

## Assignment - 4

### ABALONE AGE PREDICTION

Assignment Date	01 September 2022
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Student Roll Number	1902232
Maximum Marks	2 Marks

### Problem Statement: Abalone Age Prediction

**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

#### Attribute Information:

Given is the attribute name, attribute type, measurement unit, and a brief description. The number of rings is the value to predict: either as a continuous value or as a classification problem.

#### Name / Data Type / Measurement Unit / Description

- 1- Sex / nominal / -- / M, F, and I (infant)
- 2- Length / continuous / mm / Longest shell measurement
- 3- Diameter / continuous / mm / perpendicular to length
- 4- Height / continuous / mm / with meat in shell
- 5- Whole weight / continuous / grams / whole abalone
- 6- Shucked weight / continuous / grams / weight of meat
- 7- Viscera weight / continuous / grams / gut weight (after bleeding)
- 8- Shell weight / continuous / grams / after being dried
- 9- Rings / integer / -- / +1.5 gives the age in years

#### Building a Regression Model

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

### **CODING:**

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

```
from google.colab import files
upload=files.upload()
df = pd.read_csv('abalone.csv')
```

```
df.describe()
```

### **OUTPUT:**

Length Diameter      Height Whole weight Shucked weight Viscera weight Shell weight

Rings						
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	9.933684				
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	1.000000				
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500
	0.130000	8.000000				
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000
	0.234000	9.000000				
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000
	0.329000	11.000000				
max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000
	1.005000	29.000000				

The screenshot shows a Google Colab notebook titled 'assignment 4.ipynb'. The code in the notebook is as follows:

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

from google.colab import files
upload=files.upload()
df = pd.read_csv('abalone.csv')
```

Below the code, there is a message: "Choose Files No file chosen. Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable. Saving abalone.csv to abalone.csv".

The next cell shows the output of `df.describe()`, which is a summary statistics table for the 'abalone' dataset:

	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
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	9.933684
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	1.000000
25%	0.450000	0.350000	0.115000	0.441500	0.186000	0.093500	0.130000	8.000000
50%	0.545000	0.425000	0.140000	0.799500	0.336000	0.171000	0.234000	9.000000
75%	0.615000	0.480000	0.165000	1.153000	0.502000	0.253000	0.329000	11.000000
max	0.815000	0.650000	1.130000	2.825500	1.488000	0.760000	1.005000	29.000000

**CODING:**

```
df.head()
```

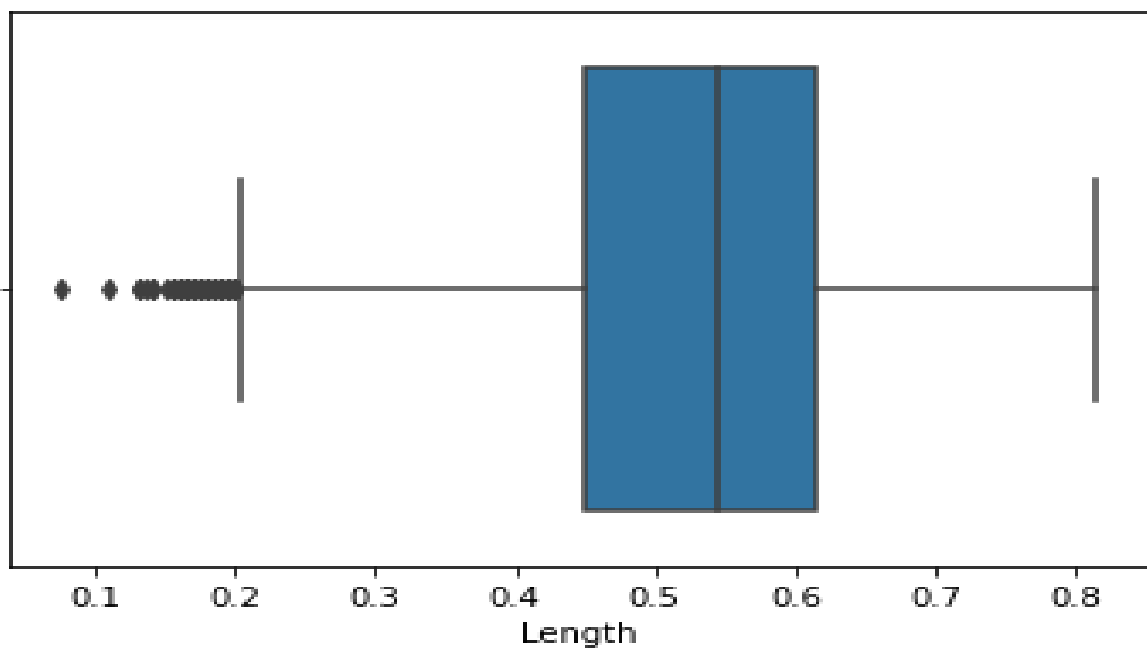
### OUTPUT:

	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

### CODING:

```
sns.boxplot(df.Length)
```

### OUTPUT:



IBM x GitHub - IBM-EPBL/IBM-EPBL x WhatsApp x DA-Assignment-4-Regression x DA\_Assignment\_3\_Python x assignment 4.ipynb - Colab x

colab.research.google.com/drive/1Q8b0DwieBR8r9j1qxROATow8Wk9OK4yg

assignment 4.ipynb ☆

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+ Code + Text Connect Editing

```
[ ] 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

```
sns.boxplot(df.Length)
```

/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 valid position

FutureWarning

<matplotlib.axes.\_subplots.AxesSubplot at 0x7fe84d2f8410>

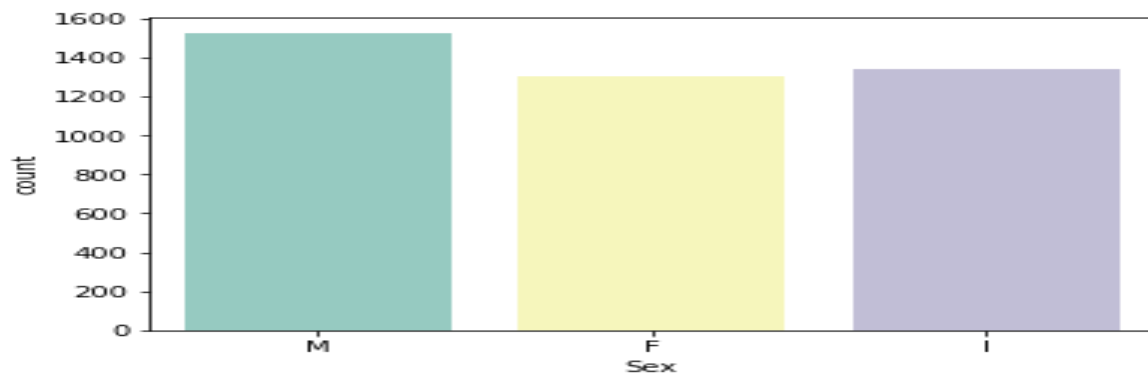
Assignment 3.ipynb assignment 4.ipynb DA-Assignment-4-Regression.pdf DA\_Assignment\_3\_Python.ipynb Show all

