

ASSIGNMENT-3 ABALONE AGE PREDICTION

Assignment Date	21 /10/2022
Student Name	Malini S
Student Roll Number	61771921029
Maximum Marks	2 Marks

Description:- Predicting the age of abalone from physical measurements. The age of abalone is determined by cutting the shell through the cone, staining it, and counting the number of rings through a microscope -- a boring and time-consuming task. Other measurements, which are easier to obtain, are used to predict age. Further information, such as weather patterns and location (hence food availability) may be required to solve the problem.

Task-1

Download and Load Dataset

Download the data set:

[abalone.csv](#)

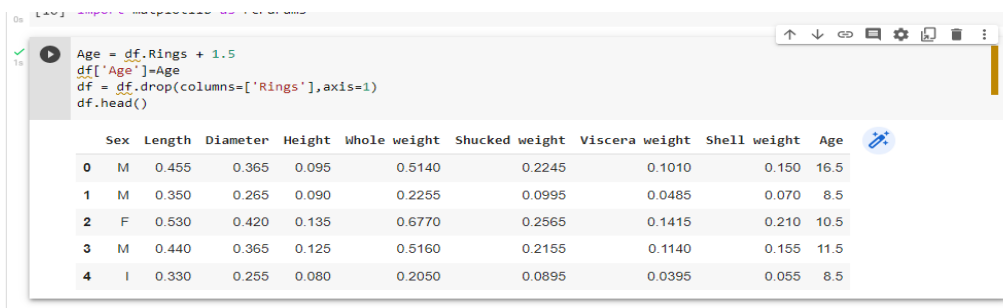
Task-2:

Load the Dataset:

Solution:

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

df=pd.read_csv('abalone.csv')df.head()
```



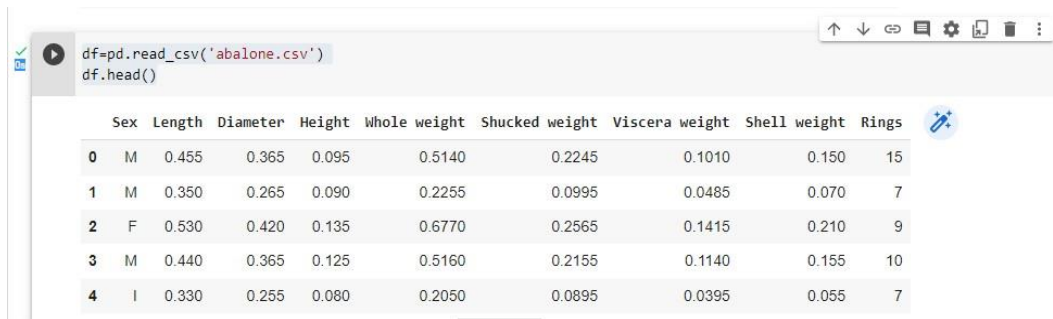
```
Age = df.Rings + 1.5
df['Age']=Age
df = df.drop(columns=['Rings'],axis=1)
df.head()
```

	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Age
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	16.5
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	8.5
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	10.5
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	11.5
4	I	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	8.5

ASSIGNMENT-3

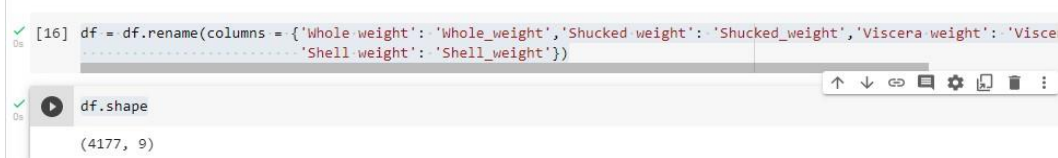
DATA VISUALIZATION AND PREPROCESSING

