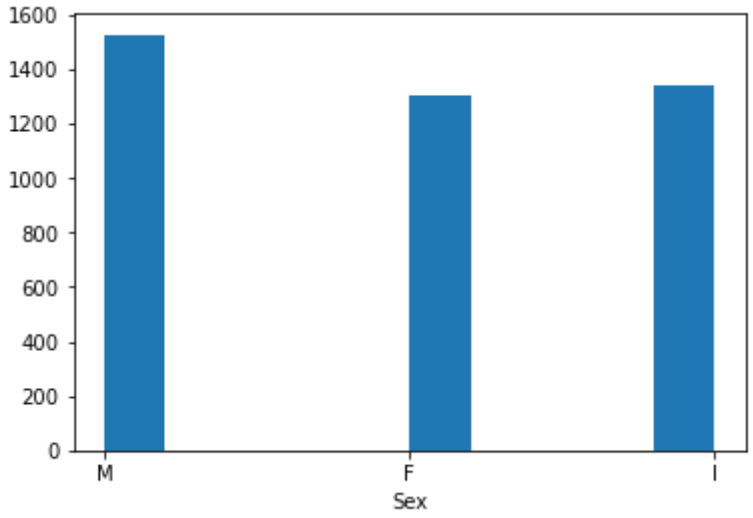
```
data.info()
```

```
<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
```

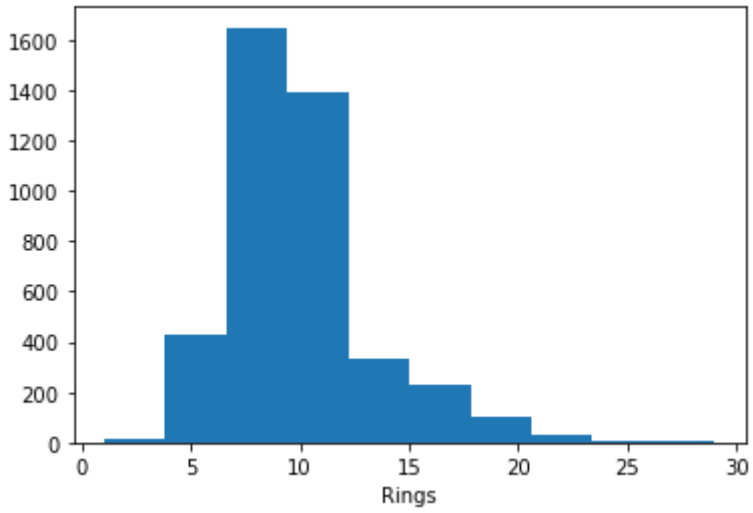
```
 2   Diameter        4177 non-null   float64
 3   Height          4177 non-null   float64
 4   Whole weight    4177 non-null   float64
 5   Shucked weight  4177 non-null   float64
 6   Viscera weight  4177 non-null   float64
 7   Shell weight    4177 non-null   float64
 8   Rings           4177 non-null   int64
dtypes: float64(7), int64(1), object(1)
memory usage: 293.8+ KB
```

# Univariate Analysis

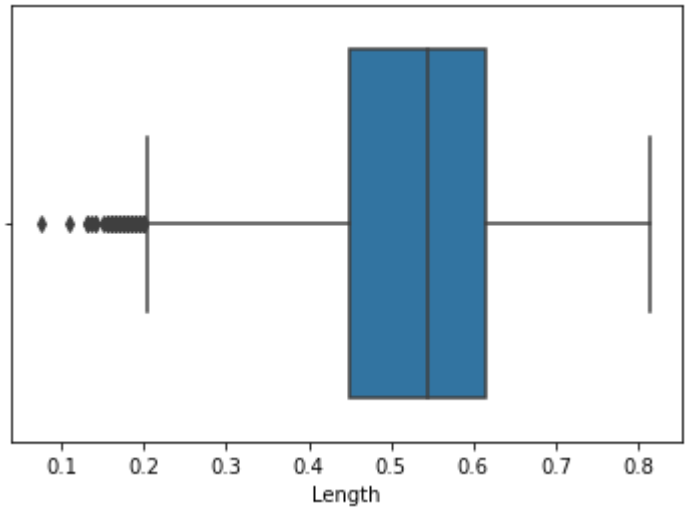
```
plt.hist(data['Sex']);
plt.xlabel('Sex');
```



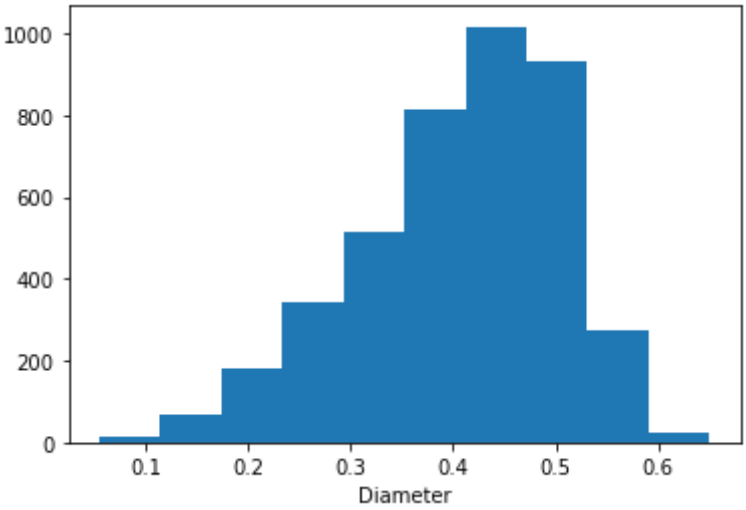

```
plt.hist(data['Rings']);
plt.xlabel('Rings');
```



