Assignment -3
Python Programming

Assignment Date	07 October 2022
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Maximum Marks	2 Marks

Problem Statement: Abalone Age Prediction

import modules

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import scale
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import
accuracy_score,confusion_matrix,classification_report
```

convert csv file to dataframe

```
ns=pd.read_csv(r"C:\Users\IBM\Documents\abalone.csv")
```

```
ns.head()
```

```
  Sex  Length  Diameter  Height  Whole weight  Shucked weight  Viscera weight
\
0   M   0.455     0.365   0.095        0.5140          0.2245          0.1010
1   M   0.350     0.265   0.090        0.2255          0.0995          0.0485
2   F   0.530     0.420   0.135        0.6770          0.2565          0.1415
3   M   0.440     0.365   0.125        0.5160          0.2155          0.1140
4   I   0.330     0.255   0.080        0.2050          0.0895          0.0395

   Shell weight  Rings
0         0.150     15
1         0.070      7
2         0.210      9
3         0.155     10
4         0.055      7
```

```
ns.tail()
```

```
     Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
4172   F   0.565     0.450   0.165        0.8870          0.3700   
4173   M   0.590     0.440   0.135        0.9660          0.4390   
4174   M   0.600     0.475   0.205        1.1760          0.5255   
4175   F   0.625     0.485   0.150        1.0945          0.5310   
4176   M   0.710     0.555   0.195        1.9485          0.9455   

      Viscera weight  Shell weight  Rings  
4172          0.2390        0.2490     11  
4173          0.2145        0.2605     10  
4174          0.2875        0.3080      9  
4175          0.2610        0.2960     10  
4176          0.3765        0.4950     12  
```

To know the shape of dataset

```
ns.shape
```

```
(4177, 9)
```

To calculate the age add '1.5' with Rings

```
age = []
for h in ns["Rings"]:
  age.append(h+1.5)
```

```
ns['Age'] = age
```

```
ns['Age']
```

```
0       16.5
1        8.5
2       10.5
3       11.5
4        8.5
        ... 
4172    12.5
4173    11.5
4174    10.5
4175    11.5
4176    13.5
Name: Age, Length: 4177, dtype: float64
```

```
ns.drop(columns=['Rings'],axis=1,inplace=True)
```

```
ns.head()
```

```
  Sex  Length  Diameter  Height  Whole weight  Shucked weight  Viscera weight  
\
```

```
0   M   0.455     0.365   0.095         0.5140           0.2245           0.1010
1   M   0.350     0.265   0.090         0.2255           0.0995           0.0485
2   F   0.530     0.420   0.135         0.6770           0.2565           0.1415
3   M   0.440     0.365   0.125         0.5160           0.2155           0.1140
4   I   0.330     0.255   0.080         0.2050           0.0895           0.0395

   Shell weight   Age
0         0.150  16.5
1         0.070   8.5
2         0.210  10.5
3         0.155  11.5
4         0.055   8.5
```

```
ns.tail()
```

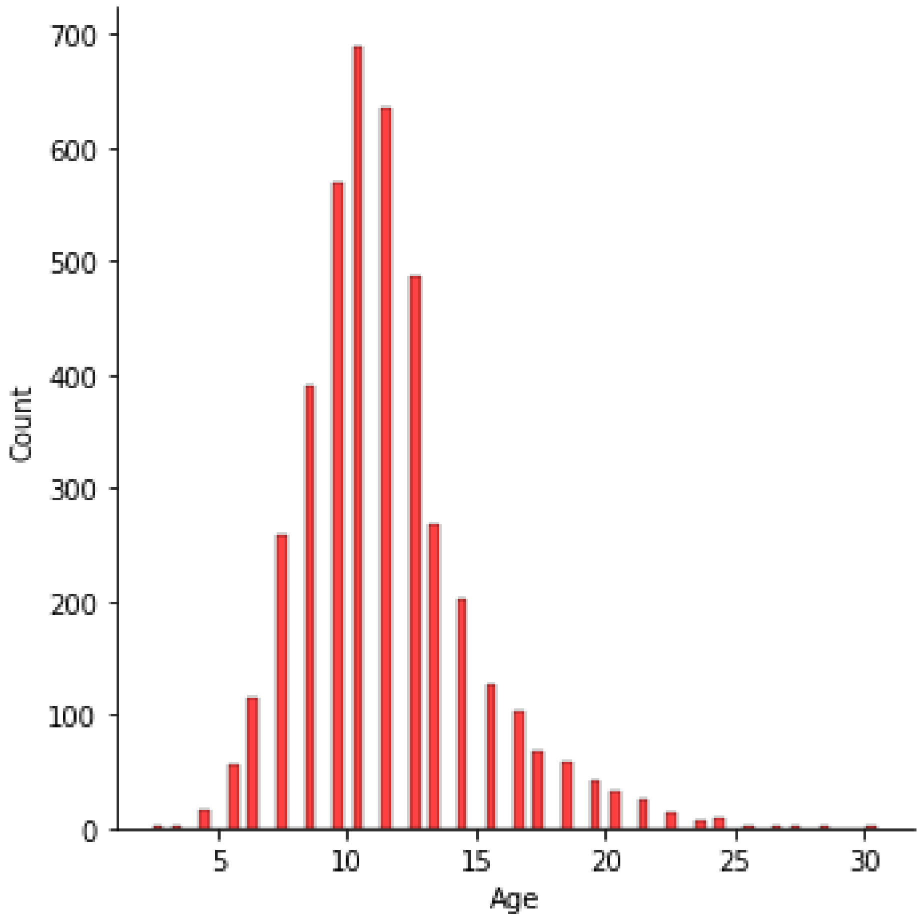
```
     Sex  Length  Diameter  Height  Whole weight  Shucked weight  \
4172   F   0.565     0.450   0.165        0.8870          0.3700
4173   M   0.590     0.440   0.135        0.9660          0.4390
4174   M   0.600     0.475   0.205        1.1760          0.5255
4175   F   0.625     0.485   0.150        1.0945          0.5310
4176   M   0.710     0.555   0.195        1.9485          0.9455