```
df=pd.read_csv('abalone.csv')  
df.head()
```



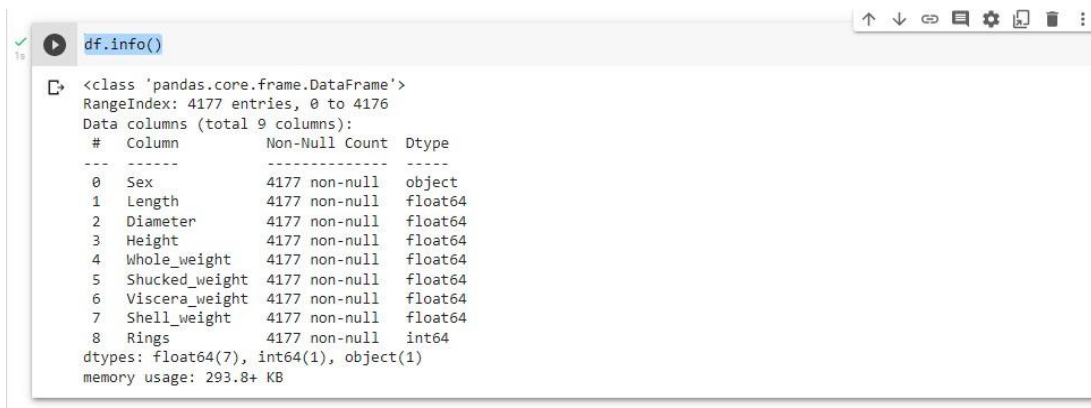
	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330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

```
df = df.rename(columns = {'Whole weight': 'Whole_weight','Shucked weight':  
'Shucked_weight','Viscera weight': 'Viscera_weight','Shell weight':  
'Shell_weight'})  
df.shape
```



```
[16] df = df.rename(columns = {'Whole weight': 'Whole_weight', 'Shucked weight': 'Shucked_weight', 'Viscera weight': 'Viscera_weight', 'Shell weight': 'Shell_weight'})  
df.shape  
(4177, 9)
```

```
df.info()
```



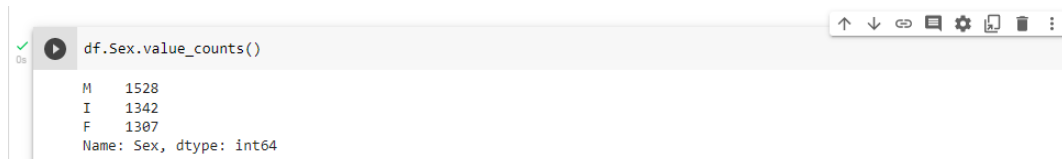
```
df.info()  
<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 4177 entries, 0 to 4176  
Data columns (total 9 columns):  
#   Column          Non-Null Count  Dtype    
---  ---            
0   Sex             4177 non-null   object   
1   Length          4177 non-null   float64  
2   Diameter        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
```