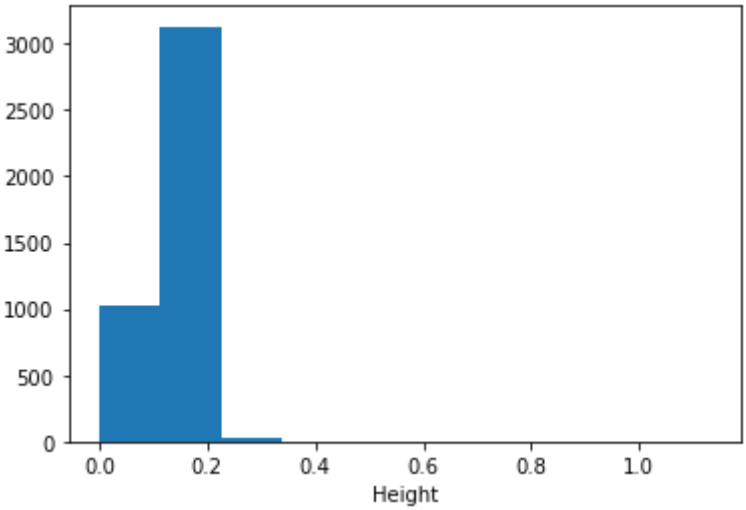

```
sns.boxplot(x=data['Length'])
plt.xlabel('Length');
```



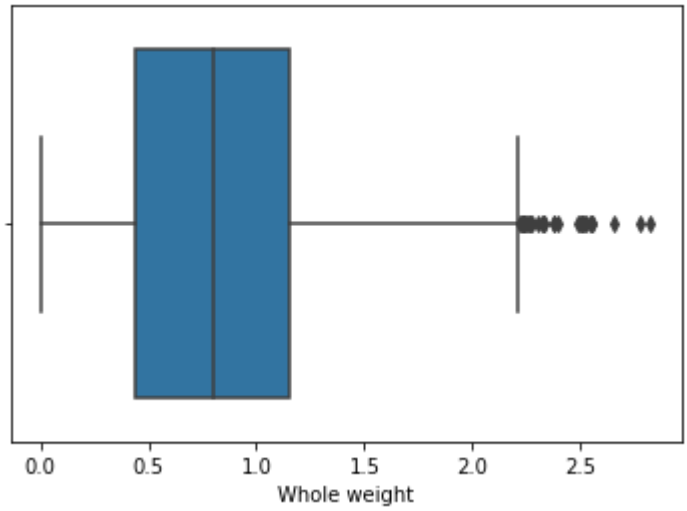

```
plt.hist(data['Diameter']);
plt.xlabel('Diameter');
```



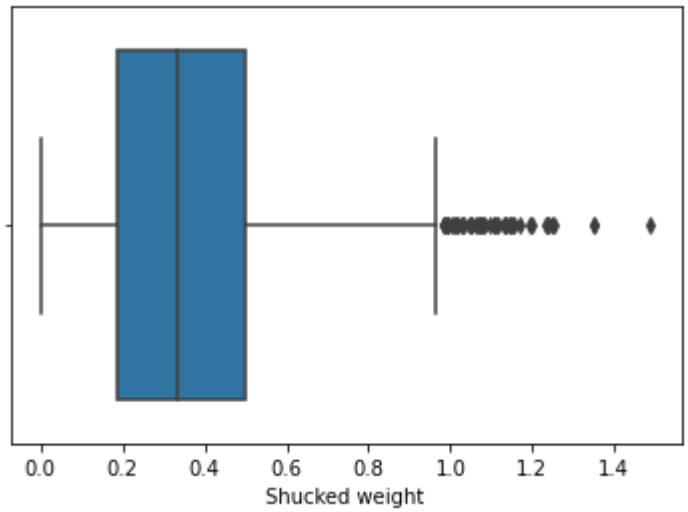

```
plt.hist(data['Height']);
plt.xlabel('Height');
```



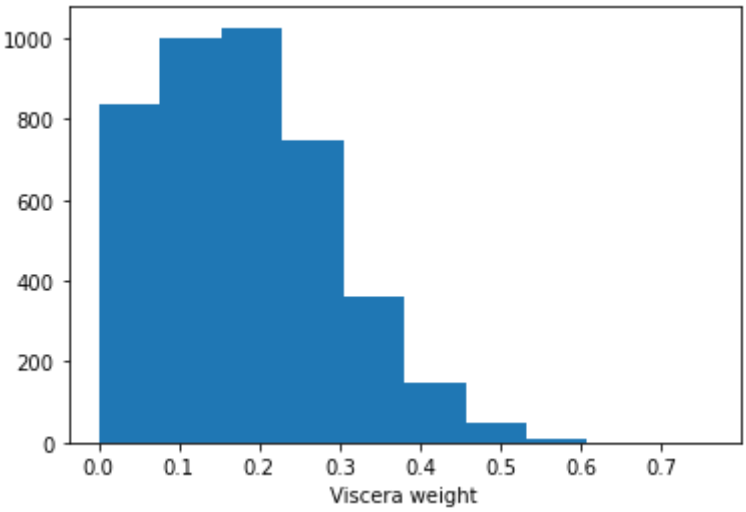

```
sns.boxplot(x=data['Whole weight'])
plt.xlabel('Whole weight');
```



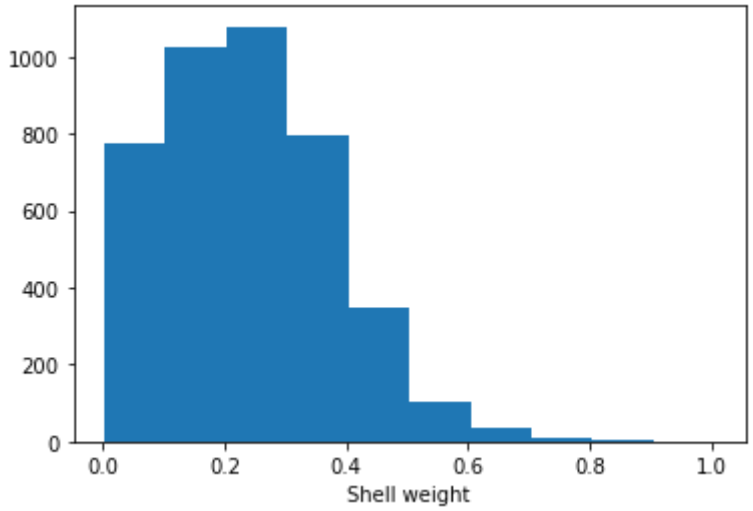

```
sns.boxplot(x=data['Shucked weight'])
plt.xlabel('Shucked weight');
```




```
plt.hist(data['Viscera weight']);
plt.xlabel('Viscera weight');
```