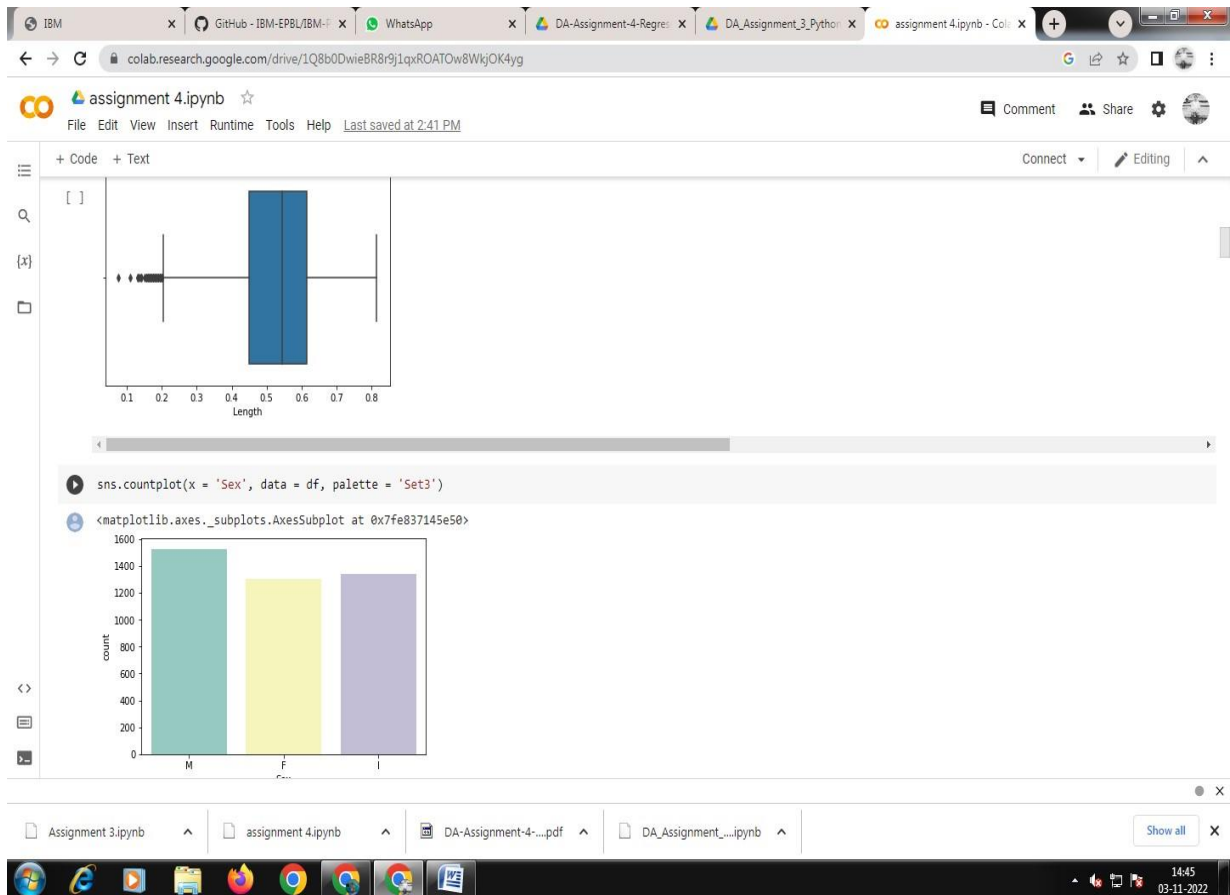
14:44 03-11-2022

## CODING:

```
sns.countplot(x = 'Sex', data = df, palette = 'Set3')
```

## OUTPUT:



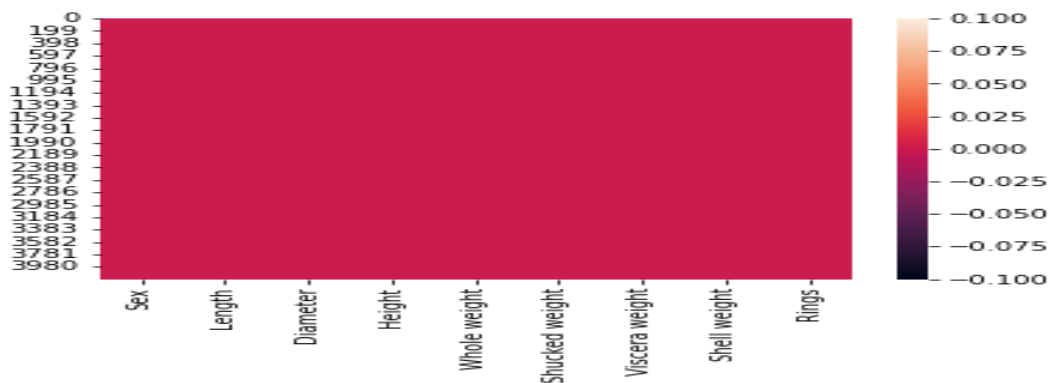


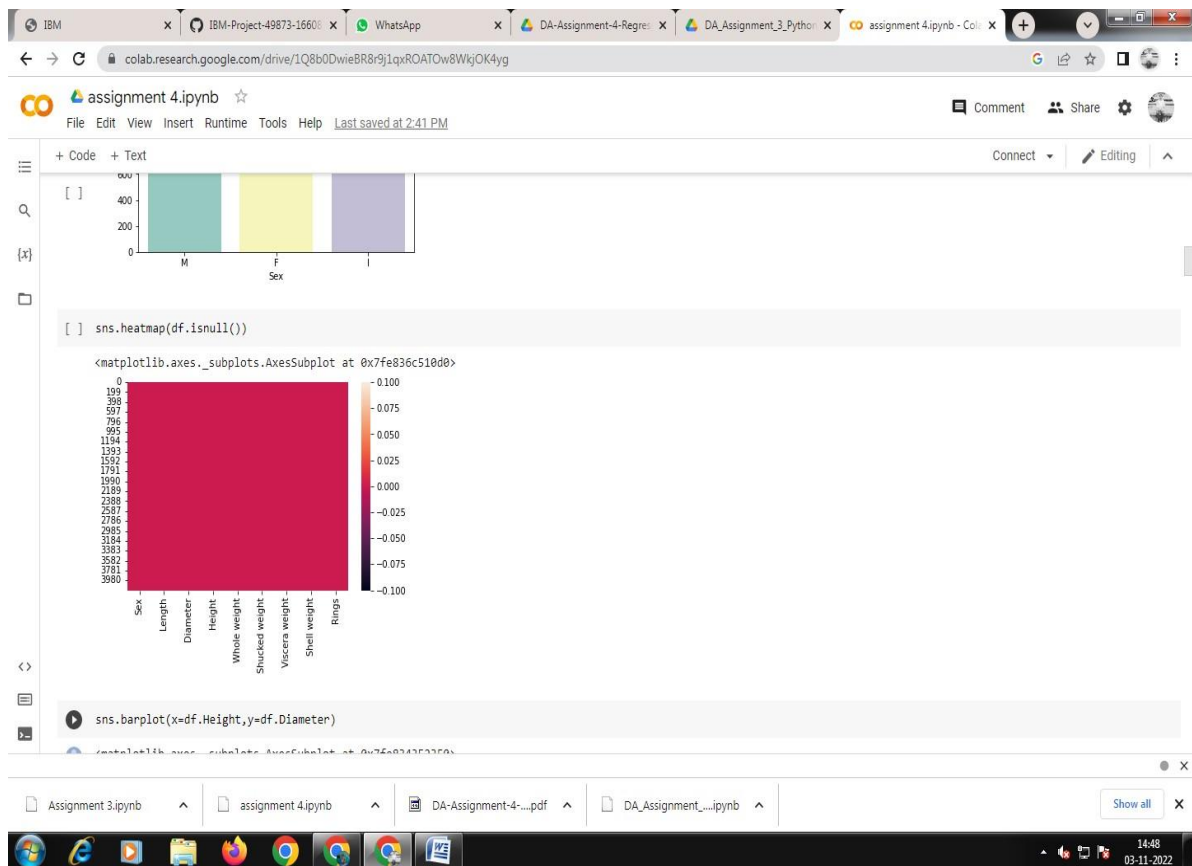
## CODING:

```
sns.heatmap(df.isnull())
```

## OUTPUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe836c510d0>
```



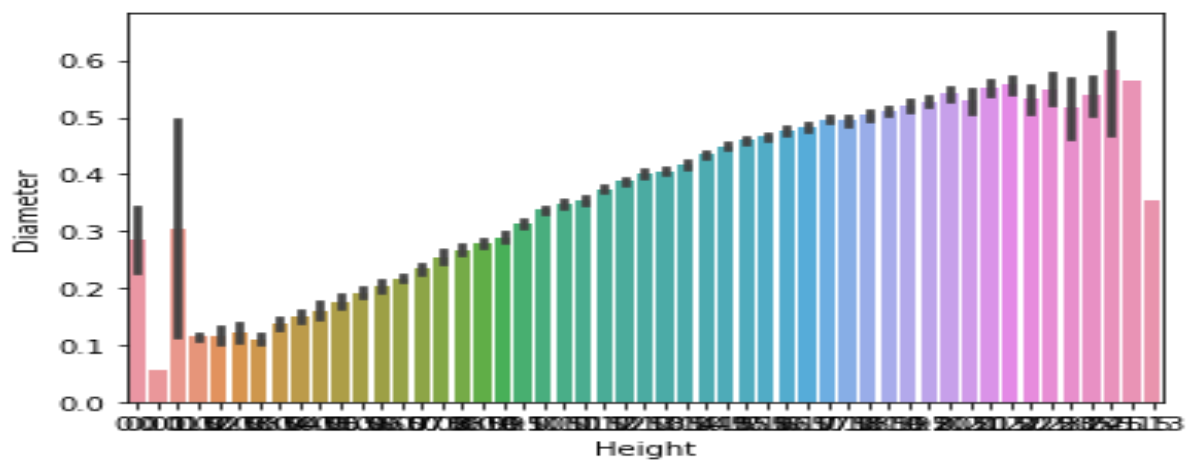


## CODING:

```
sns.barplot(x=df.Height,y=df.Diameter)
```

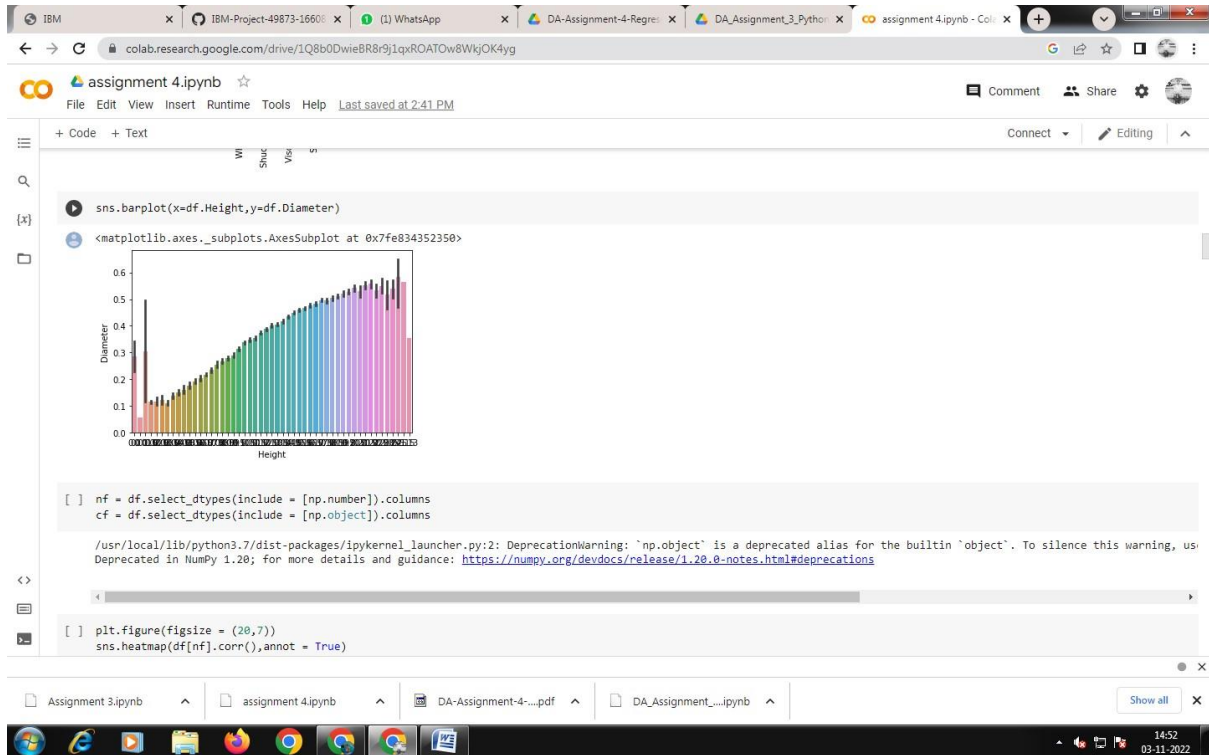
## OUTPUT:

<matplotlib.axes.\_subplots.AxesSubplot at 0x7fe834352350>



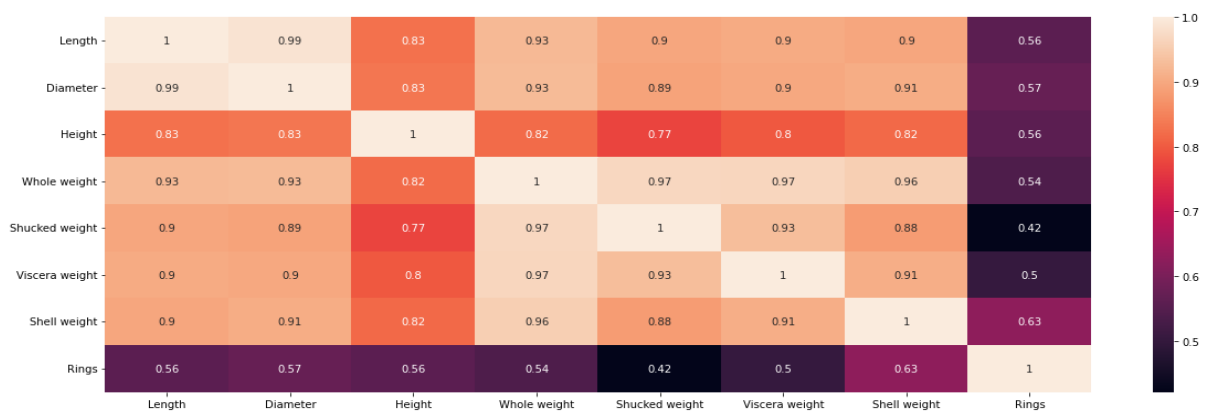
## CODING:

```
nf = df.select_dtypes(include = [np.number]).columns
cf = df.select_dtypes(include = [np.object]).columns
```

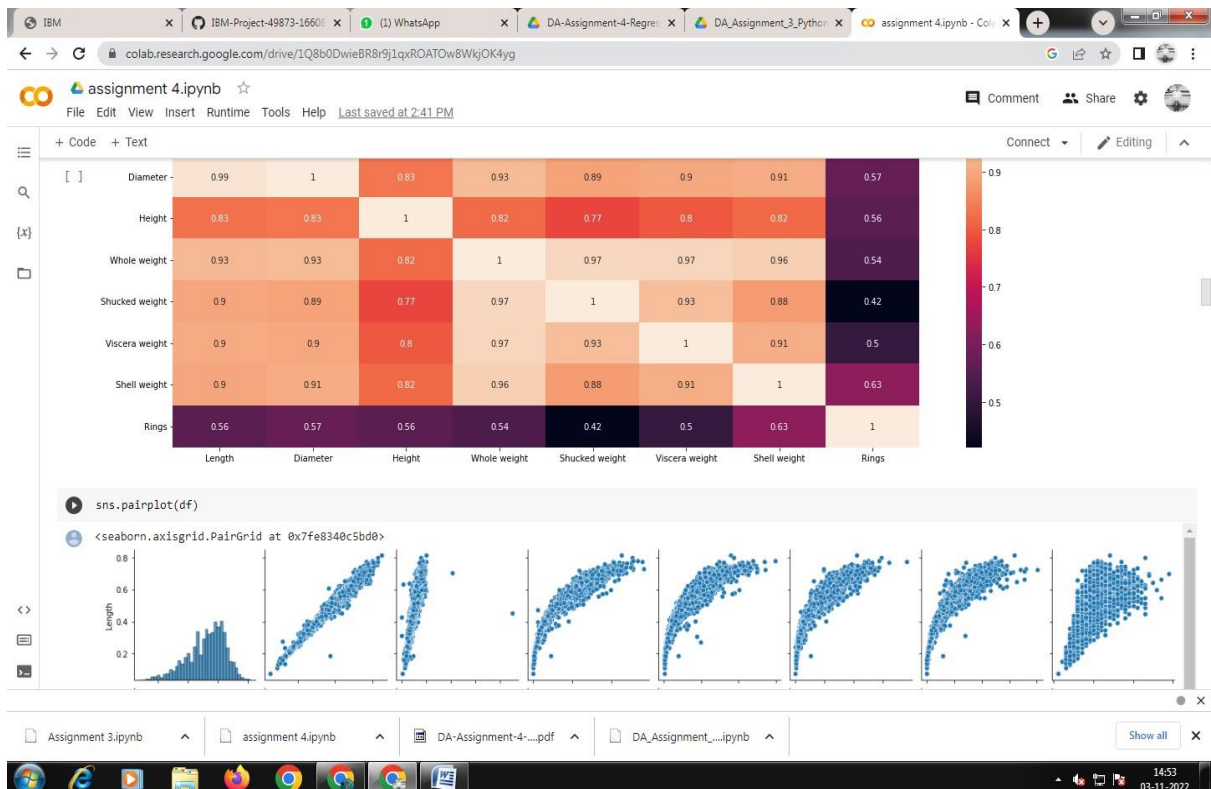
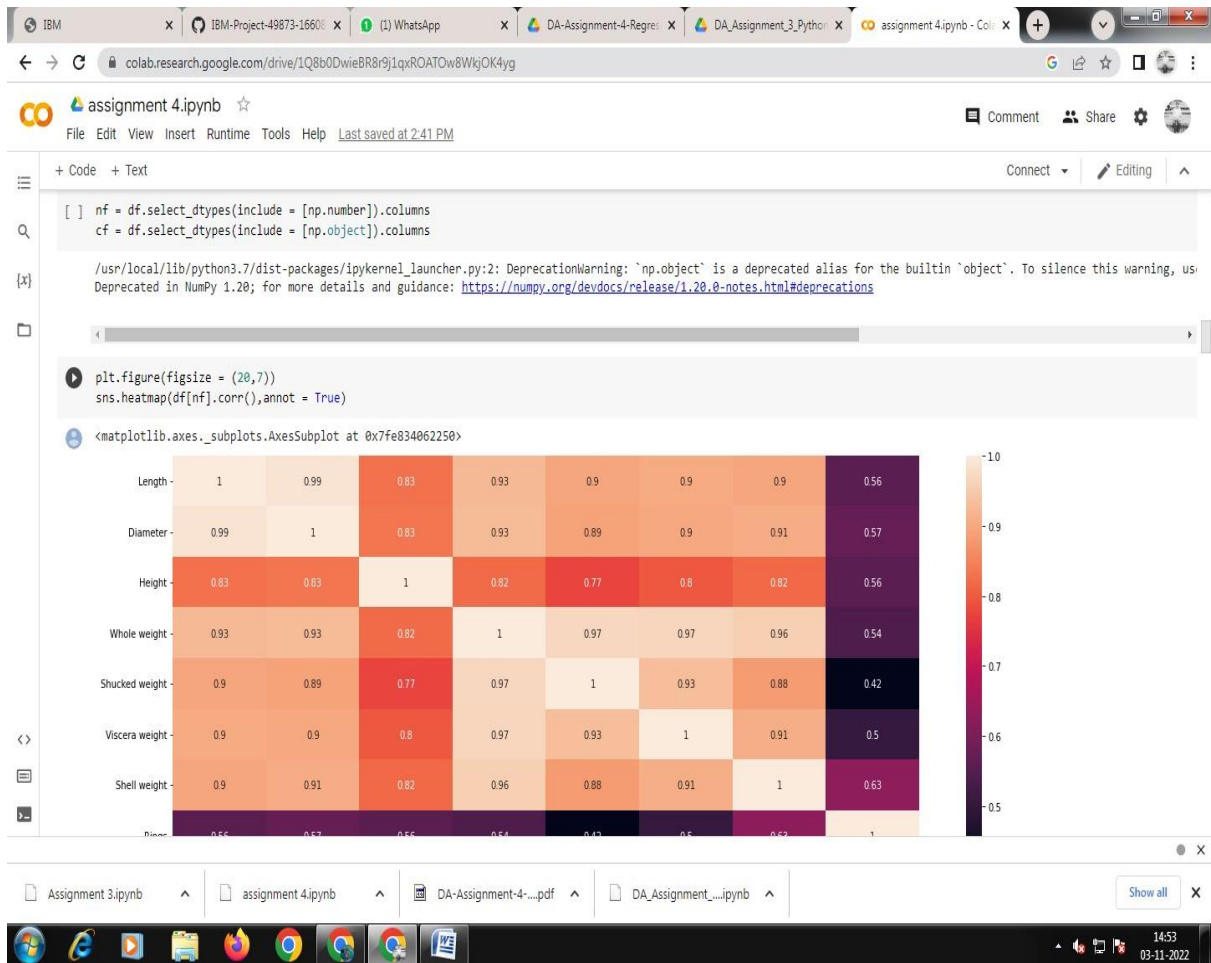


```
plt.figure(figsize = (20,7)) sns.heatmap(df[nf].corr(),annot
= True)
```

## OUTPUT:



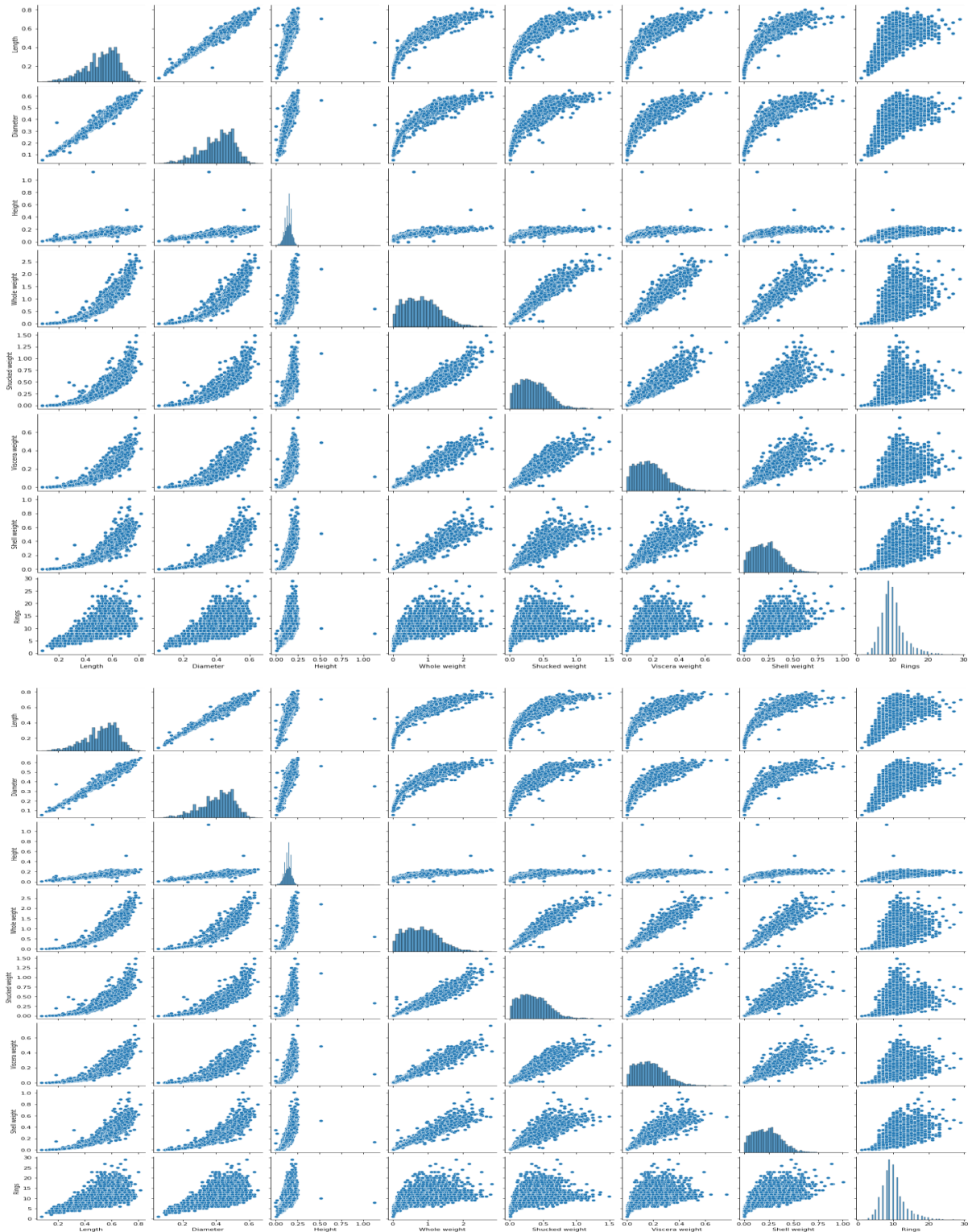




**CODING:**