      Viscera weight  Shell weight   Age
4172          0.2390        0.2490  12.5
4173          0.2145        0.2605  11.5
4174          0.2875        0.3080  10.5
4175          0.2610        0.2960  11.5
4176          0.3765        0.4950  13.5
```

Perform Visualizations

Univariate Analysis

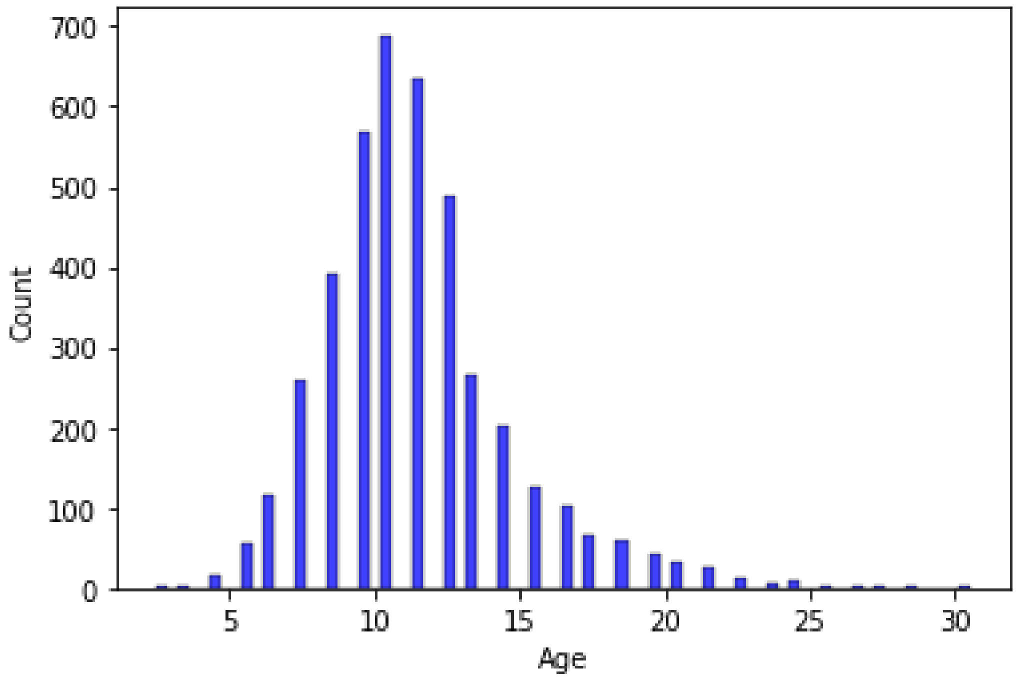
```
xz.displot(ns["Age"], color='red')
```

```
<seaborn.axisgrid.FacetGrid at 0x131100d0c18>
```



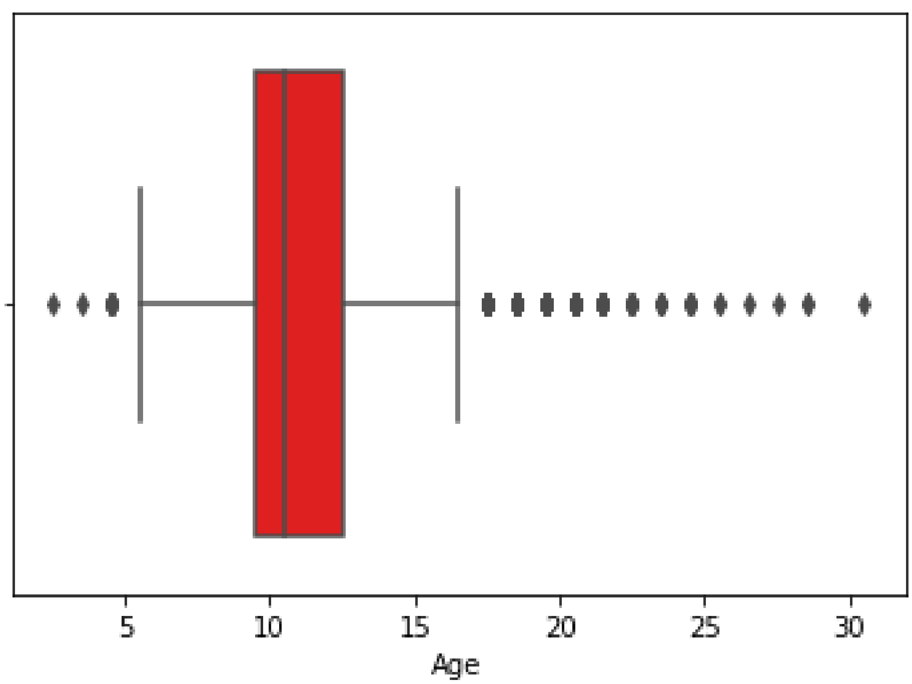

