ASSIGNMENT - 4

Assignment Date	17 October 2022
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Student Roll Number	210519205034
Maximum Marks	2 Marks

Questions:

Problem Statement: Abalone Age Prediction

Building a Regression Mode

1. Download the dataset: Dataset
2. Load the dataset into the tool.
3. Perform Below Visualizations. · Univariate Analysis · Bi-Variate Analysis Multi-Variate Analysis
4. Perform descriptive statistics on the dataset.
5. Check for Missing values and deal with them.
6. Find the outliers and replace them outliers
7. Check for Categorical columns and perform encoding.
8. Split the data into dependent and independent variables.
9. Scale the independent variables
10. Split the data into training and testing
11. Build the Model
12. Train the Model
13. Test the Model
14. Measure the performance using Metrics

In [ ]:
```python
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sb
```

In [ ]:
```python
ak=pd.read_csv("/content/abalone.csv")
```

In [ ]:
```python
ak.info
```

Out[32]:
```
<bound method DataFrame.info of      Sex  Length  Diameter  Height  Whole weigh
t  Shucked weight  \
0      M   0.455     0.365   0.095        0.5140          0.2245
1      M   0.350     0.265   0.090        0.2255          0.0995
2      F   0.530     0.420   0.135        0.6770          0.2565
3      M   0.440     0.365   0.125        0.5160          0.2155
4      I   0.330     0.255   0.080        0.2050          0.0895
...   ..     ...       ...     ...           ...             ...
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
0             0.1010        0.1500     15
1             0.0485        0.0700      7
2             0.1415        0.2100      9
3             0.1140        0.1550     10
4             0.0395        0.0550      7
...              ...           ...    ...
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

[4177 rows x 9 columns]>
```

In [ ]:
```python
ak.isnull().sum()
```

Out[33]:
```
Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
Viscera weight    0
Shell weight      0
Rings             0
dtype: int64
```