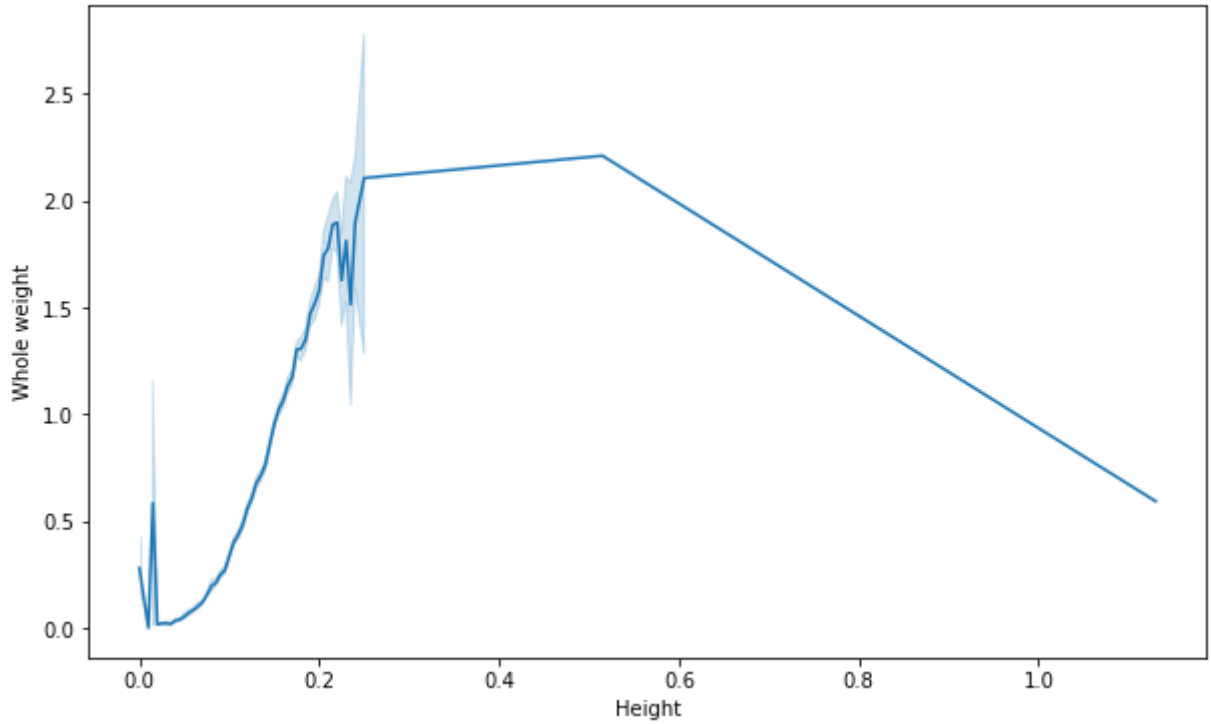



```
plt.hist(data['Shell weight']);
plt.xlabel('Shell weight');
```

