ASSIGNMENT-3

# ABALONE AGE PREDICTION

| | |
|---|---|
| Assignment Date | 21 /10/2022 |
| Student Name | Malini S |
| Student Roll Number | 61771921027 |
| 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 |

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DATA VISUALIZATION AND PREPROCESSING

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

```
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': 'Visce
                             '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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**Task-3:**

## 3. Perform Below Visualizations.

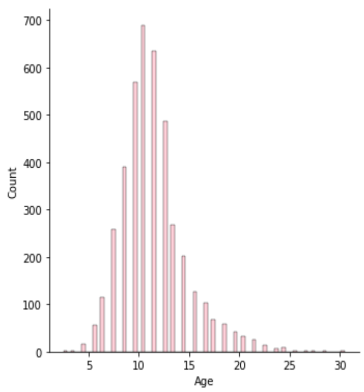
- Univariate Analysis
- Bi - Variate Analysis
- Multi - Variate Analysis

**Univariate Analysis:**

**SOLUTION:**

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

```
<seaborn.axisgrid.FacetGrid at 0x7f1974763310>
```

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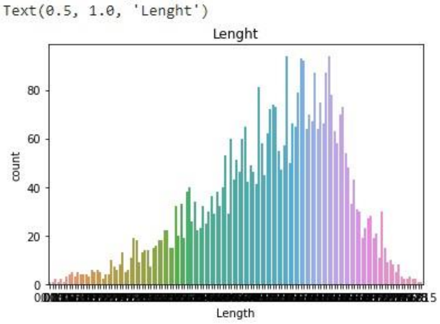
sns.countplot(df.Length)
plt.title('Lenght')

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

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a key
  FutureWarning
Text(0.5, 1.0, 'Lenght')
```

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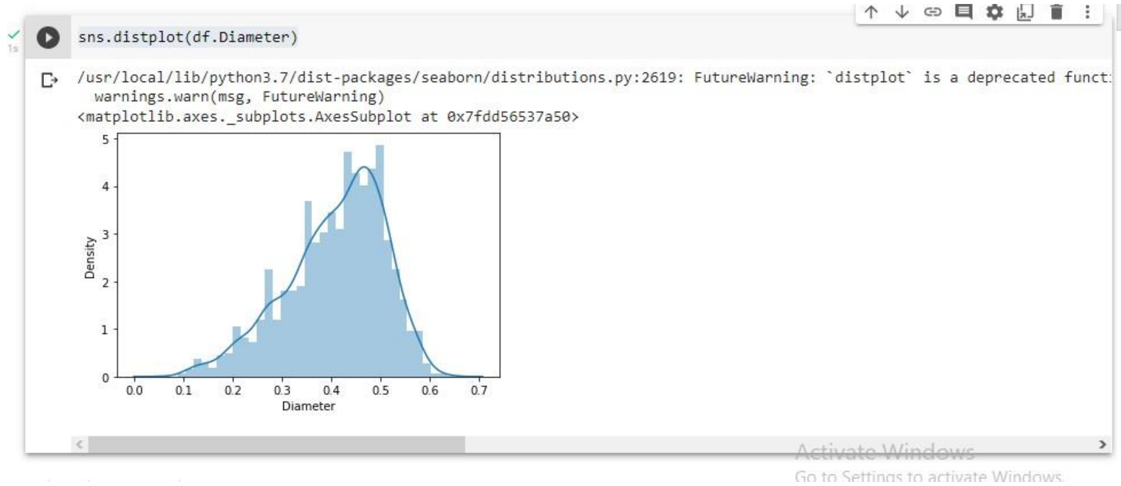
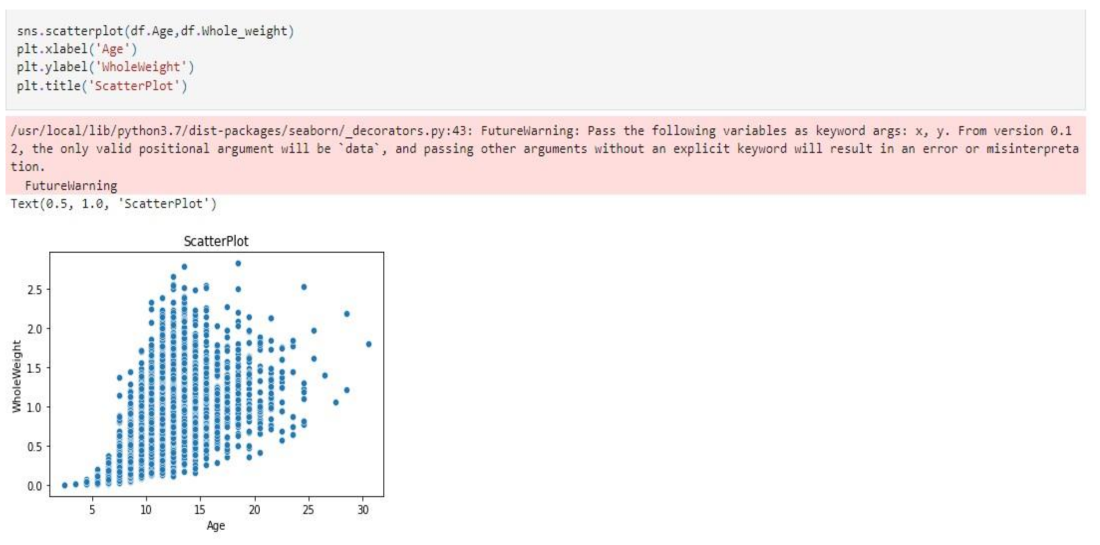
sns.distplot(df.Diameter)