```
xz.histplot(x=ns['Age'],color='blue')
```

```
<AxesSubplot:xlabel='Age', ylabel='Count'>
```



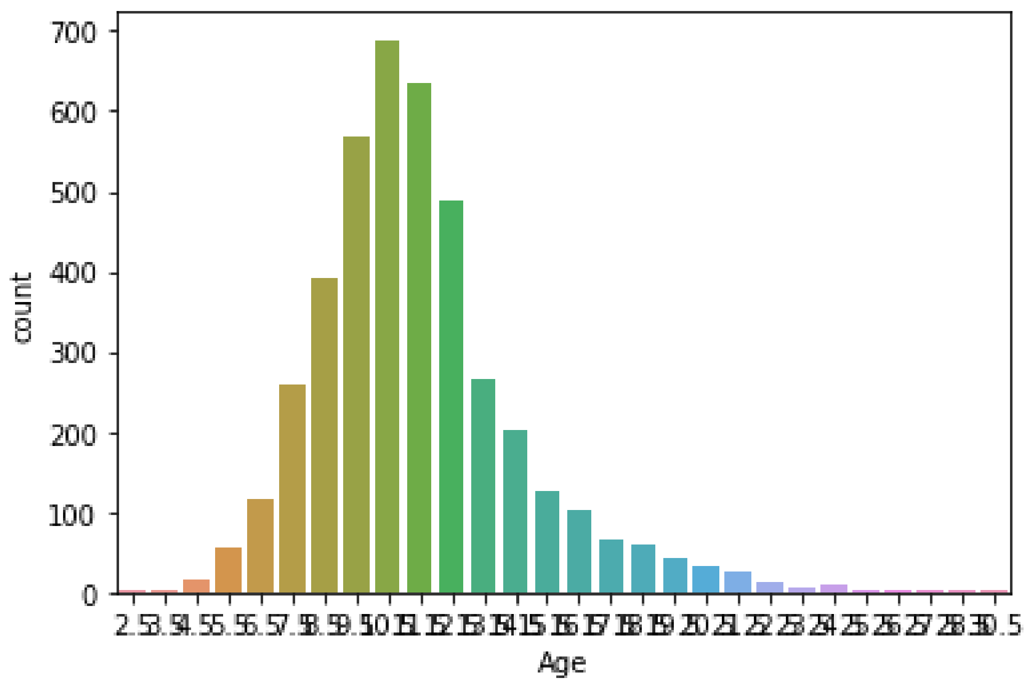