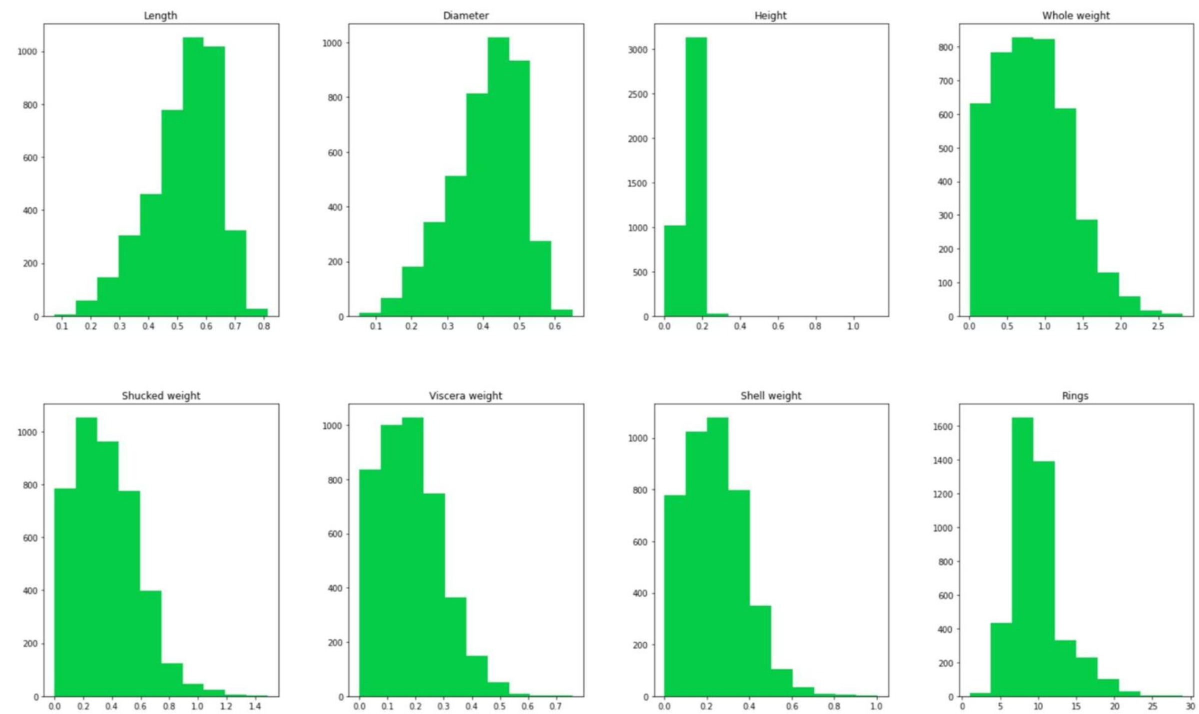
UNI-VARIATE ANALYSIS

In [ ]:

```
ak.hist(figsize=(25,15),grid=False , color="#05cc46" , layout=(2,4))
```

Out[34]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f98071de550>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f98072cc1d0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f98070ce510>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f9807084b10>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f9807046150>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f980707d750>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f9807034dd0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f9806ff8350>]],
      dtype=object)
```



In [ ]:

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

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarn
ing: `np.object` is a deprecated alias for the builtin `object`. To silence thi
s warning, use `object` by itself. Doing this will not modify any behavior and
is safe.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devd
ocs/release/1.20.0-notes.html#deprecations (https://numpy.org/devdocs/release/
1.20.0-notes.html#deprecations)
```

In [ ]:
```
print(numerical_features)
categorical_features
```

```
Index(['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight',
       'Viscera weight', 'Shell weight', 'Rings'],
      dtype='object')
```

Out[36]:
```
Index(['Sex'], dtype='object')
```

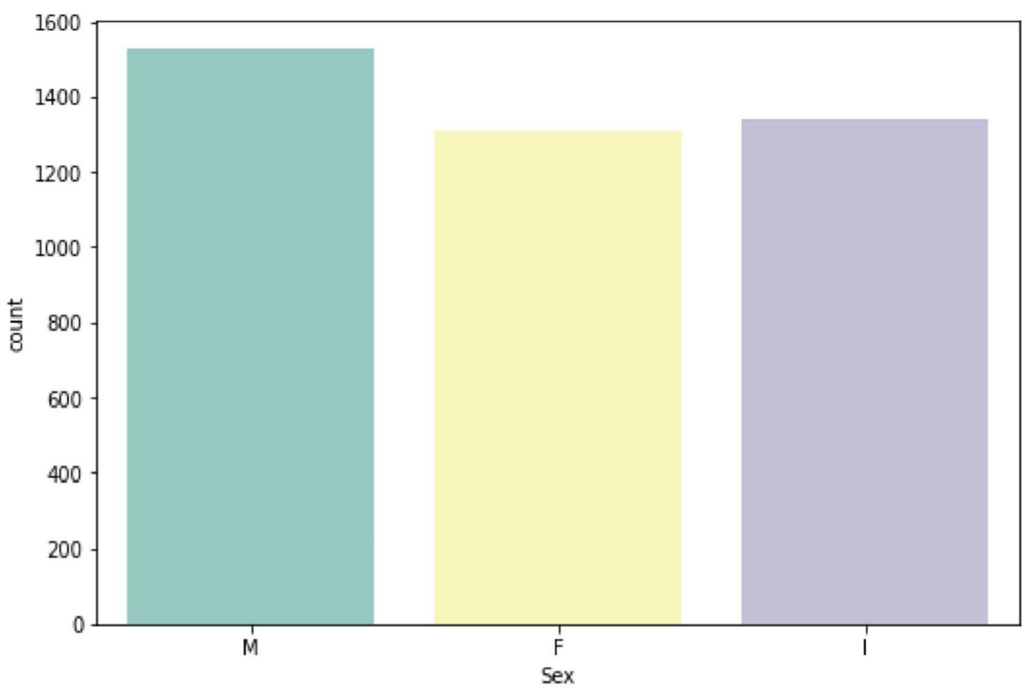
In [ ]:
```
ak['age']=ak['Rings']+1.5
```