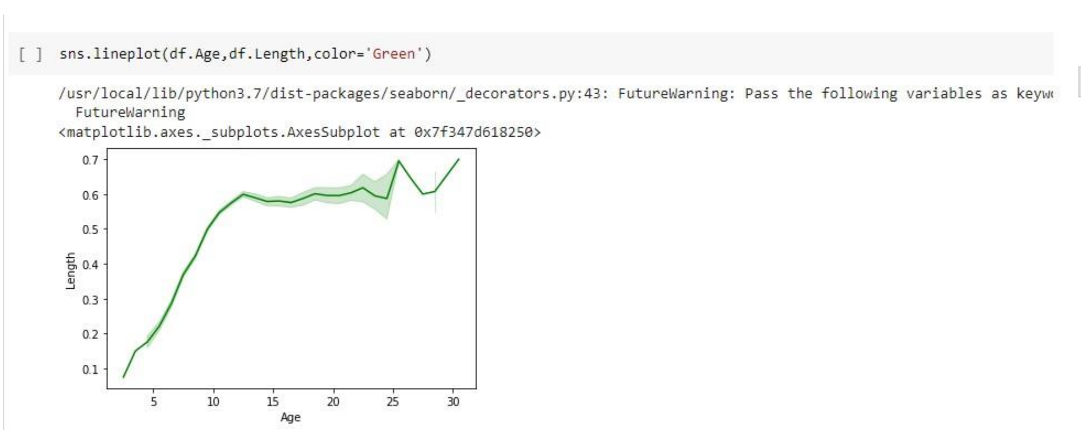



# Bi-Variate Analysis:

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




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



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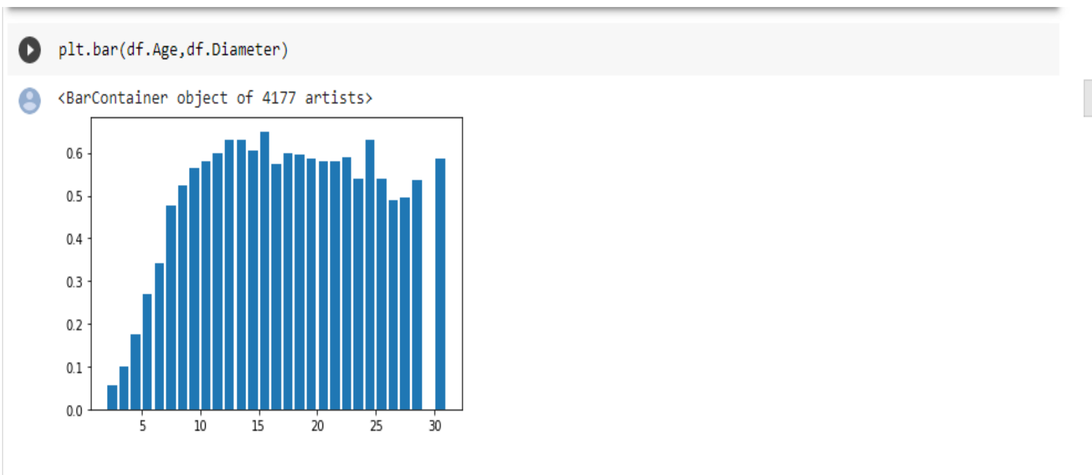
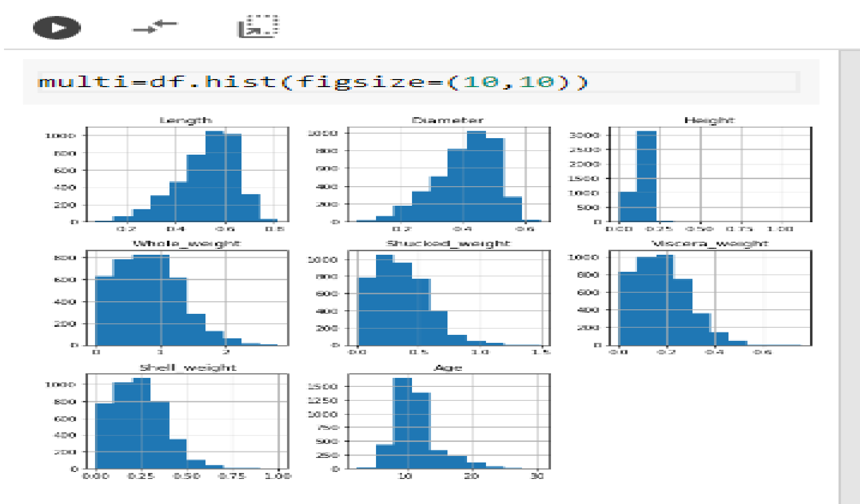
plt.bar(df.Age,df.Diameter)