```
xz.boxplot(x=ns['Age'],color='red')
```

```
<AxesSubplot:xlabel='Age'>
```




```
xz.countplot(x=ns['Age'])
```

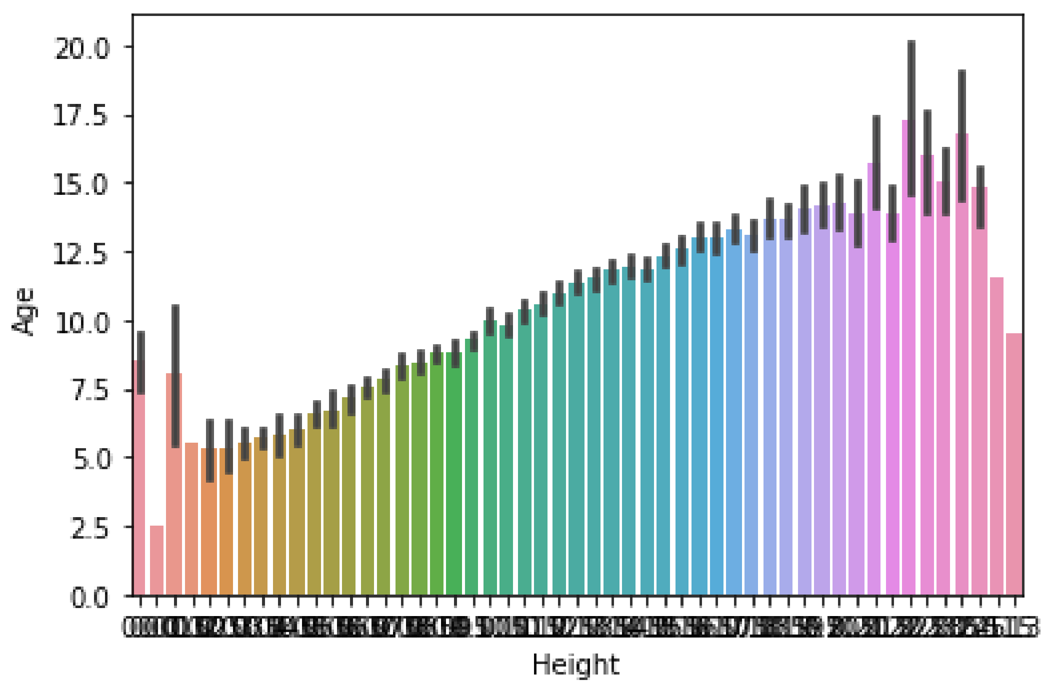
```
<AxesSubplot:xlabel='Age', ylabel='count'>
```



Bi-Variate Analysis

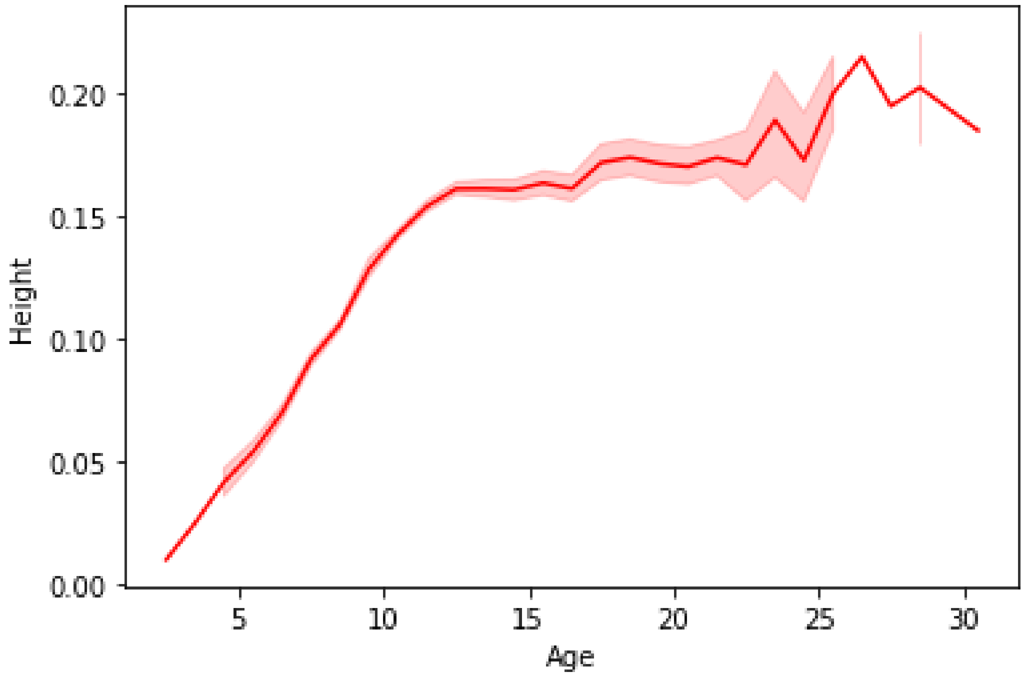
```
xz.barplot(x=ns['Height'],y=ns['Age'])
```

<AxesSubplot:xlabel='Height', ylabel='Age'>



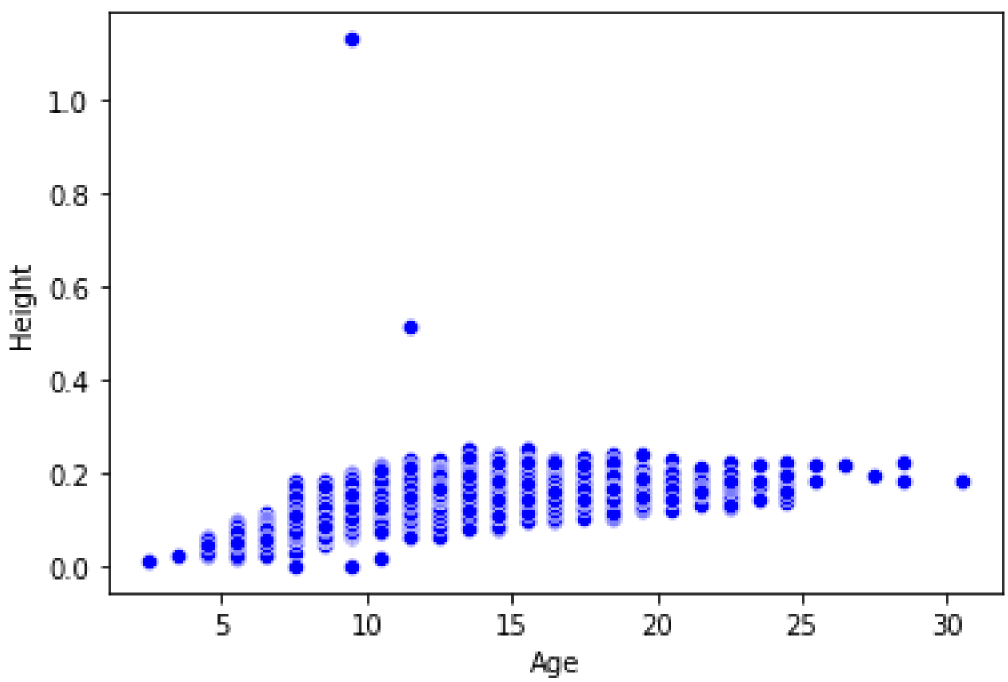