In [ ]:
```
ak.age
```

Out[38]:
```
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
```

In [ ]:
```
sb.countplot(x="Sex" , data=ak , palette='Set3')
```

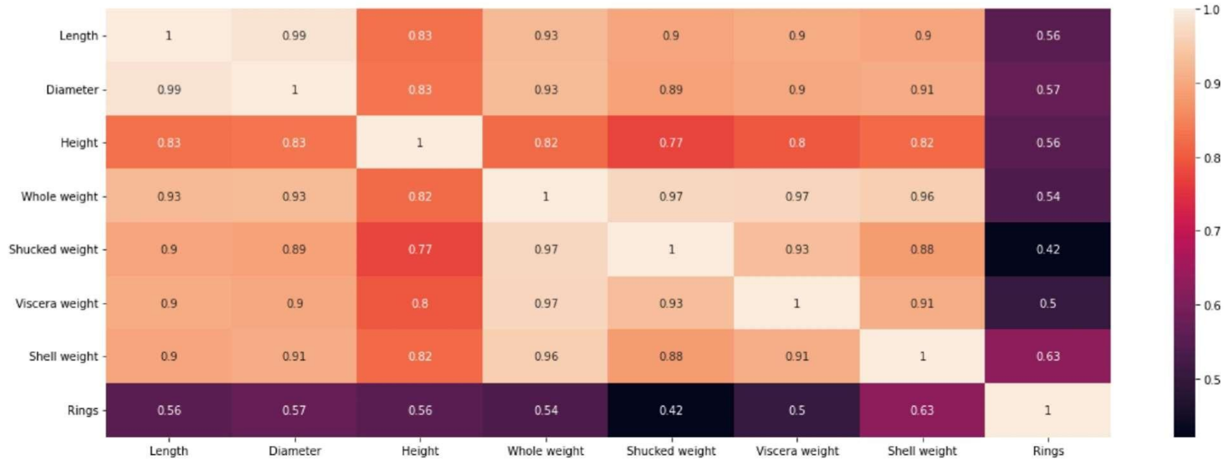
Out[39]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f9806cc67d0>
```



BI-VARIATE ANALYSIS

In [ ]:
```
plt.figure(figsize = (20,7))
sb.heatmap(ak[numerical_features].corr(),annot=True)
```

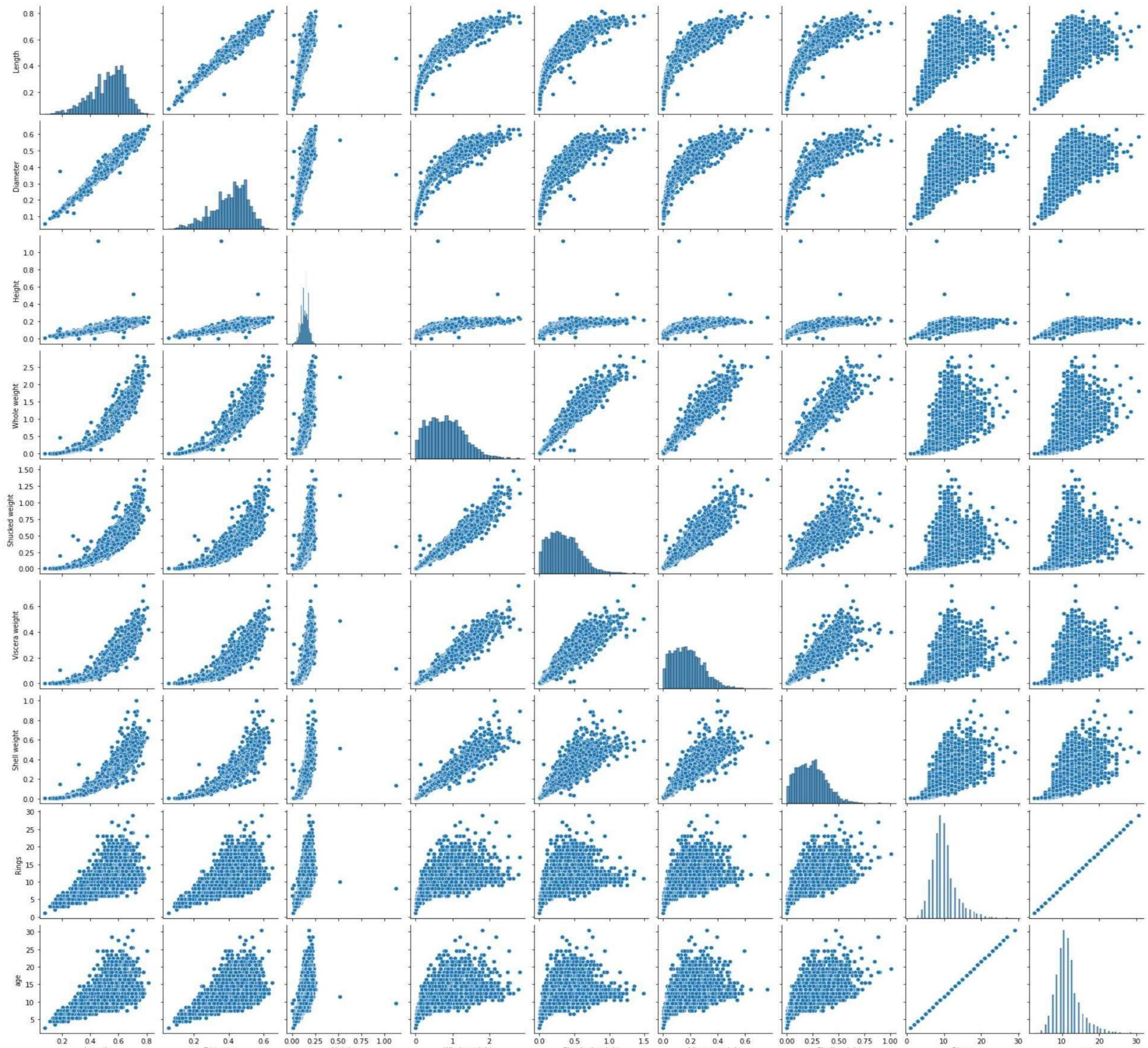
Out[40]: <matplotlib.axes._subplots.AxesSubplot at 0x7f98097d8e90>



MULTI-VARIAT ANALYSIS

In [ ]:
```
sb.pairplot(ak)
```

Out[41]: <seaborn.axisgrid.PairGrid at 0x7f98083d8c50>



Descriptive Statistics

In [ ]:
```
ak.describe
```

Out[42]:
```
<bound method NDFrame.describe of       Sex  Length  Diameter  Height  Whole wei
ght  Shucked weight  \
0       M   0.455     0.365   0.095       0.5140         0.2245
1       M   0.350     0.265   0.090       0.2255         0.0995
2       F   0.530     0.420   0.135       0.6770         0.2565
3       M   0.440     0.365   0.125       0.5160         0.2155
4       I   0.330     0.255   0.080       0.2050         0.0895
...    ..     ...       ...     ...          ...            ...
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   age
0             0.1010        0.1500     15  16.5
1             0.0485        0.0700      7   8.5
2             0.1415        0.2100      9  10.5
3             0.1140        0.1550     10  11.5
4             0.0395        0.0550      7   8.5
...              ...           ...    ...   ...
4172          0.2390        0.2490     11  12.5
4173          0.2145        0.2605     10  11.5
4174          0.2875        0.3080      9  10.5
4175          0.2610        0.2960     10  11.5
4176          0.3765        0.4950     12  13.5