## Multi-Variate Analysis:

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



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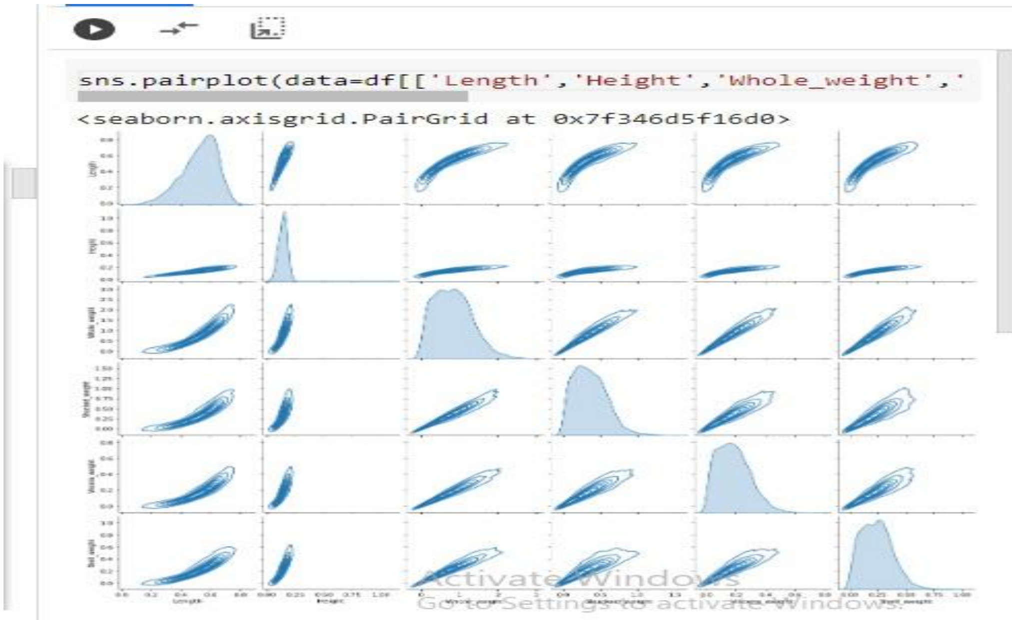
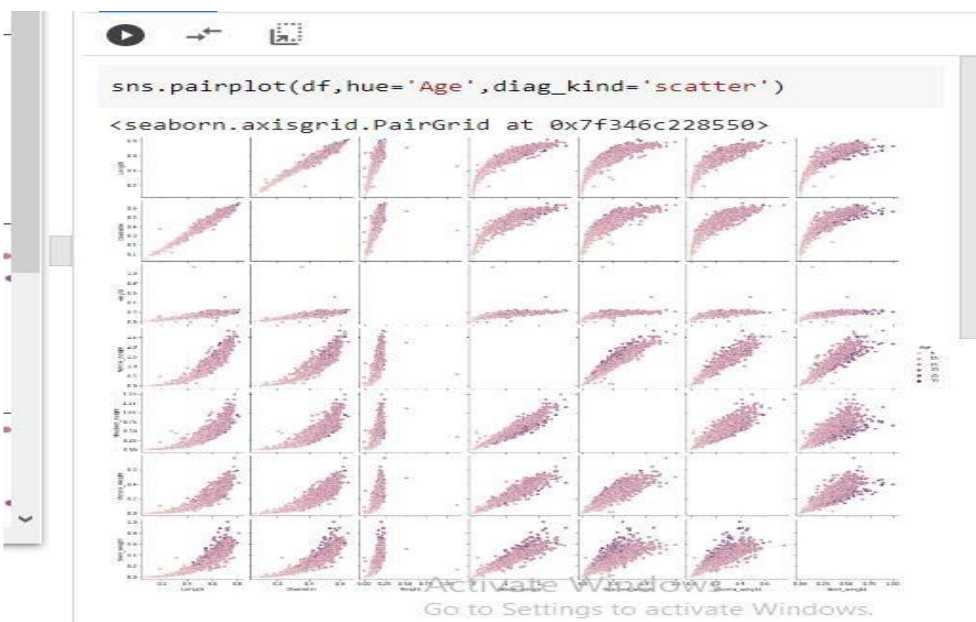
sns.pairplot(data=df[['Length','Height','Whole_weight','Shucked_weight','Viscera_weight',
'Shell_weight']],kind='kde')




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



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# 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

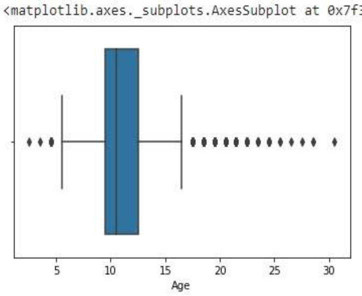
df.isnull().any()    #no missing data

```
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)

```
sns.boxplot(df.Age)

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f346ad34710>
```

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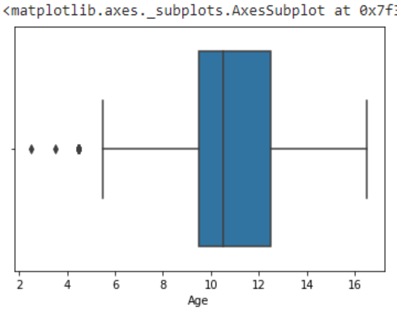
```
In [ ]: q1=df.Age.quantile(0.25)
        q3=df.Age.quantile(0.75)

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)
```

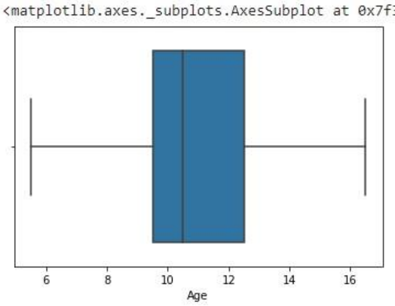
sns.boxplot(df.Age)

```
sns.boxplot(df.Age)

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f346ac51b50>
```




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

```
sns.boxplot(df.Age)

/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f346ac3ad50>
```

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```
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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## 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
```

# 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
2580     9.5
2814     5.5
Name: Age, Length: 1254, dtype: float64
```

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
```

#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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