```
df.Sex.unique()
```



```
[21] df.Sex.unique()  
array(['M', 'F', 'I'], dtype=object)
```

```
df.Sex.value_counts()
```



```
df.Sex.value_counts()  
M    1528  
I    1342  
F    1307  
Name: Sex, dtype: int64
```

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ABALONE AGE PREDICTION

Task-3:

3. Perform Below Visualizations.

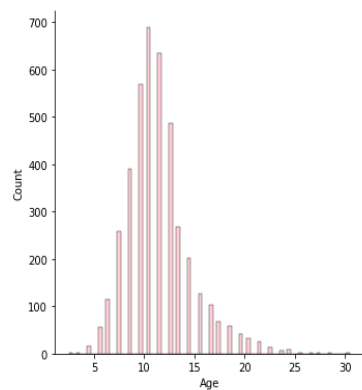
- Univariate Analysis
- Bi - Variate Analysis
- Multi - Variate Analysis

Univariate Analysis:

SOLUTION:

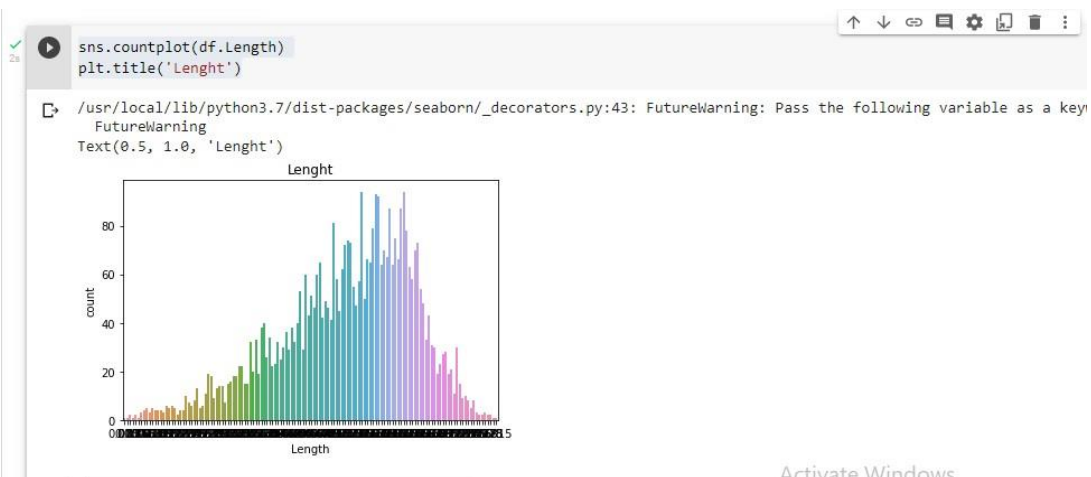
```
sns.displot(df.Age,color='Pink')
```

<seaborn.axisgrid.FacetGrid at 0x7f1974763310>



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```
sns.countplot(df.Length)  
plt.title('Lenght')
```

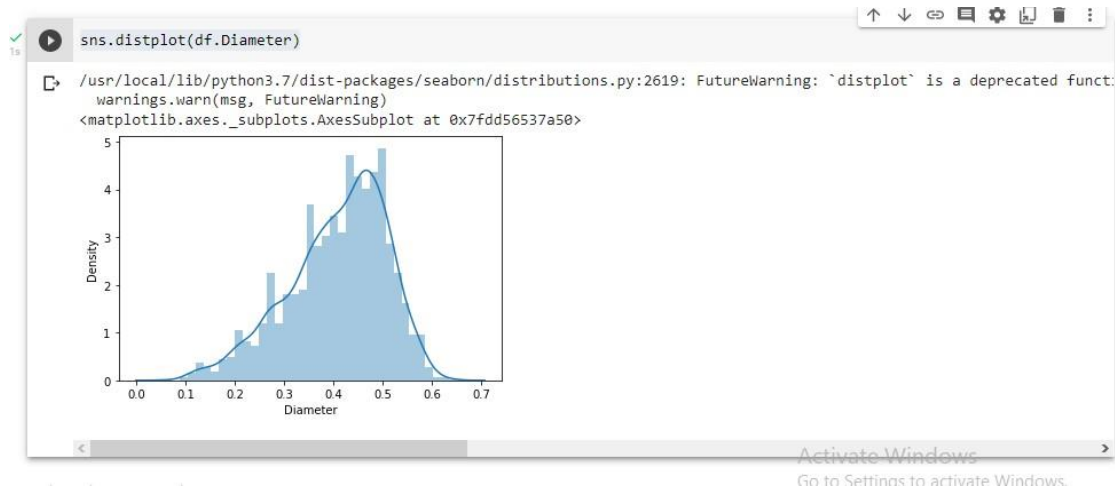


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DATA VISUALIZATION AND PREPROCESSING

```
sns.distplot(df.Diameter)
```



Bi-Variate Analysis:

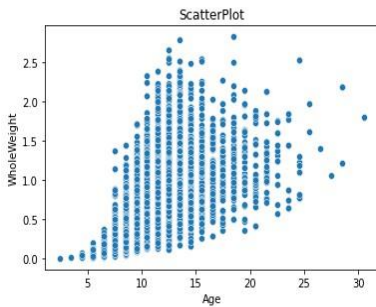
```
sns.scatterplot(df.Age,df.Whole_weight)  
plt.xlabel('Age')  
plt.ylabel('WholeWeight')  
plt.title('ScatterPlot')
```

```
sns.scatterplot(df.Age,df.Whole_weight)  
plt.xlabel('Age')  
plt.ylabel('WholeWeight')  
plt.title('ScatterPlot')
```

`/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.`

`FutureWarning`

`Text(0.5, 1.0, 'ScatterPlot')`



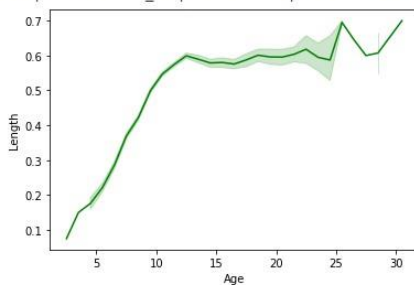
```
sns.lineplot(df.Age,df.Length,color='Green')
```

```
[ ] sns.lineplot(df.Age,df.Length,color='Green')
```

`/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.`

`FutureWarning`

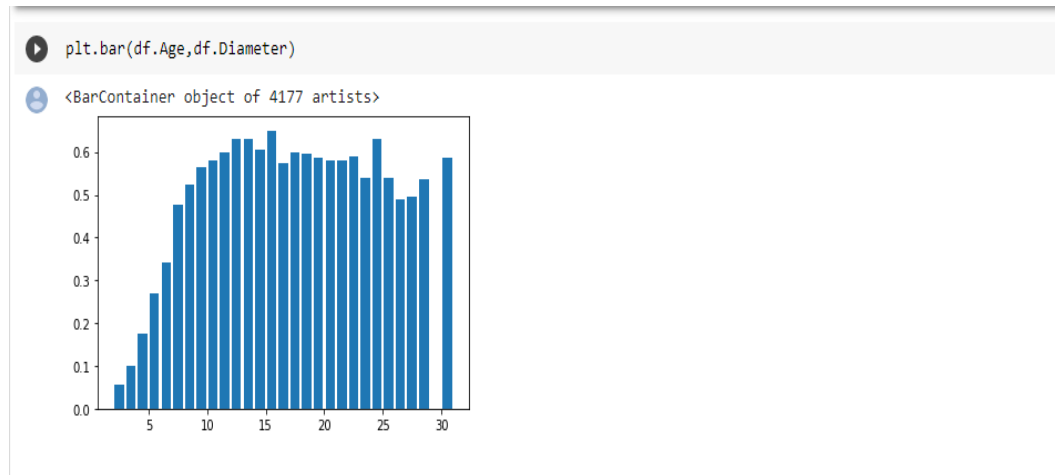
`<matplotlib.axes._subplots.AxesSubplot at 0x7f347d618250>`



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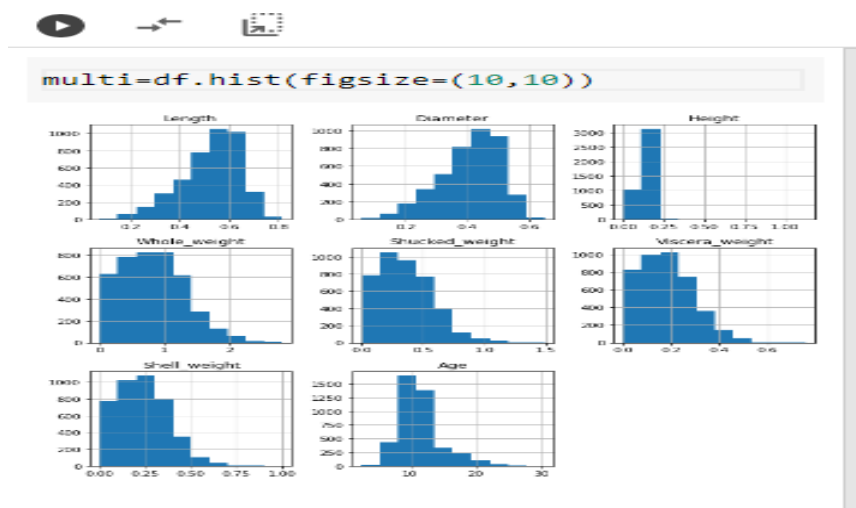
ABALONE AGE PREDICTION

```
plt.bar(df.Age,df.Diameter)
```