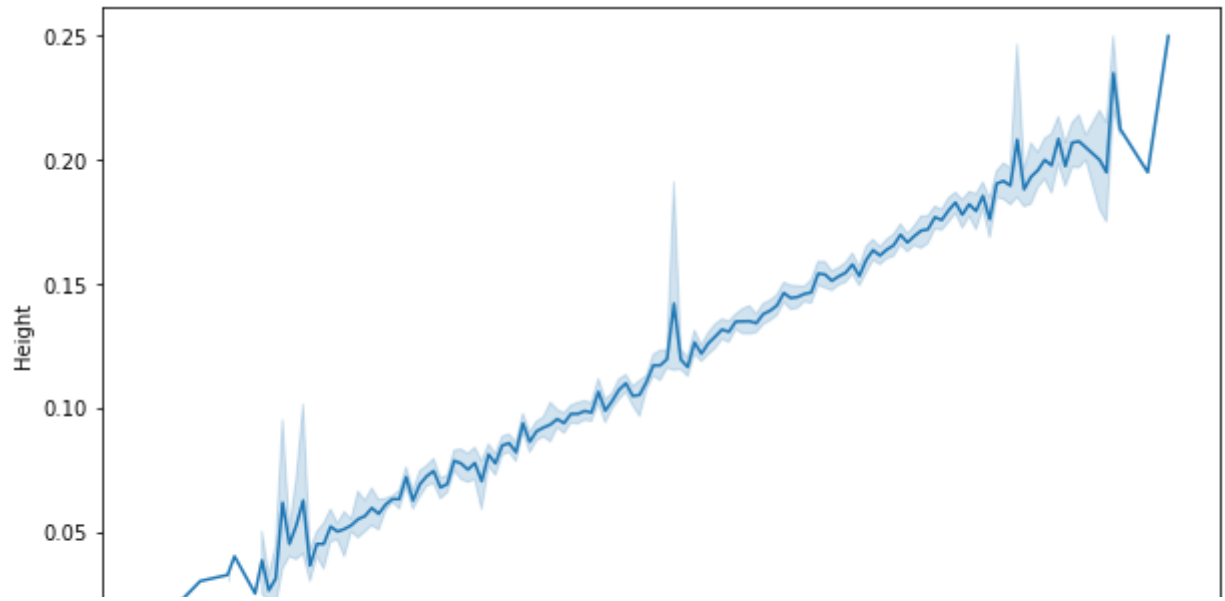



## Bivariate Analysis

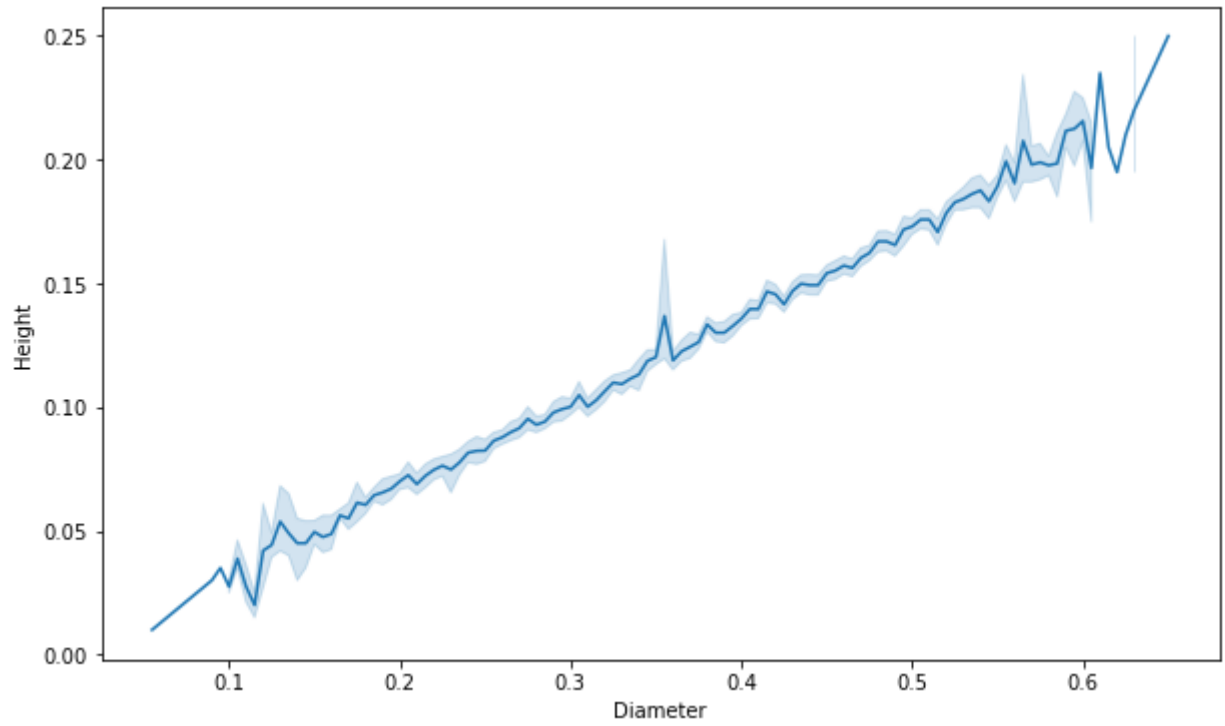
```
plt.figure(figsize=(10, 6))
sns.lineplot(x=data["Height"], y=data["Whole weight"]);
plt.xlabel('Height');
plt.ylabel('Whole weight');
```



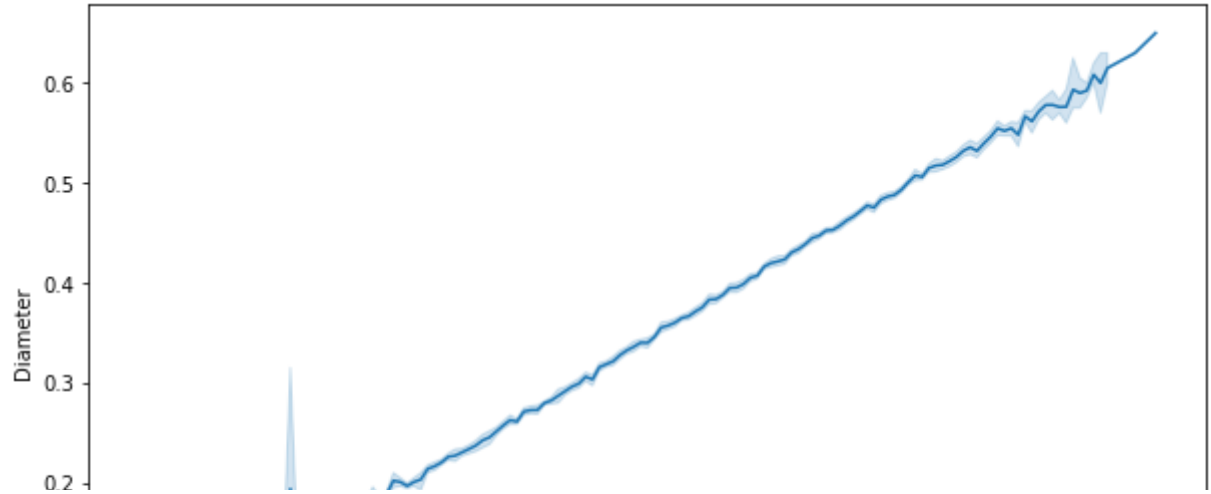

```
plt.figure(figsize=(10, 6))
sns.lineplot(x=data["Length"], y=data["Height"]);
plt.xlabel('Length');
plt.ylabel('Height');
```



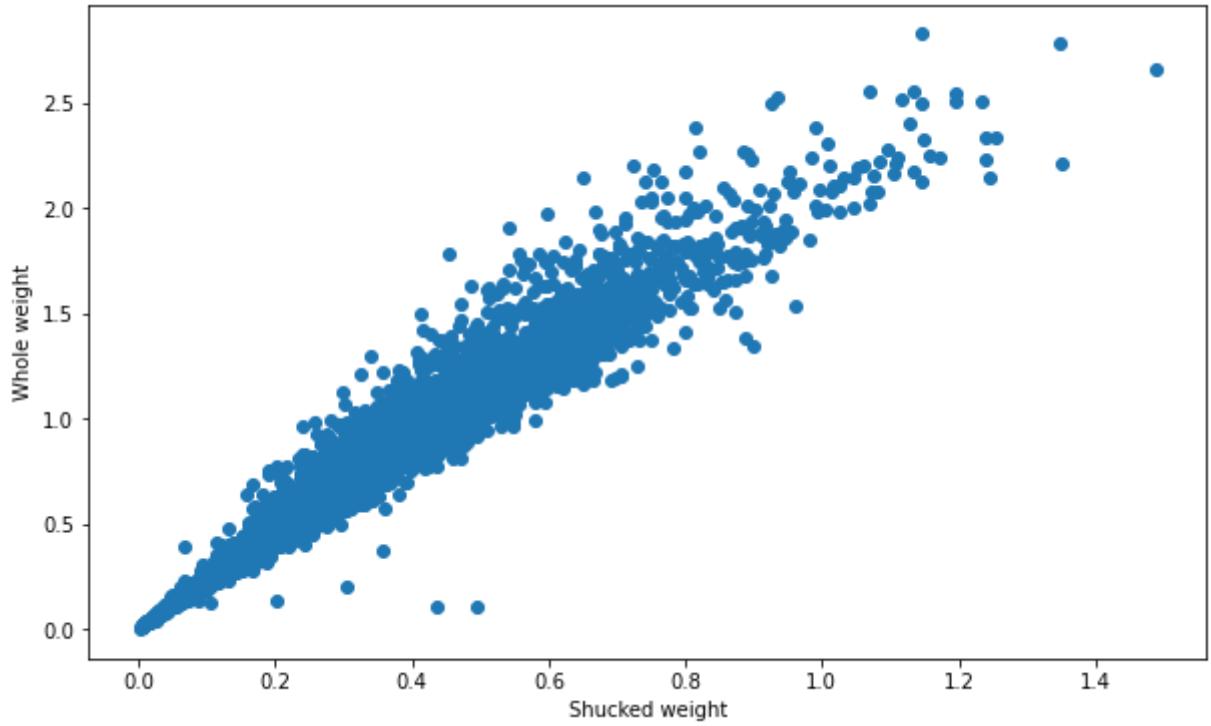

```
plt.figure(figsize=(10, 6))
sns.lineplot(x=data["Diameter"], y=data["Height"]);
plt.xlabel('Diameter');
plt.ylabel('Height');
```