[4177 rows x 10 columns]>
```

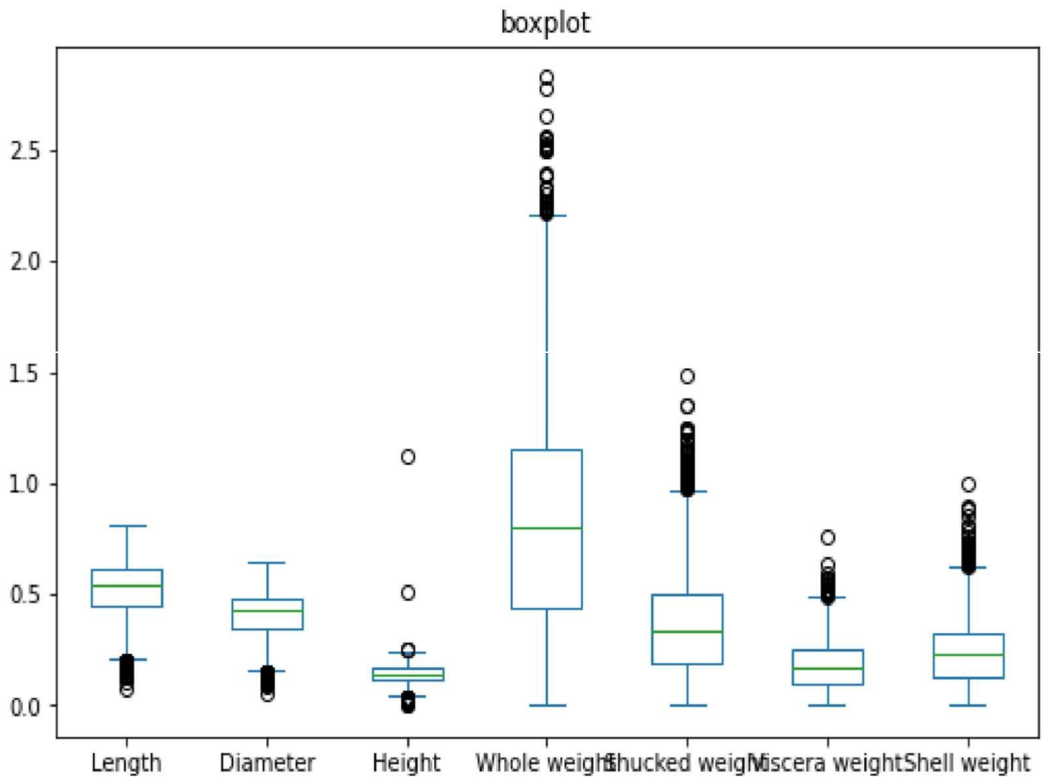
In [ ]:
```
Missing_Values=ak.isnull().sum()
```

In [ ]:
```
Missing_Values
```

Out[46]:
```
Sex               0
Length            0
Diameter          0
Height            0
Whole weight      0
Shucked weight    0
Viscera weight    0
Shell weight      0
Rings             0
age               0
dtype: int64
```

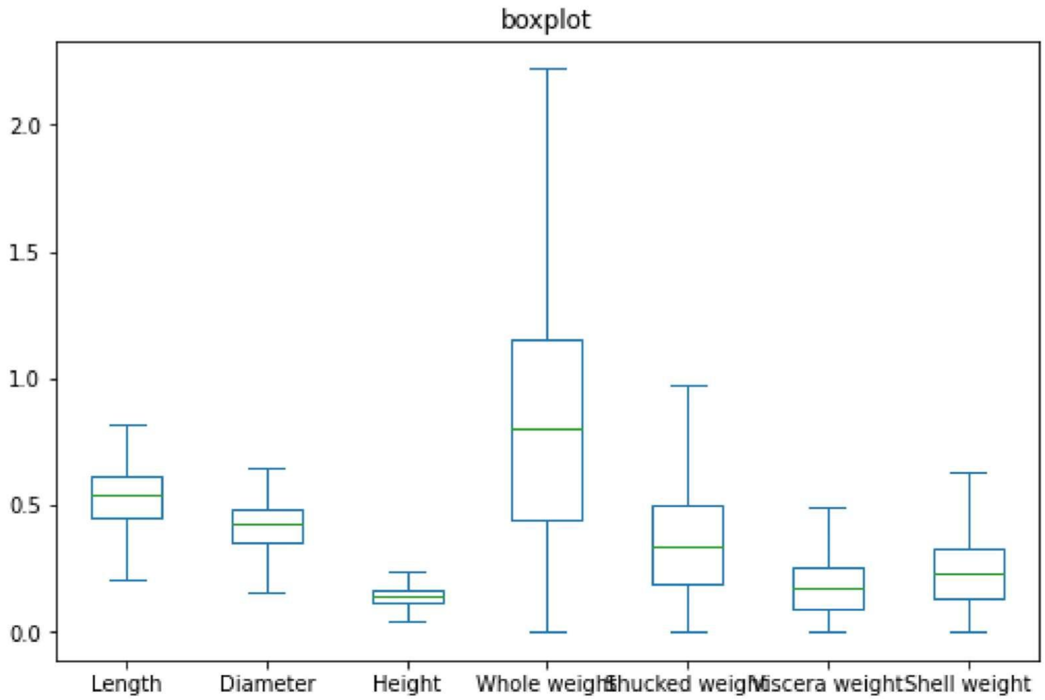
FINDING OUTLIERS AND REPLACING THEM