Multi-Variate Analysis:

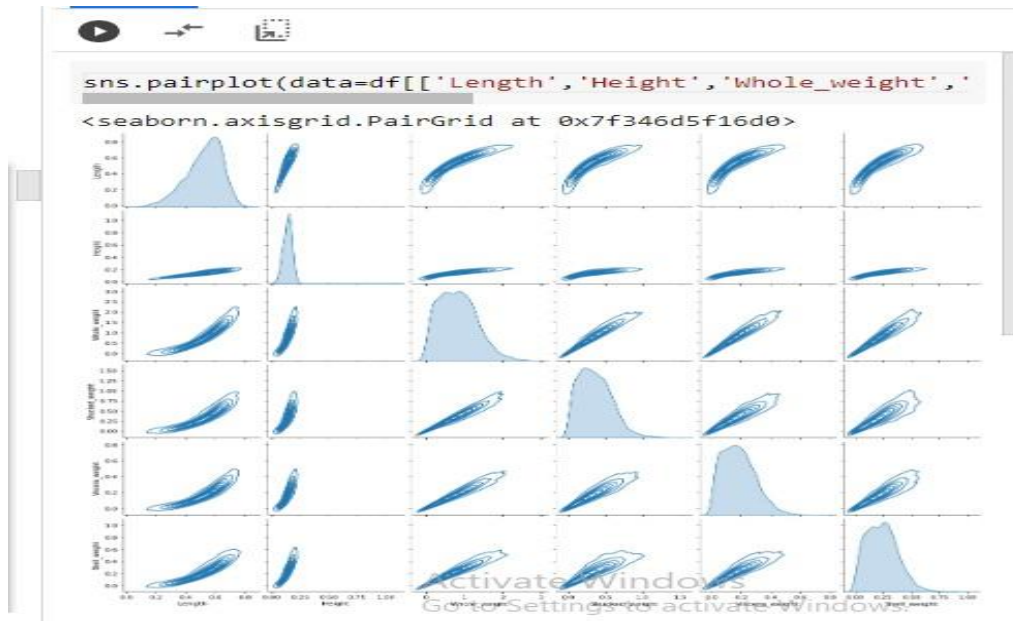
```
multi=df.hist(figsize=(10,10))
```



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DATA VISUALIZATION AND PREPROCESSING

```
sns.pairplot(data=df[['Length','Height','Whole_weight','Shucked_weight','Viscera_weight',  
'Shell_weight']],kind='kde')
```



```
sns.pairplot(df,hue='Age',diag_kind='scatter')
```



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DATA VISUALIZATION AND PREPROCESSING

Descriptive statistics

`df.describe()`

```
df.describe()
```

	Length	Diameter	Height	Whole_weight	Shucked_weight	Viscera_weight	Shell_weight	Age
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	11.433684
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	2.500000
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130000	9.500000
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234000	10.500000
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	0.329000	12.500000
max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000	1.005000	30.500000

Handle missing data

`df.isnull().any()` #no missing data

```
df.isnull().any() #no missing data
```

Sex	False
Length	False
Diameter	False
Height	False
Whole_weight	False
Shucked_weight	False
Viscera_weight	False
Shell_weight	False
Age	False
dtype:	bool