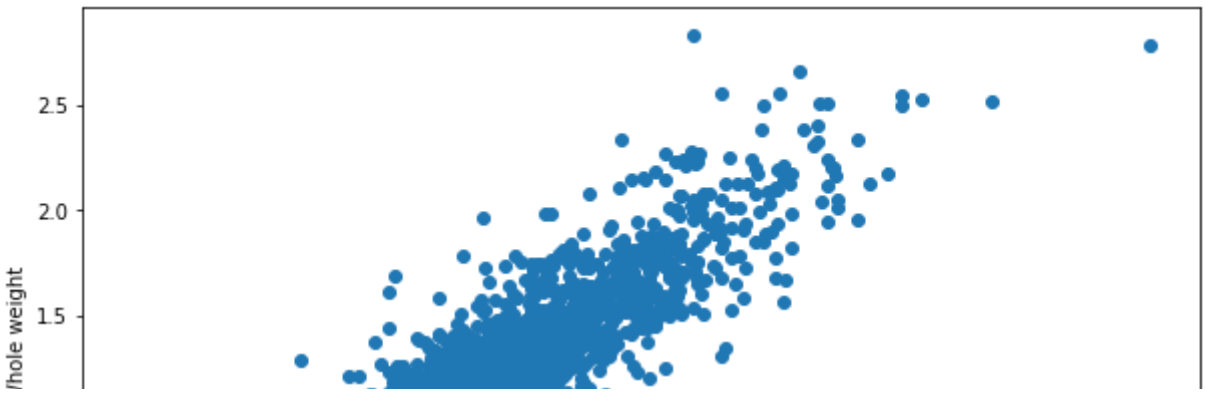

```
plt.figure(figsize=(10, 6))
sns.lineplot(x=data["Length"], y=data["Diameter"]);
plt.xlabel('Length');
plt.ylabel('Diameter');
```




```
plt.figure(figsize=(10, 6))
plt.scatter(x=data["Shucked weight"], y=data["Whole weight"]);
plt.xlabel('Shucked weight');
plt.ylabel('Whole weight');
```

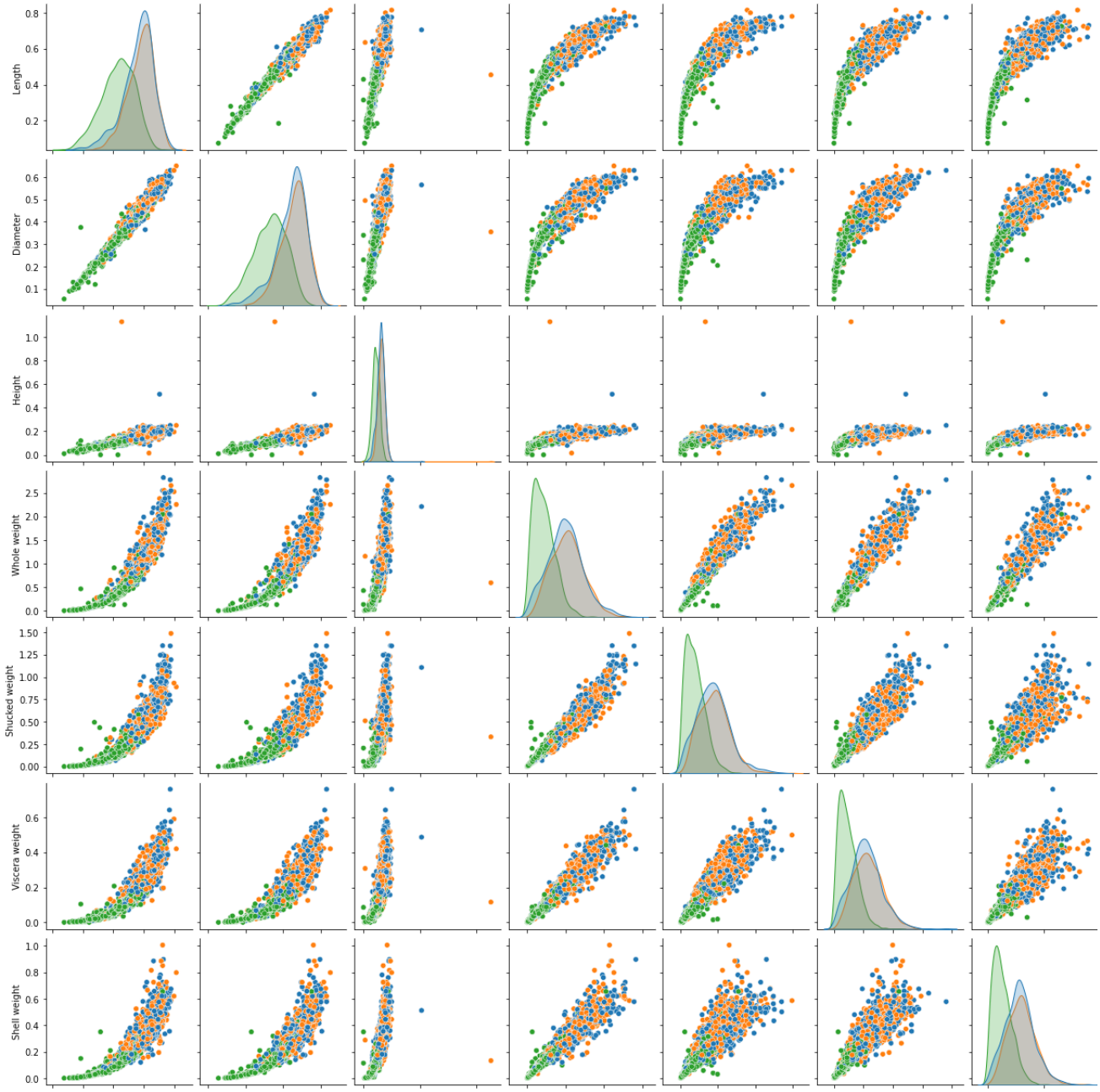



```
plt.figure(figsize=(10, 6))
plt.scatter(x=data["Viscera weight"], y=data["Whole weight"]);
plt.xlabel('Viscera weight');
plt.ylabel('Whole weight');
```