```
xz.lineplot(x=ns['Age'],y=ns['Height'], color='red')
```

```
<AxesSubplot:xlabel='Age', ylabel='Height'>
```



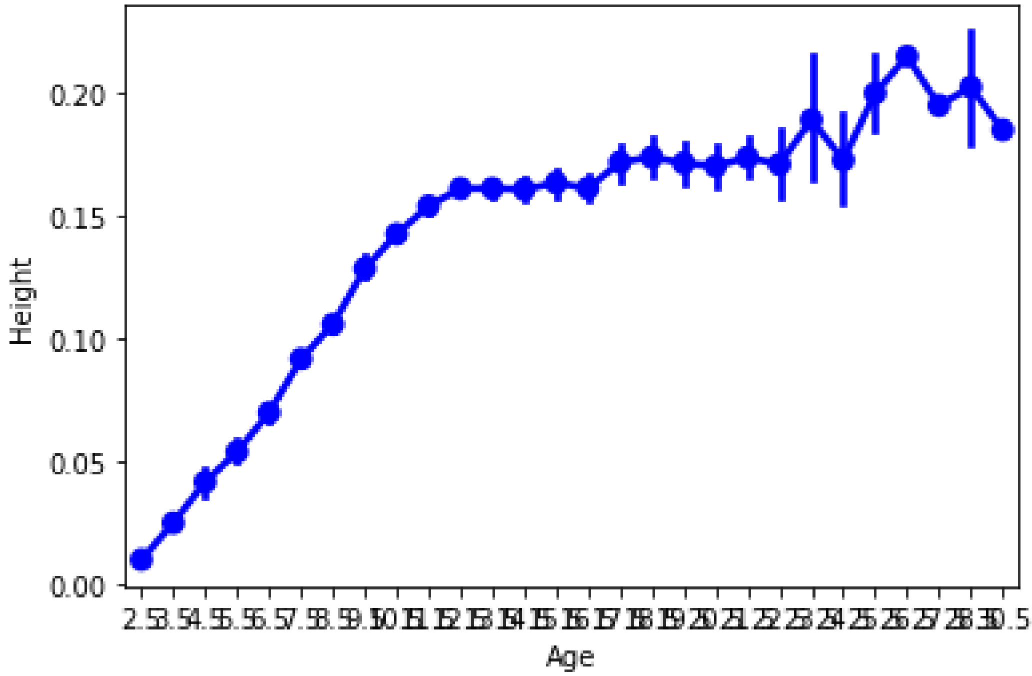

```
xz.scatterplot(x=ns['Age'],y=ns['Height'],color='blue')
```

```
<AxesSubplot:xlabel='Age', ylabel='Height'>
```



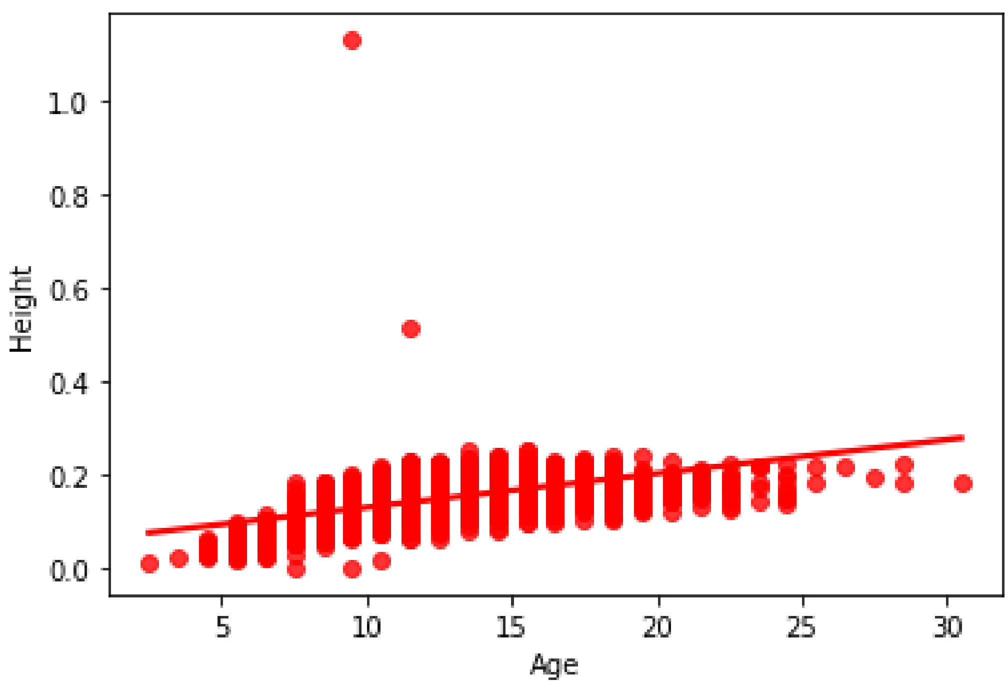