Outliers Replacement

`sns.boxplot(df.Age)`



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DATA VISUALIZATION AND PREPROCESSING

```
In [ ]: q1=df.Age.quantile(0.25)
        q3=df.Age.quantile(0.75)

In [ ]: IQR = q3-q1

In [ ]: upper_limit=q3 + 1.5 * IQR
        lower_limit=q1 - 1.5 * IQR

In [ ]: upper_limit,lower_limit

Out[ ]: (17.0, 5.0)

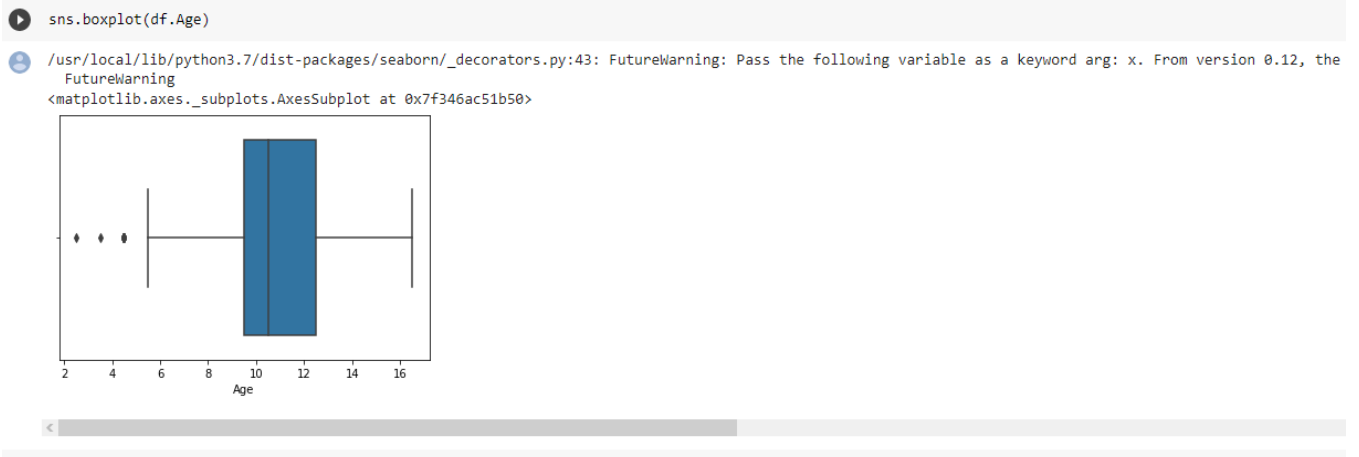
In [ ]: df.Age.median()

Out[ ]: 10.5

In [ ]: df.Age=np.where(df.Age>upper_limit,10.5,df.Age) #Median=10.5

In [ ]: sns.boxplot(df.Age)
```

sns.boxplot(df.Age)



df.Age=np.where(df.Age<lower_limit,10.5,df.Age) #Median=10.5



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DATA VISUALIZATION AND PREPROCESSING

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df.Sex=le.fit_transform(df.Sex)
df.head()
```

df.head()

	Sex	Length	Diameter	Height	Whole_weight	Shucked_weight	Viscera_weight	Shell_weight	Age
0	2	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	16.5
1	2	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	8.5
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	10.5
3	2	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	11.5
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	8.5

Split the data into dependent and independent variables

```
y=df['Age']
y
```

#y - target columns
#X - predicting columns

```
[ ] y=df['Age']
y
```

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

```
X=df.drop(columns=['Age'],axis=1)
X.head()
```

X=df.drop(columns=['Age'],axis=1)
X.head()

	Sex	Length	Diameter	Height	Whole_weight	Shucked_weight	Viscera_weight	Shell_weight
0	2	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150
1	2	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070
2	0	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210
3	2	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155
4	1	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055

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DATA VISUALIZATION AND PREPROCESSING

Scale the independent variables