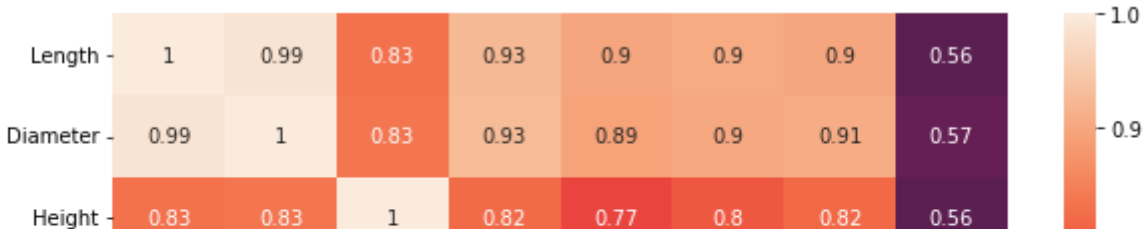



## Multi-variate Analysis

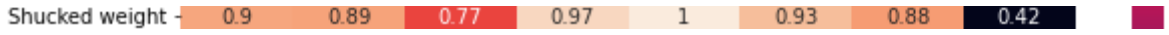
```
sns.pairplot(data, hue='Sex');
```




```
plt.figure(figsize=(10, 6));
sns.heatmap(data.corr(), annot=True);
```




# Descriptive Statistics




```
data.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 | |
| **max** | 0.815000 | 0.650000 | 1.130000 | 2.825500 | 1.488000 | 0.760000 | |

# Handling Missing Values

```
data.isna().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
```

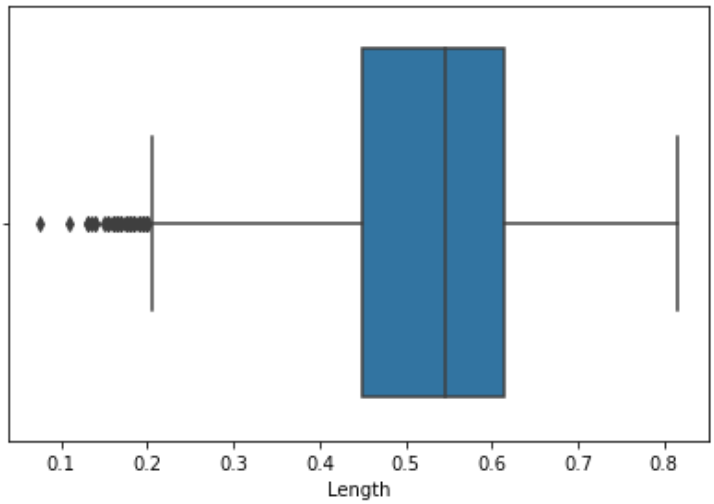
# Outlier Handling

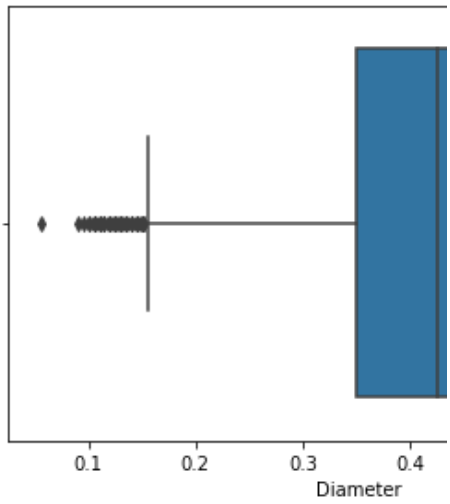
```
numeric_cols = ['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight', 'Viscera
```

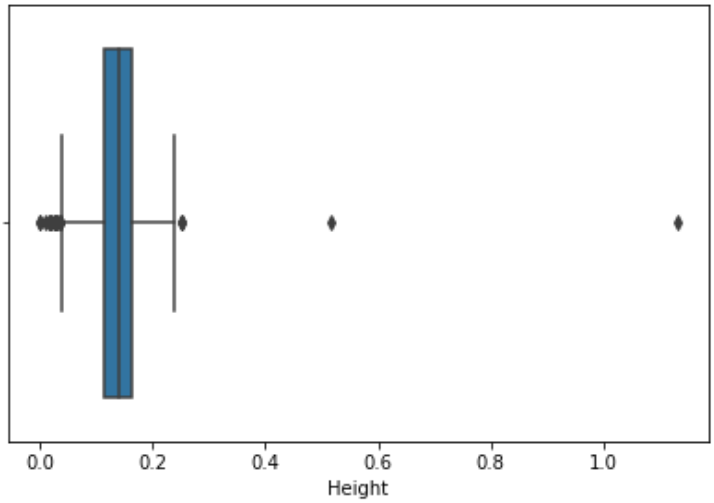
```
def boxplots(cols):
```

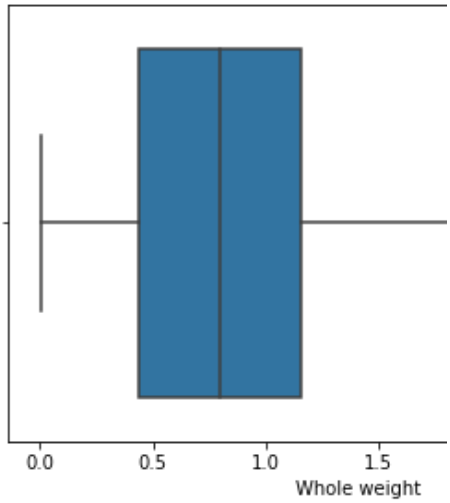
```
    fig, axes = plt.subplots(4, 2, figsize=(15, 20))