```
xz.pointplot(x=ns['Age'], y=ns['Height'], color="blue")
```

```
<AxesSubplot:xlabel='Age', ylabel='Height'>
```




```
xz.regplot(x=ns['Age'],y=ns['Height'],color='Red')
```

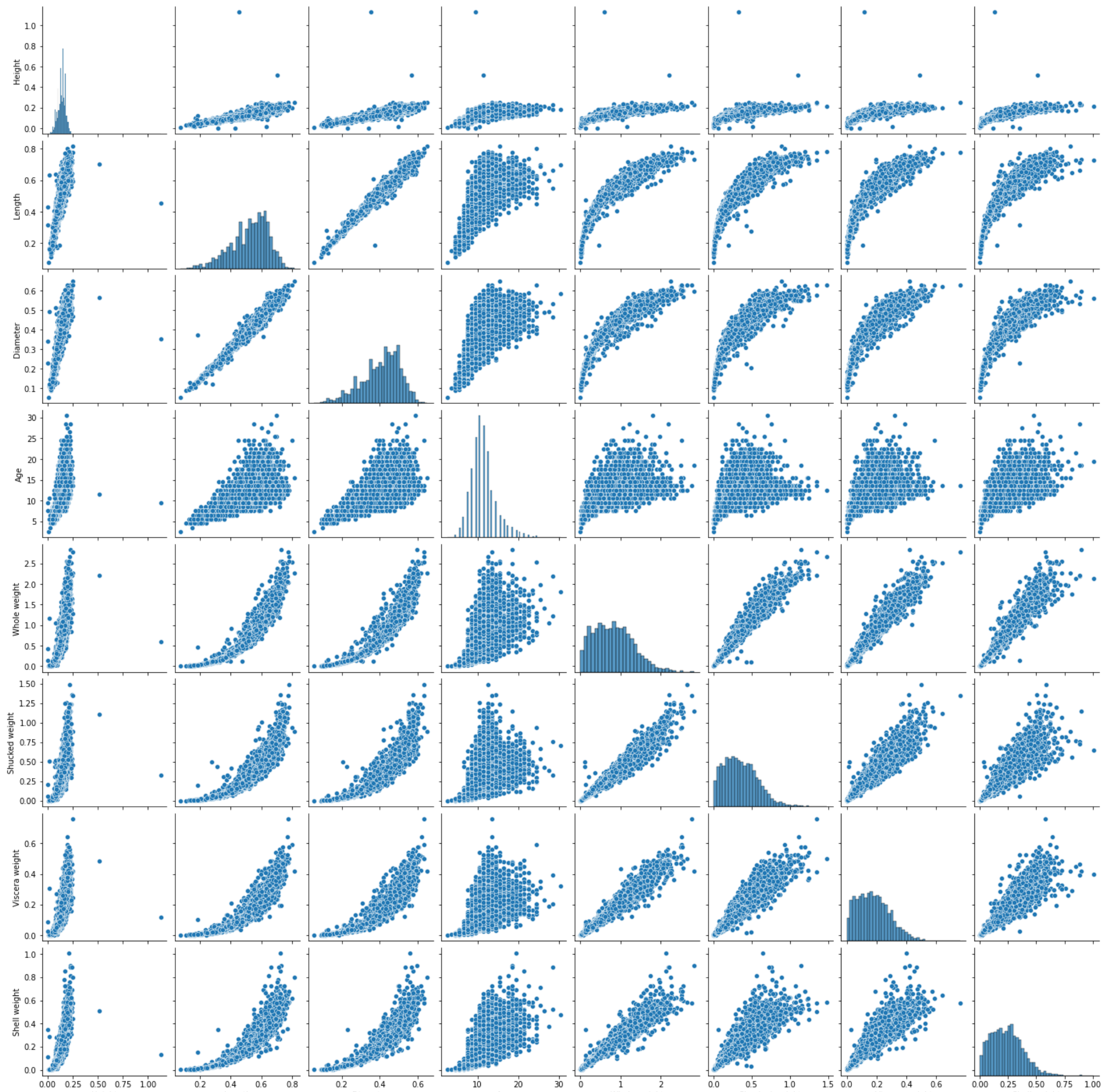
<AxesSubplot:xlabel='Age', ylabel='Height'>



Multi-Variate Analysis