```
from sklearn.preprocessing import scale
df2=pd.DataFrame(scale(X),columns=X.columns)
df2.head()
```

```
[ ] from sklearn.preprocessing import scale

df2=pd.DataFrame(scale(X),columns=X.columns)
df2.head()
```

	Sex	Length	Diameter	Height	Whole_weight	Shucked_weight	Viscera_weight	Shell_weight
0	1.151980	-0.574558	-0.432149	-1.064424	-0.641898	-0.607685	-0.726212	-0.638217
1	1.151980	-1.448986	-1.439929	-1.183978	-1.230277	-1.170910	-1.205221	-1.212987
2	-1.280690	0.050033	0.122130	-0.107991	-0.309469	-0.463500	-0.356690	-0.207139
3	1.151980	-0.699476	-0.432149	-0.347099	-0.637819	-0.648238	-0.607600	-0.602294
4	-0.064355	-1.615544	-1.540707	-1.423087	-1.272086	-1.215968	-1.287337	-1.320757

Split the data data into training and testing

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(df2,y,test_size=0.3,random_state=1)
X_train.shape,X_test.shape
```

```
y_train.shape,y_test.shape

((2923,), (1254,))
```

Build the model

```
from sklearn.linear_model import LinearRegression
lr=LinearRegression() #Linear Regression Model
from sklearn.linear_model import Ridge
r=Ridge() #Ridge Regression Model
from sklearn.linear_model import Lasso
l=Lasso() #Lasso Regression Model
```

```
[2] from sklearn.linear_model import LinearRegression
lr=LinearRegression() #Linear Regression Model

[4] from sklearn.linear_model import Ridge
r=Ridge() #Ridge Regression Model

[1] from sklearn.linear_model import Lasso
l=Lasso() #Lasso Regression Model
```

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DATA VISUALIZATION AND PREPROCESSING

Train the model

```
lr.fit(X_train,y_train) #Training lr model
pred1_train=lr.predict(X_train)
pred1_train
r.fit(X_train,y_train) #Training r model
pred2_train=r.predict(X_train)
pred2_train
l.fit(X_train,y_train) #Training l model
```

```
[ ] lr.fit(X_train,y_train) #Training lr model
LinearRegression()

[ ] pred1_train=lr.predict(X_train)
pred1_train

array([11.37532295, 10.8623978 , 10.98473747, ...,  8.47235413,
       10.0771839 ,  8.2997195 ])
```

```
[ ] r.fit(X_train,y_train) #Training r model
Ridge()

[ ] pred2_train=r.predict(X_train)
pred2_train

array([11.37024121, 10.86610153, 10.98923414, ...,  8.47158189,
       10.08029538,  8.29939996])

[ ] l.fit(X_train,y_train) #Training l model
Lasso()
```

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```
pred3_train=l.predict(X_train)
pred3_train
```

```
▶ pred3_train=l.predict(X_train)
pred3_train

⬅ array([10.90661081, 10.94589013, 10.96552979, ..., 10.19958302,
        10.86733149, 10.14066404])
```

↑ ↓ ↻ 🗨 ✎ 📄

Test the model

y_test

```
▶ y_test

⬅
17      11.5
1131     9.5
299     10.5
1338    11.5
2383    10.5
...
802     10.5
3016     8.5
2886     9.5
2500     9.5
2814     5.5
Name: Age, Length: 1254, dtype: float64
```

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DATA VISUALIZATION AND PREPROCESSING

```
pred1=lr.predict(X_test)
pred1
pred2=r.predict(X_test)
pred2
pred3=l.predict(X_test)
pred3
```

```
▶ pred1=lr.predict(X_test)
pred1 #Testing data using linear regression model
```

```
array([ 9.82570208, 10.03404396,  9.28563548, ..., 10.0965599 ,
        10.66920195,  7.77742412])
```