    t=0
    for i in range(4):
        for j in range(2):
            sns.boxplot(ax=axes[i][j], data=data, x=cols[t])
            t+=1

    plt.show()


def Flooring_outlier(col):
    Q1 = data[col].quantile(0.25)
    Q3 = data[col].quantile(0.75)
    IQR = Q3 - Q1
    whisker_width = 1.5
    lower_whisker = Q1 -(whisker_width*IQR)
    upper_whisker = Q3 + (whisker_width*IQR)
    data[col]=np.where(data[col]>upper_whisker,upper_whisker,np.where(data[col]<lower_whis


print('Before Outliers Handling')
print('='*100)
boxplots(numeric_cols)
for col in numeric_cols:
    Flooring_outlier(col)
print('\n\n\nAfter Outliers Handling')
print('='*100)
boxplots(numeric_cols)
```

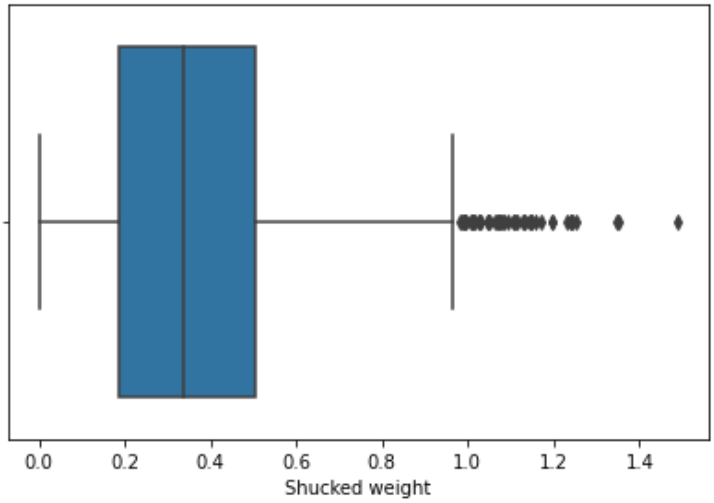
```
Before Outliers Handling
==========================================================================================
```

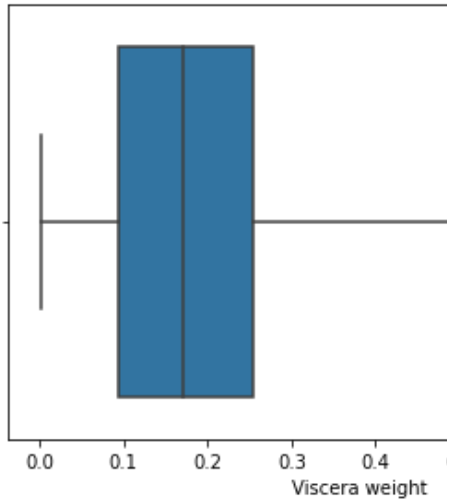


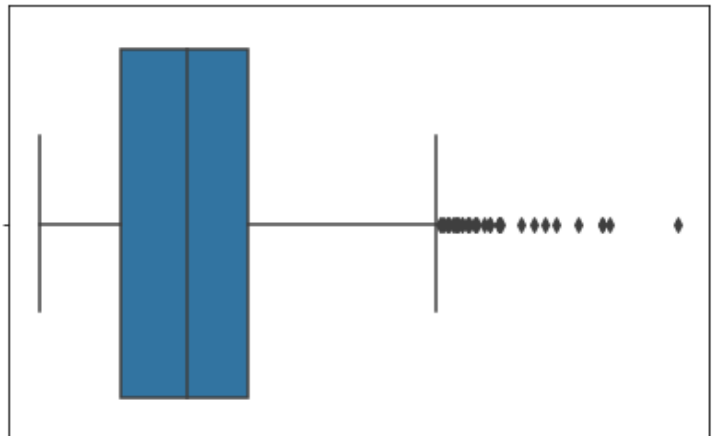



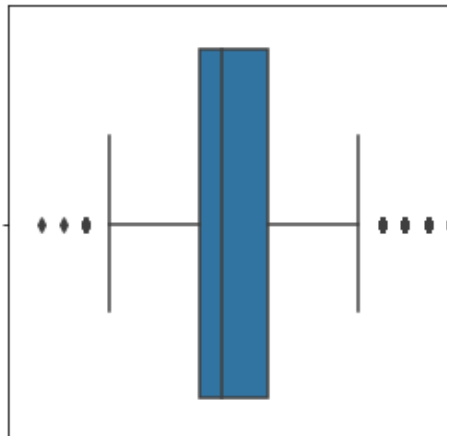



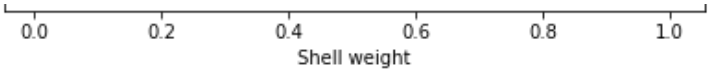



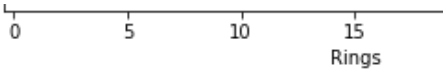



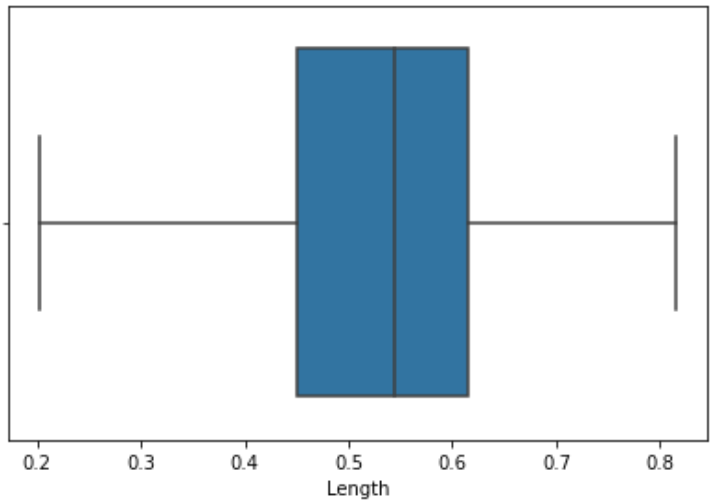



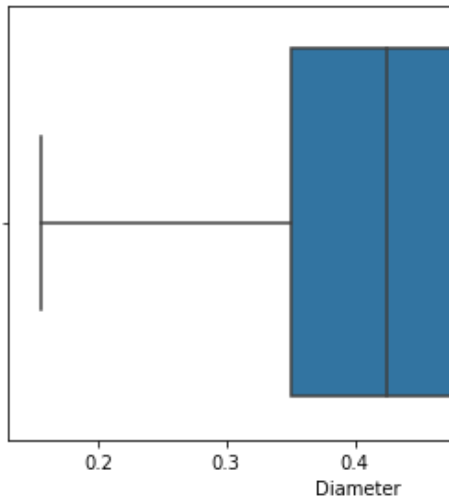


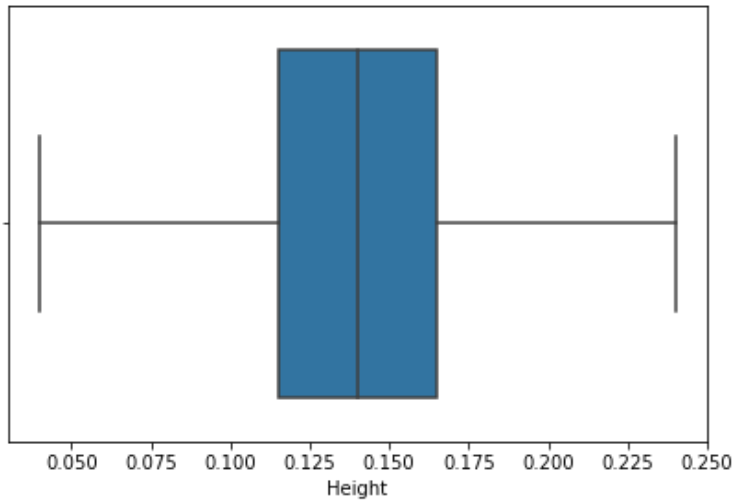


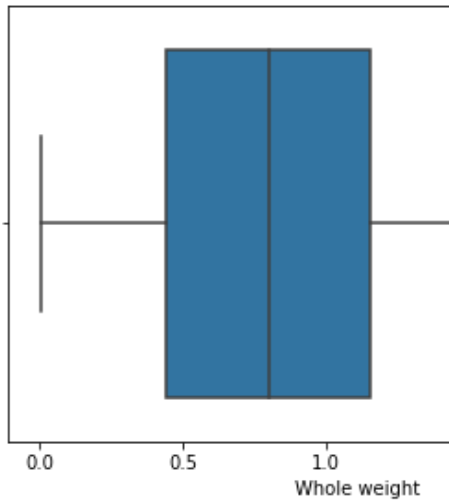



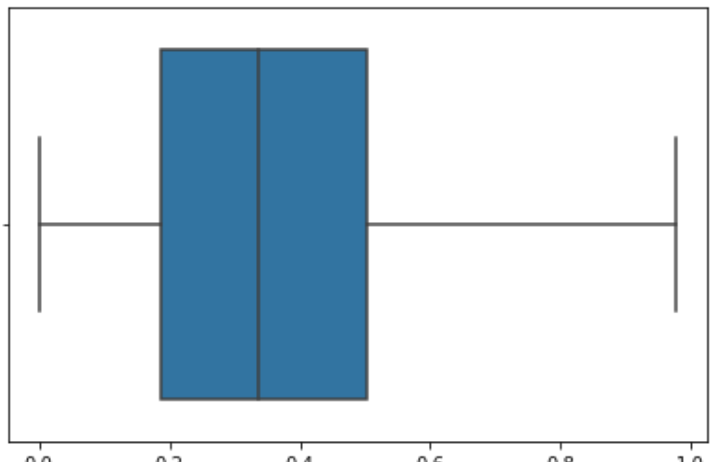