```
xz.pairplot(data=ns[["Height","Length","Diameter","Age","Whole weight","Shucked weight","Viscera weight","Shell weight"]])
```

```
<seaborn.axisgrid.PairGrid at 0x13110619438>
```



Perform descriptive statistics on the dataset

```
ns.describe()
```

```
            Length     Diameter       Height  Whole weight  Shucked weight  \
count  4177.000000  4177.000000  4177.000000   4177.000000     4177.000000
mean      0.523992     0.407881     0.139516      0.828742        0.359367
std       0.120093     0.099240     0.041827      0.490389        0.221963
min       0.075000     0.055000     0.000000      0.002000        0.001000
25%       0.450000     0.350000     0.115000      0.441500        0.186000
50%       0.545000     0.425000     0.140000      0.799500        0.336000
75%       0.615000     0.480000     0.165000      1.153000        0.502000
max       0.815000     0.650000     1.130000      2.825500        1.488000
```

```
       Viscera weight  Shell weight          Age
count     4177.000000   4177.000000  4177.000000
mean         0.180594      0.238831    11.433684
std          0.109614      0.139203     3.224169
min          0.000500      0.001500     2.500000
25%          0.093500      0.130000     9.500000
50%          0.171000      0.234000    10.500000
75%          0.253000      0.329000    12.500000
max          0.760000      1.005000    30.500000
```

check the null value and if exist delete the null value

```
data.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
```

Find the outliers and replace them outliers

```
outliers=ns.quantile(q=(0.25,0.75))

outliers
```

```
      Length  Diameter  Height  Whole weight  Shucked weight  Viscera weight  \
0.25   0.450      0.35   0.115        0.4415           0.186          0.0935
0.75   0.615      0.48   0.165        1.1530           0.502          0.2530

      Shell weight   Age
0.25         0.130   9.5
0.75         0.329  12.5
```

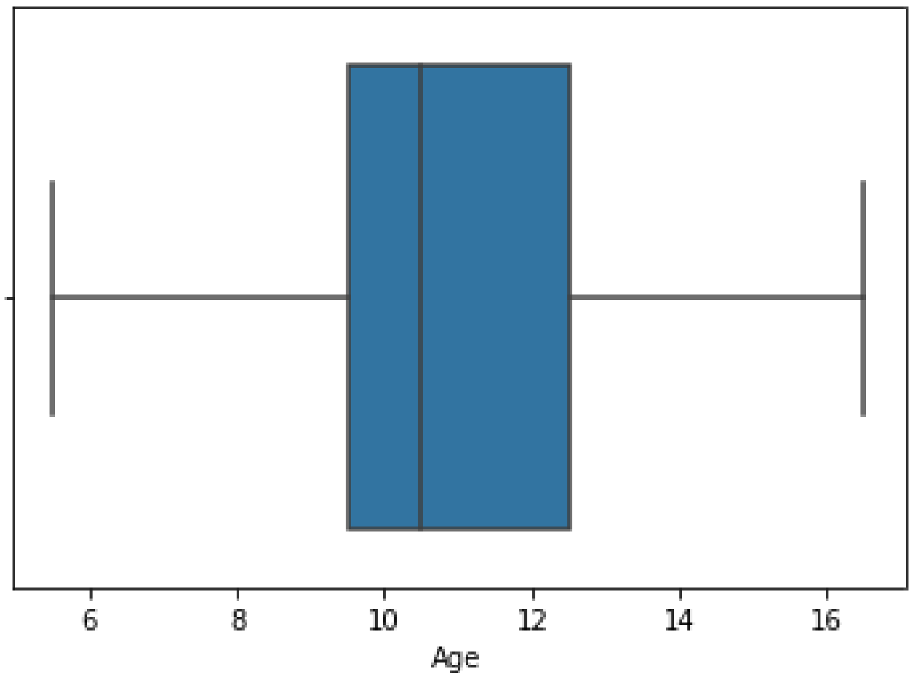
```
d1 = ns.Age.quantile(0.25)
d2 = ns.Age.quantile(0.75)
r = d2 -d1
lower_limit = d1 - 1.5 * r
ns.median(numeric_only=True)
```

```
Length             0.5450
Diameter           0.4250
Height             0.1400
Whole weight       0.7995
```

```
Shucked weight     0.3360
Viscera weight     0.1710
Shell weight       0.2340
Age               10.5000
dtype: float64
```

```
ns['Age'] = np.where(ns['Age'] < lower_limit, 7, ns['Age'])
xz.boxplot(x=ns.Age,showfliers = False)
```

```
<AxesSubplot:xlabel='Age'>
```



Check for Categorical columns and perform encoding

```
ip = LabelEncoder()
ns.Sex = ip.fit_transform(ns.Sex)
```

```
ns.head()
```

```
   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
2    0   0.530     0.420   0.135        0.6770          0.2565
3    2   0.440     0.365   0.125        0.5160          0.2155
4    1   0.330     0.255   0.080        0.2050          0.0895