```
[ ] pred2=r.predict(X_test)
pred2 #Testing data using ridge model
```

```
array([ 9.82297354, 10.04038957,  9.28565669, ..., 10.10174311,
        10.66576784,  7.77789848])
```

```
[ ] pred3=l.predict(X_test)
pred3 #Testing data using lasso model
```

```
array([10.59237624, 10.96552979, 10.35670031, ..., 10.69057454,
        10.92625047, 10.04246574])
```

```
age_pred = pd.DataFrame({'Actual_value':y_test,'Predicted_value_using_lr':pred1,'Predicted_value_using_r':pred2,'Predicted_value_using_l':pred3})
age_pred.head()
```

```
[ ] age_pred = pd.DataFrame({'Actual_value':y_test,'Predicted_value_using_lr':pred1,'Predicted_value_using_r':pred2,'Predicted_value_using_l':pred3})
age_pred.head()
```

	Actual_value	Predicted_value_using_lr	Predicted_value_using_r	Predicted_value_using_l
17	11.5	9.825702	9.822974	10.592376
1131	9.5	10.034044	10.040390	10.965530
299	10.5	9.285635	9.285657	10.356700
1338	11.5	11.109891	11.111671	11.044088
2383	10.5	10.901944	10.905969	10.788773

Measure the performance using metrics

```
from sklearn import metrics
#R2-square
#Testing accuracy of linear regression, ridge, lasso
print(metrics.r2_score(y_test,pred1))
print(metrics.r2_score(y_test,pred2))
print(metrics.r2_score(y_test,pred3))
```

```
[ ] from sklearn import metrics
```

```
▶ #R2-square
#Testing accuracy of linear regression, ridge, lasso
```

```
print(metrics.r2_score(y_test,pred1))
print(metrics.r2_score(y_test,pred2))
print(metrics.r2_score(y_test,pred3))
```

```
0.4162940378151394
0.41640627795250973
0.17272068414915298
```

ASSIGNMENT-3

DATA VISUALIZATION AND PREPROCESSING

#R2-square

#Training accuracy of linear regression, ridge, lasso

```
print(metrics.r2_score(y_train,pred1_train))
```

```
print(metrics.r2_score(y_train,pred2_train))
```

```
print(metrics.r2_score(y_train,pred3_train))
```

```
#R2-square
#Training accuracy of linear regression, ridge, lasso

print(metrics.r2_score(y_train,pred1_train))
print(metrics.r2_score(y_train,pred2_train))
print(metrics.r2_score(y_train,pred3_train))
```

```
0.40173116413670873
0.40172280022100826
0.17472314547809642
```

MSE(Mean square error)

Testing accuracy of linear regression, ridge, lasso

```
print(metrics.mean_squared_error(y_test,pred1))
```

```
print(metrics.mean_squared_error(y_test,pred2))
```

```
print(metrics.mean_squared_error(y_test,pred3))
```

```
## MSE(Mean square error)
#Testing accuracy of linear regression, ridge, lasso

print(metrics.mean_squared_error(y_test,pred1))
print(metrics.mean_squared_error(y_test,pred2))
print(metrics.mean_squared_error(y_test,pred3))
```

```
3.066910254318059
3.0663205217291396
4.346694365552255
```

RMSE

#Testing accuracy of linear regression, ridge, lasso

```
print(np.sqrt(metrics.mean_squared_error(y_test,pred1)))
```

```
print(np.sqrt(metrics.mean_squared_error(y_test,pred2)))
```

```
print(np.sqrt(metrics.mean_squared_error(y_test,pred3)))
```

```
## RMSE
#Testing accuracy of linear regression, ridge, lasso

print(np.sqrt(metrics.mean_squared_error(y_test,pred1)))
print(np.sqrt(metrics.mean_squared_error(y_test,pred2)))
print(np.sqrt(metrics.mean_squared_error(y_test,pred3)))
```

```
1.751259619336339
1.7510912374085879
2.084872745649541
```

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DATA VISUALIZATION AND PREPROCESSING