```
sns.pairplot(df)
```

**OUTPUT:**



**CODING:**

```
df['Height'].describe()
```

#### **OUTPUT:**

```
count    4177.000000
mean      0.139516
std       0.041827 min
0.000000
25%       0.115000
50%       0.140000 75%
0.165000 max
1.130000
Name: Height, dtype: float64
```

#### **CODING:**

```
df['Height'].mean()
```

#### **OUTPUT:**

```
0.13951639932966242
```

#### **CODING:**

```
df.max()
```

#### **OUTPUT:**

```
Sex      M
Length    0.815
Diameter  0.65
Height    1.13
```

Whole weight 2.8255

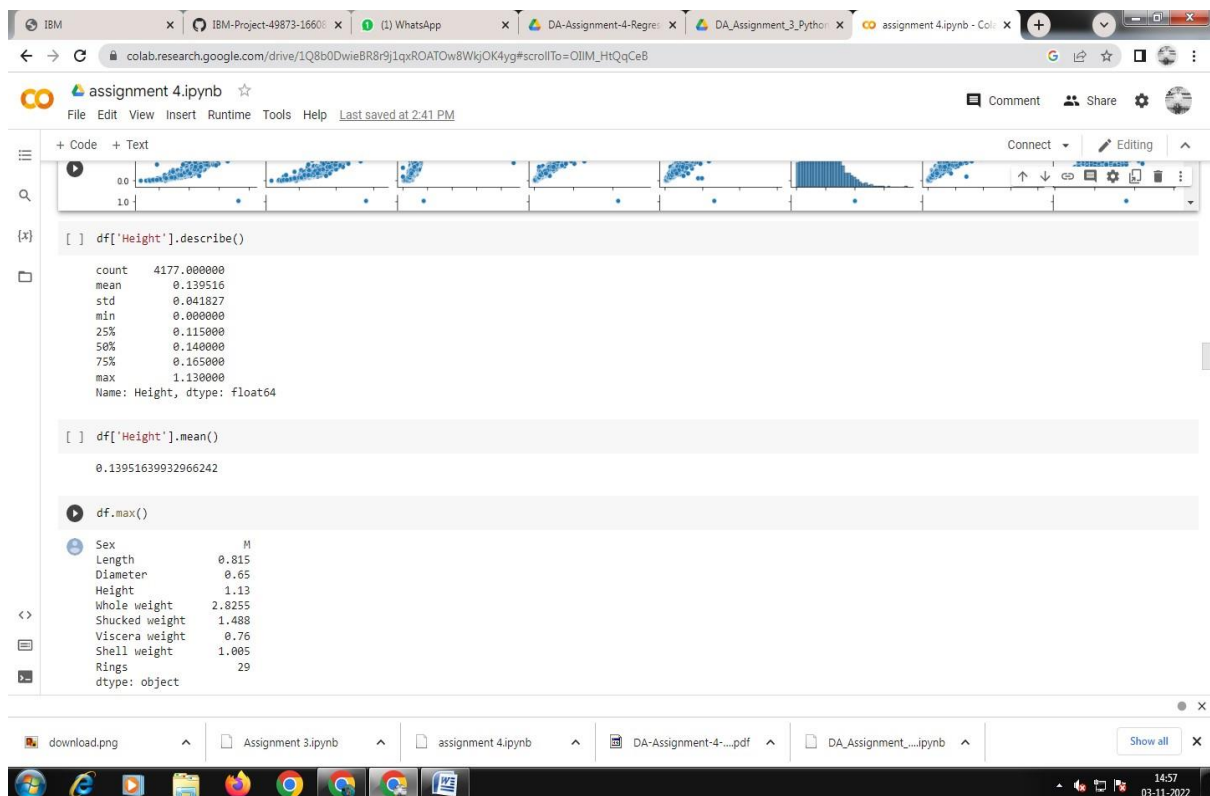
Shucked weight 1.488

Viscera weight 0.76

Shell weight 1.005

Rings 29

dtype: object



## CODING:

```
df['Sex'].value_counts()
```

## OUTPUT:

M 1528

I 1342

F 1307

Name: Sex, dtype: int64

**CODING:**

```
df[df.Height == 0]
```

**OUTPUT:**

Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight
1257	I	0.430	0.34	0.0	0.428	0.2065	0.0860
I	0.315	0.23	0.0	0.134	0.0575	0.0285	0.3505

**CODING:**

```
df['Shucked weight'].kurtosis()
```

**OUTPUT:**

```
0.5951236783694207
```

**CODING:**

```
df['Diameter'].median()
```

**OUTPUT:**

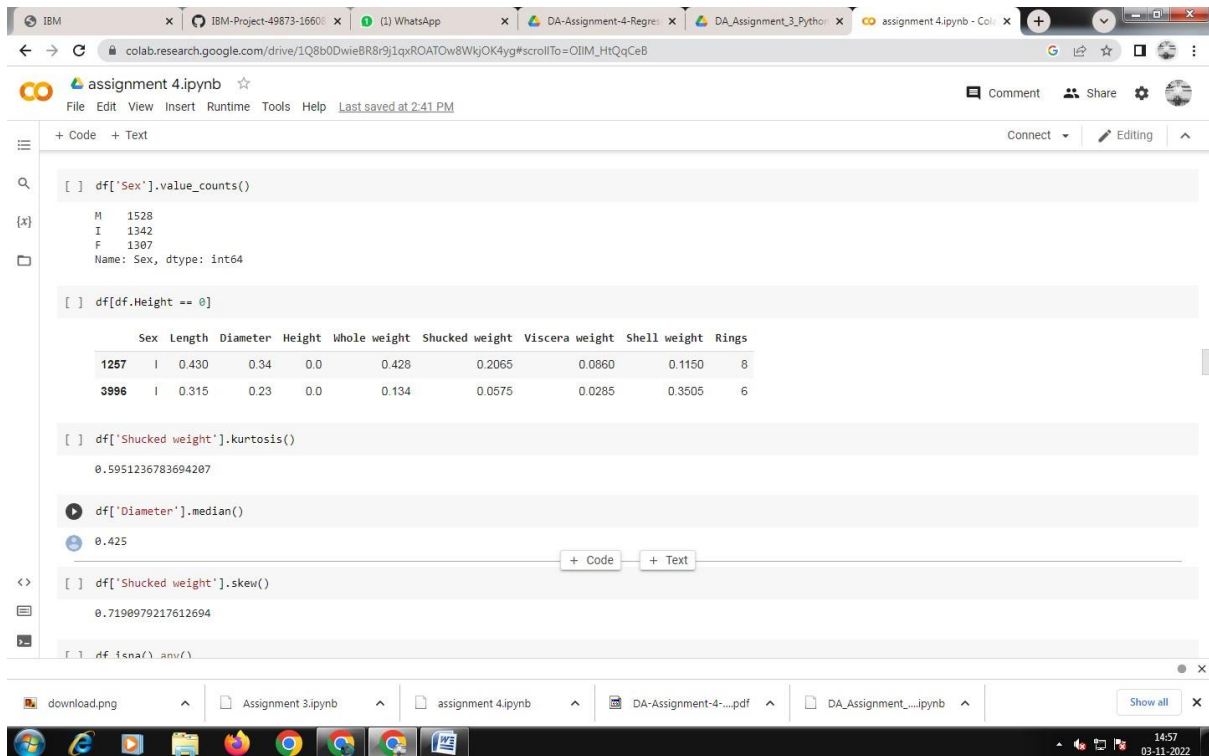
```
0.425
```

**CODING:**