   Viscera weight  Shell weight   Age
0          0.1010         0.150  16.5
1          0.0485         0.070   8.5
2          0.1415         0.210  10.5
```

```
3           0.1140         0.155   11.5
4           0.0395         0.055    8.5
```

Split the data into dependent and independent variables

```
d= ns["Sex"]

d

0       2
1       2
2       0
3       2
4       1
       ..
4172    0
4173    2
4174    2
4175    0
4176    2
Name: Sex, Length: 4177, dtype: int32

id=ns.drop(columns=["Sex"],axis=1)
id.head()

   Length  Diameter  Height  Whole weight  Shucked weight  Viscera weight  \
0   0.455     0.365   0.095        0.5140          0.2245          0.1010
1   0.350     0.265   0.090        0.2255          0.0995          0.0485
2   0.530     0.420   0.135        0.6770          0.2565          0.1415
3   0.440     0.365   0.125        0.5160          0.2155          0.1140
4   0.330     0.255   0.080        0.2050          0.0895          0.0395

   Shell weight   Age
0         0.150  16.5
1         0.070   8.5
2         0.210  10.5
3         0.155  11.5
4         0.055   8.5
```

Scale the independent variables

```
id_Scaled = pd.DataFrame(scale(id), columns=id.columns)
id_Scaled.head()

     Length  Diameter    Height  Whole weight  Shucked weight  Viscera weight
\
0 -0.574558 -0.432149 -1.064424     -0.641898       -0.607685       -0.726212
1 -1.448986 -1.439929 -1.183978     -1.230277       -1.170910       -1.205221
2  0.050033  0.122130 -0.107991     -0.309469       -0.463500       -0.356690
3 -0.699476 -0.432149 -0.347099     -0.637819       -0.648238       -0.607600
```

```
4 -1.615544 -1.540707 -1.423087     -1.272086       -1.215968       -1.287337

   Shell weight       Age
0     -0.638217  1.577830
1     -1.212987 -0.919022
2     -0.207139 -0.294809
3     -0.602294  0.017298
4     -1.320757 -0.919022
```

Split the data into training and testing

```
X_train, X_test, Y_train, Y_test = train_test_split(indep_Scaled, dep,
test_size=0.5, random_state=0)
```

```
X_train.shape,X_test.shape
```

```
((2088, 8), (2089, 8))
```

```
Y_train.shape,Y_test.shape
```

```
((2088,), (2089,))
```

```
X_train.head()
```

```
        Length  Diameter    Height  Whole weight  Shucked weight  \
4149 -2.031938 -1.943819 -1.662195     -1.437280       -1.335371
315  -0.616198 -0.532927 -0.705762     -0.755087       -0.745112
1604  0.133312  0.474853  0.011563      0.292166        0.268692
926  -0.782755 -0.835261 -1.183978     -0.823409       -0.641479
3077  1.340855  1.029133  0.609334      1.460766        1.471739

      Viscera weight  Shell weight       Age
4149       -1.451569     -1.500373 -1.231128
315        -1.036427     -0.710063 -0.606915
1604        0.678883      0.216754  0.017298
926        -0.853947     -1.033372 -0.919022
3077        1.796573      1.197456  0.017298
```

```
X_test.head()
```

```
        Length  Diameter    Height  Whole weight  Shucked weight  \
668   0.216591  0.172519  0.370226      0.181016       -0.368878
1580 -0.199803 -0.079426 -0.466653     -0.433875       -0.443224
3784  0.799543  0.726798  0.370226      0.870348        0.755318
463  -2.531611 -2.447709 -2.020857     -1.579022       -1.522362
2615  1.007740  0.928354  0.848442      1.390405        1.415417

      Viscera weight  Shell weight       Age
668         0.569396      0.690940  0.953617
1580       -0.343004     -0.325685 -0.606915
3784        1.764639      0.565209  0.329404
```

```
463         -1.538247     -1.572219 -1.543234
2615         1.778325      0.996287  0.641511
```

```
Y_train.head()
```

```
4149    1
315     1
1604    2
926     1
3077    2
Name: Sex, dtype: int32
```

```
Y_test.head()
```

```
668     2
1580    1
3784    2
463     1
2615    2
Name: Sex, dtype: int32
```

Train the model

```
model = RandomForestClassifier(n_estimators=10,criterion='entropy')
```

```
model.fit(X_Train,Y_Train)
```

```
RandomForestClassifier(criterion='entropy', n_estimators=10)
```

```
y_predict = model.predict(X_test)
```

Error matrix

```
accuracy_score(Y_test,y_predict)
```

```
0.8085208233604595
```

```
pd.crosstab(Y_test,y_predict)
```

```
col_0    0    1    2
Sex
0      521   23  108
1       39  613   41
2      121   68  555
```

```
print(classification_report(Y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.77      0.80      0.78       652
           1       0.87      0.88      0.88       693
           2       0.79      0.75      0.77       744
```

accuracy			0.81	2089
macro avg	0.81	0.81	0.81	2089
weighted avg	0.81	0.81	0.81	2089