```
In [ ]: plt.rcParams['figure.figsize']=[8.50,5.50]
        ax = ak[['Length','Diameter','Height','Whole weight','Shucked weight','Viscera we
```




```
In [ ]: for i in range(1,8):
            Q1 = ak.iloc[:,i].quantile(0.25)
            Q3 = ak.iloc[:,i].quantile(0.75)
            IQR = Q3 - Q1
            whisker_width = 1.5
            lower_whisker = Q1 - (whisker_width*IQR)
            upper_whisker = Q3 + (whisker_width*IQR)
            ak.iloc[:,i] = np.where(ak.iloc[:,i]>upper_whisker,upper_whisker,np.where(ak.
```

In [ ]:
```
plt.rcParams["figure.figsize"] = [8.50, 5.50]
ay = ak[['Length','Diameter','Height','Whole weight','Shucked weight','Viscera we
```



Checking for Categorical columns and performing encoding

In [ ]:
```
cate_data = ak.select_dtypes(include=['object']).copy()
```

In [ ]:
```
from sklearn.preprocessing import LabelBinarizer

lb = LabelBinarizer()
lb_results = lb.fit_transform(cate_data['Sex'])
lb_results_df = pd.DataFrame(lb_results, columns=lb.classes_)

print(lb_results_df.head())
```

```
   F  I  M
0  0  0  1
1  0  0  1
2  1  0  0
3  0  0  1
4  0  1  0
```

In [ ]:
```
result_df = pd.concat([cate_data, lb_results_df], axis=1)

print(result_df.head())
```

```
  Sex  F  I  M
0   M  0  0  1
1   M  0  0  1
2   F  1  0  0
3   M  0  0  1
4   I  0  1  0
```

Splitting into dependent and independent variables

In [ ]:
```
x=ak.iloc[:,1:2].values
x
```

Out[64]:
```
array([[0.455],
       [0.35 ],
       [0.53 ],
       ...,
       [0.6  ],
       [0.625],
       [0.71 ]])
```

In [ ]:
```
y=ak.age
y
```

Out[54]:
```
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
```

In [ ]:
```
x.shape
```

Out[55]:
```
(4177, 7)
```

In [ ]:
```
y.shape
```

Out[56]:
```
(4177,)
```

Scaling the independent variables

In [ ]:
```
print ("\n ORIGIONAL VALUES: \n\n", x,y)
```

```
 ORIGIONAL VALUES: 

 [[0.455]
 [0.35 ]
 [0.53 ]
 ...
 [0.6  ]
 [0.625]
 [0.71 ]] 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
```

In [ ]:
```
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:

 [[0.4122449 ]
 [0.24081633]
 [0.53469388]
 ...
 [0.64897959]
 [0.68979592]
 [0.82857143]]
```

SPLITING THE DATA

In [ ]:
```
X = ak.drop('age', axis = 1)
y = ak['age']
```

In [ ]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error,mean_squared_error,r2_score
x_train, x_test, y_train, y_test = train_test_split(new_y,x,test_size=0.2)
```

In [ ]:
```
x_train.shape,x_test.shape
```

Out[78]:
```
((3341, 1), (836, 1))
```

In [ ]:
```
y_train.shape,y_test.shape
```

Out[79]:
```
((3341, 1), (836, 1))
```

Building and training the model

In [ ]:
```
model=LinearRegression()
model.fit(x_train,y_train)
```

Out[80]:
```
LinearRegression()
```

Testing the model

In [ ]:
```
y_pred=model.predict(x_test)
```

Measure the performance using Metrics

In [ ]:
```
print('R Squared value:', r2_score(y_test,y_pred))
print('Mean Absolute Error:', mean_absolute_error(y_test,y_pred))
print('Mean Squared Error:', mean_squared_error(y_test,y_pred))
print('Root Mean Squared Error:', np.sqrt(mean_squared_error(y_test,y_pred)))
```

```
R Squared value: 1.0
Mean Absolute Error: 2.905039313836758e-17
Mean Squared Error: 2.853878008501086e-33
Root Mean Squared Error: 5.342169979045113e-17
```