```
After Outliers Handling
==========================================================================================
```

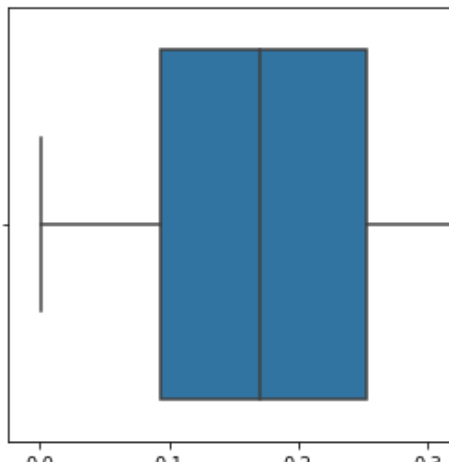




# Encode Categorical Columns

```
data = pd.get_dummies(data, columns = ['Sex'])
data
```

| | Length | Diameter | Height | Whole weight | Shucked weight | Viscera weight | Shell weight | Rings | Se |
|---|---|---|---|---|---|---|---|---|---|
| **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 x 11 columns

## Split Data into Dependent & Independent Columns

```
Y = data[['Rings']]
X = data.drop(['Rings'], axis=1)
```

## Scale the independent Variables

```
scaler = StandardScaler()
X = scaler.fit_transform(X)
X
```

```
array([[-0.58311728, -0.44088378, -1.15809314, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [-1.46569411, -1.45976205, -1.28875125, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.04729474,  0.11949927, -0.1128283 , ...,  1.48184628,
        -0.68801788, -0.75948762],
       ...,
       [ 0.63567929,  0.67988232,  1.71638519, ..., -0.67483383,
        -0.68801788,  1.31667716],
       [ 0.84581663,  0.78177015,  0.27914602, ...,  1.48184628,
        -0.68801788, -0.75948762],
       [ 1.56028358,  1.49498494,  1.45506898, ..., -0.67483383,
        -0.68801788,  1.31667716]])
```

## Train Test Split

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=42)
X_train.shape, X_test.shape, Y_train.shape, Y_test.shape
```

```
((3341, 10), (836, 10), (3341, 1), (836, 1))
```

# Model Training & Testing

```
model = LinearRegression()
model.fit(X_train, Y_train)
model.score(X_train, Y_train), model.score(X_test, Y_test)
```

```
(0.5743537797259437, 0.574066914479568)
```

```
model = DecisionTreeRegressor(max_depth=15, max_leaf_nodes=40)
model.fit(X_train, Y_train)
model.score(X_train, Y_train), model.score(X_test, Y_test)
```

```
(0.6299341126842184, 0.5533377990647702)
```