```
df['Shucked weight'].skew()
```

**OUTPUT:**

```
0.7190979217612694
```



## CODING:

```
df.isna().any()
```

## OUTPUT:

Sex            False

Length        False

Diameter      False

Height        False

Whole weight   False

Shucked weight False

Viscera weight False

Shell weight   False

Rings         False

dtype: bool

## CODING:

```

missing_values = df.isnull().sum().sort_values(ascending = False)
percentage_missing_values = (missing_values/len(df))*100

pd.concat([missing_values, percentage_missing_values], axis = 1, keys= ['Missing values', '% Missing'])

```

### OUTPUT:

```

Missing values % Missing
Sex      0      0.0

Length 0      0.0

Diameter      0      0.0

Height 0      0.0

Whole weight 0      0.0

Shucked weight 0      0.0

Viscera weight 0      0.0

Shell weight      0      0.0
Rings      0      0.0

```

### CODING:

```

q1=df.Rings.quantile(0.25)

q2=df.Rings.quantile(0.75)

iqr=q2-q1
print(iqr)

```

```

df['Shucked weight'].skew()
0.7198979217612694

df.isna().any()
Sex          False
Length       False
Diameter     False
Height       False
Whole weight False
Shucked weight False
Viscera weight False
Shell weight False
Rings        False
dtype: bool

missing_values = df.isnull().sum().sort_values(ascending = False)
percentage_missing_values = (missing_values/len(df))*100
pd.concat([missing_values, percentage_missing_values], axis = 1, keys= ['Missing values', '% Missing'])

```

	Missing values	% Missing
Sex	0	0.0
Length	0	0.0
Diameter	0	0.0
Height	0	0.0
Whole weight	0	0.0

**OUTPUT:**

3.0

**CODING:**

df = pd.get\_dummies(df) dummy\_df

= df

df.boxplot( rot = 90, figsize=(20,5))

```

q1=df.Rings.quantile(0.25)
q2=df.Rings.quantile(0.75)
IQR=q2-q1

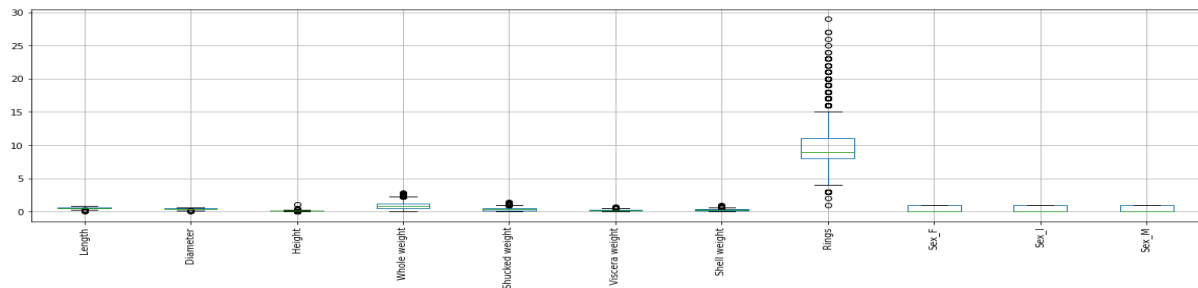
print(IQR)
3.0

df = pd.get_dummies(df)
dummy_df = df
df.boxplot( rot = 90, figsize=(20,5))

```

**OUTPUT:**



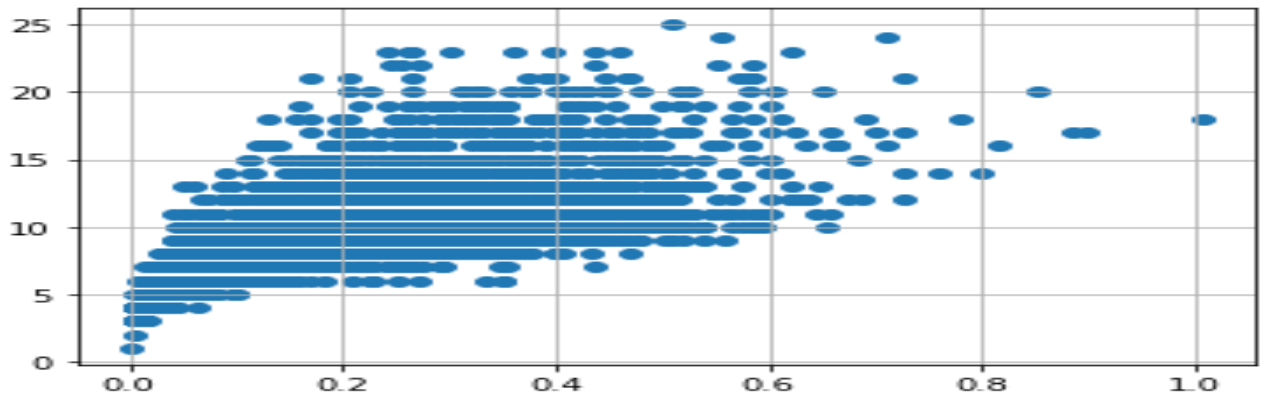


## CODING:

```

df['age'] = df['Rings'] df = df.drop('Rings', axis = 1) df.drop(df[(df['Viscera
weight']> 0.5) & (df['age'] < 20)].index, inplace=True) df.drop(df[(df['Viscera
weight']<0.5) & (df['age'] > 25)].index, inplace=True) var = 'Shell weight'
plt.scatter(x = df[var], y = df['age']) plt.grid(True)
  
```

## OUTPUT:



```

assignment 4.ipynb
File Edit View Insert Runtime Tools Help Last saved at 2:41 PM
+ Code + Text
[ ] df.drop(df[(df['Viscera weight'] > 0.5) & (df['age'] < 20)].index, inplace=True)
df.drop(df[(df['Viscera weight'] < 0.5) & (df['age'] > 25)].index, inplace=True)

[ ] var = 'Shell weight'
plt.scatter(x = df[var], y = df['age'])
plt.grid(True)

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

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: 'np.object' is a deprecated alias for the builtin 'object'. To silence this warning, use
'Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations'

[ ] numerical_features
https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations

```

## CODING:

```

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

```

## OUTPUT:

```
Index([], dtype='object')
```

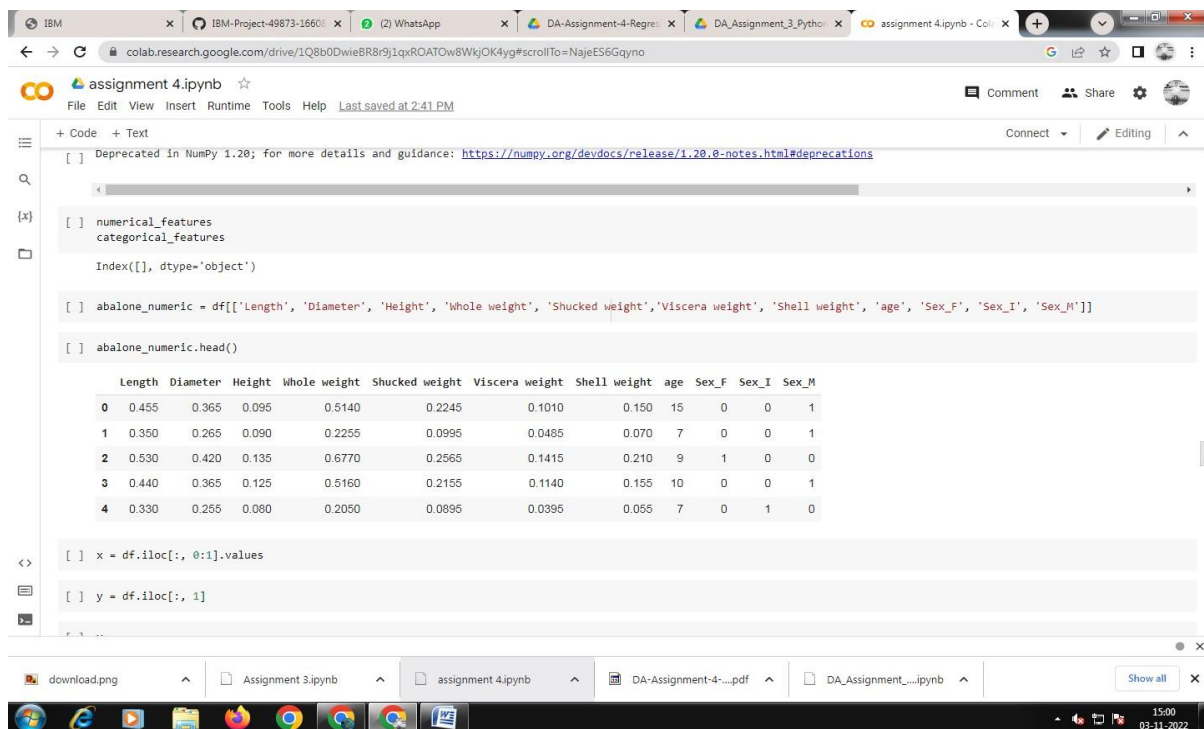
## CODING:

```
abalone_numeric = df[['Length', 'Diameter', 'Height', 'Whole weight', 'Shucked weight', 'Viscera weight', 'Shell weight', 'age', 'Sex_F', 'Sex_I', 'Sex_M']] abalone_numeric.head()
```

## OUTPUT:

Length Diameter Height Whole weight Shucked weight Viscera weight Shell weight age Sex\_F Sex\_I Sex\_M

0	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15	0	0	1
1	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7	0	0	1
2	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9	1	0	0
3	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10	0	0	1
4	0.330	0.255	0.080	0.2050	0.0895	0.0395	0.055	7	0	1	0



## CODING:

```
x = df.iloc[:, 0:1].values
y = df.iloc[:, 1]
```

## OUTPUT:

```
0 0.365
```

```
1    0.265
2    0.420
3    0.365
4    0.255

4172  0.450
4173  0.440
4174  0.475
4175  0.485
4176  0.555
```

Name: Diameter, Length: 4150, dtype: float64

#### **CODING:**

```
print ("\n ORIGINAL VALUES: \n\n", x,y)
```

#### **OUTPUT:**

ORIGINAL VALUES:

```
[[0.455]
 [0.35 ]
 [0.53 ]
 [0.6  ]
 [0.625]
 [0.71 ]] 0    0.365

1    0.265
2    0.420
3    0.365
4    0.255

4172  0.450
```

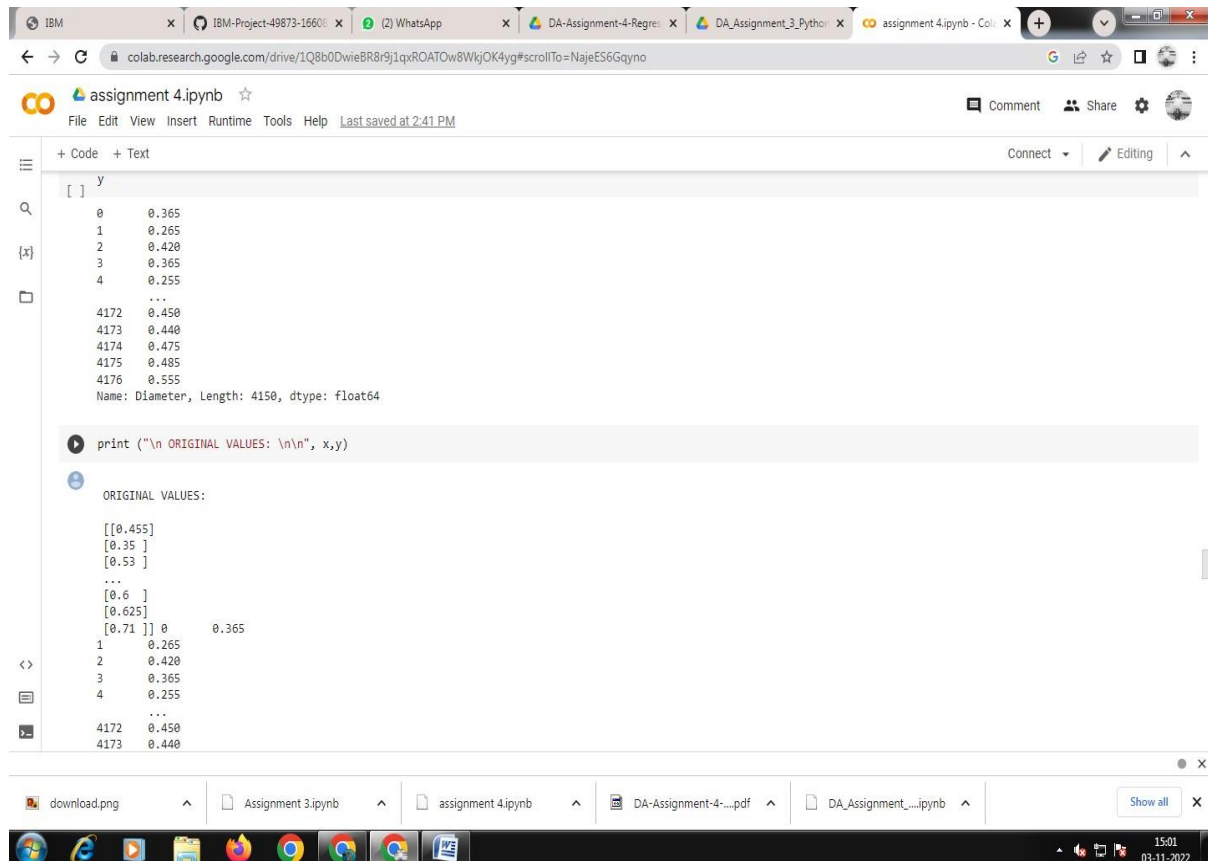
4173 0.440

4174 0.475

4175 0.485

4176 0.555

Name: Diameter, Length: 4150, dtype: float64



```
print ("\n ORIGINAL VALUES: \n\n", x,y)
```

ORIGINAL VALUES:

```
[[0.455]
 [0.35 ]
 [0.53 ]
 ...
 [0.6 ]
 [0.625]
 [0.71 ]] 0 0.365
1 0.265
2 0.420
3 0.365
4 0.255
...
4172 0.450
4173 0.440
```

## CODING:

```
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)
```

## OUTPUT:

VALUES AFTER MIN MAX SCALING:

```
[[0.51351351]
```

[0.37162162]

[0.61486486]

[0.70945946]

[0.74324324]

[0.85810811]]

### **CODING:**

```
X = df.drop('age', axis = 1) y = df['age'] from sklearn.preprocessing
```

```
import StandardScaler from sklearn.model_selection import
```

```
train_test_split, cross_val_score from sklearn.feature_selection
```

```
import SelectKBest standardScale = StandardScaler()
```

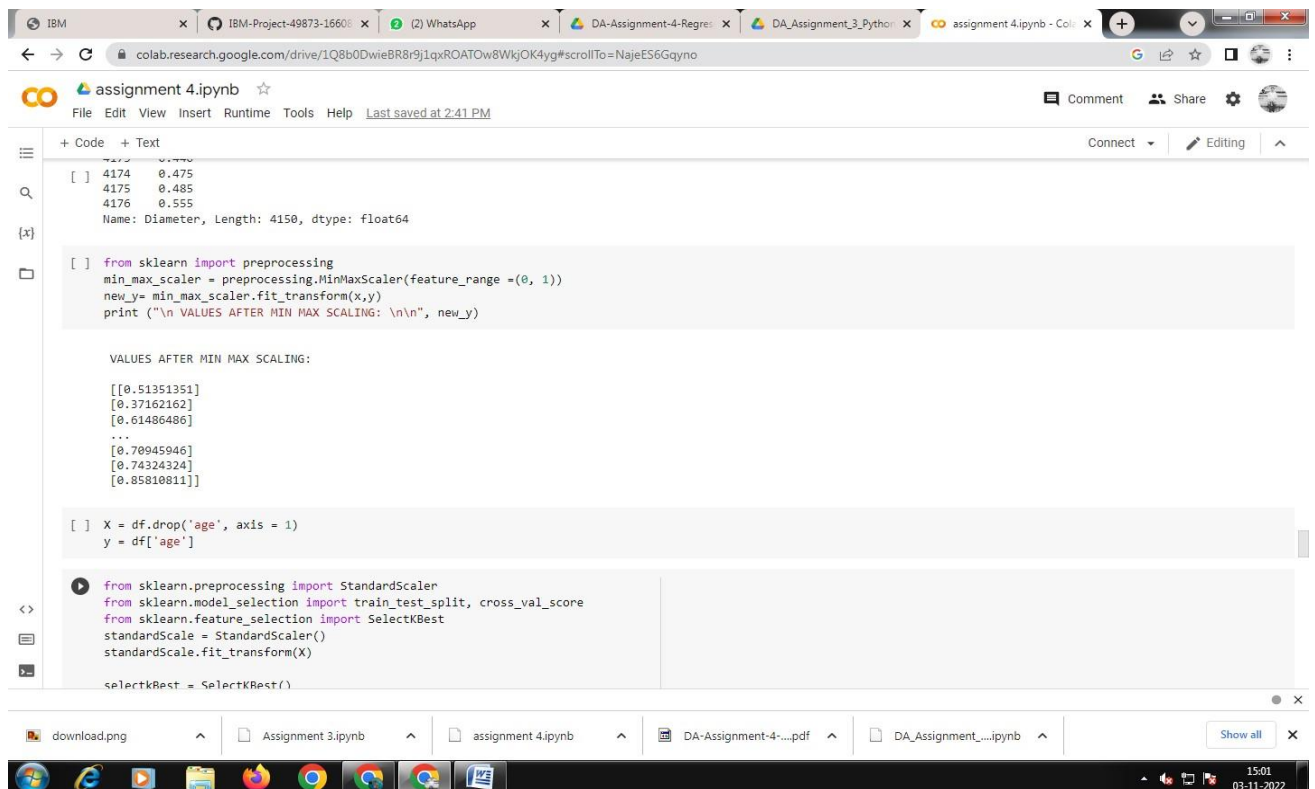
```
standardScale.fit_transform(X)
```

```
selectkBest = SelectKBest()
```

```
X_new = selectkBest.fit_transform(X, y)
```

```
X_train, X_test, y_train, y_test = train_test_split(X_new, y, test_size = 0.25)
```

```
X_train
```



## OUTPUT:

```
array([[0.255, 0.185, 0.06 , ..., 0. , 1. , 0. ],
       [0.655, 0.505, 0.165, ..., 1. , 0. , 0. ],
       [0.355, 0.26 , 0.09 , ..., 0. , 1. , 0. ],
       ...,
       [0.635, 0.495, 0.015, ..., 1. , 0. , 0. ],
       [0.335, 0.245, 0.09 , ..., 0. , 1. , 0. ],
       [0.65 , 0.5 , 0.17 , ..., 1. , 0. , 0. ]])
```

## CODING:

y\_train

OUTPUT:

813    5

3150   10

2485   8

2307 16

844 8

1298 10

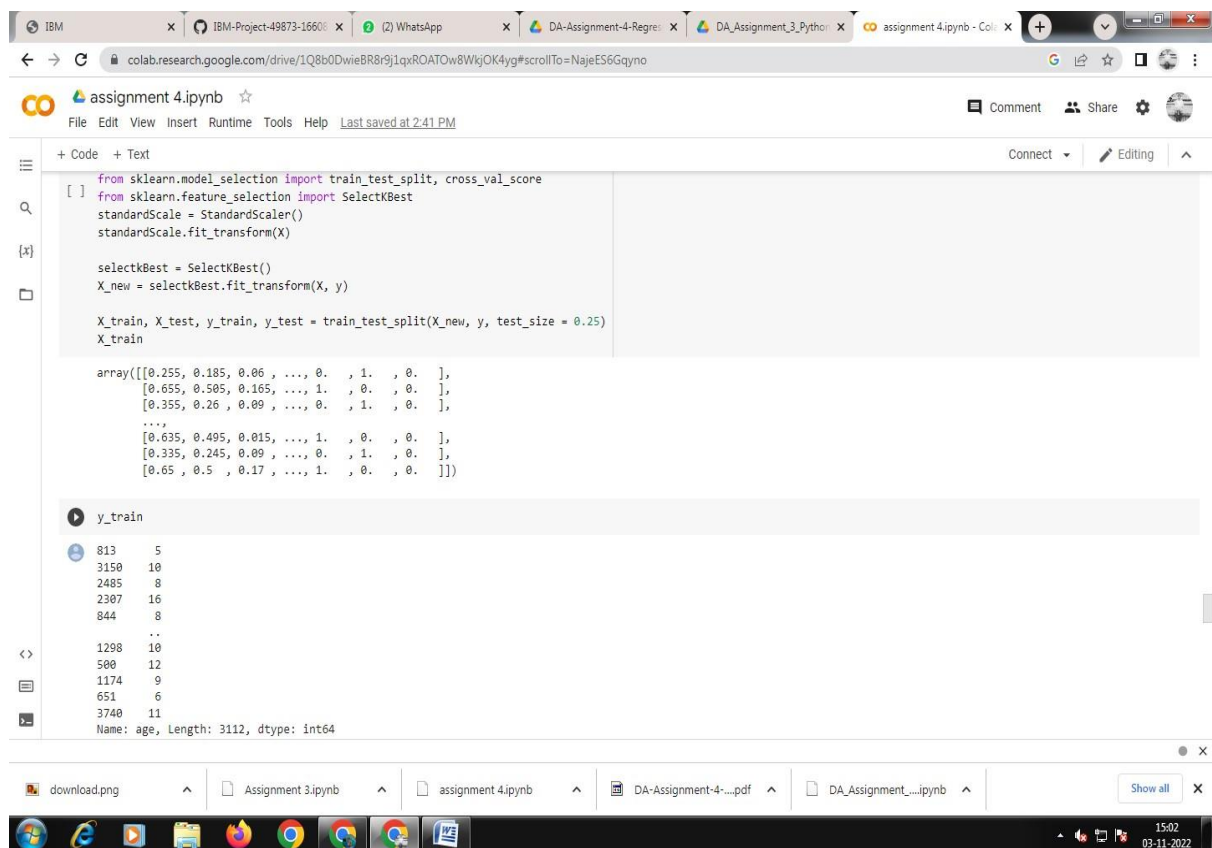
500 12

1174 9

651 6

3740 11

Name: age, Length: 3112, dtype: int64



```
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.feature_selection import SelectKBest
standardScale = StandardScaler()
standardScale.fit_transform(X)

selectKBest = SelectKBest()
X_new = selectKBest.fit_transform(X, y)

X_train, X_test, y_train, y_test = train_test_split(X_new, y, test_size = 0.25)
X_train

array([[0.255, 0.185, 0.06, ..., 0., 1., 0. ],
       [0.655, 0.505, 0.165, ..., 1., 0., 0. ],
       [0.355, 0.26, 0.09, ..., 0., 1., 0. ],
       ...,
       [0.635, 0.495, 0.015, ..., 1., 0., 0. ],
       [0.335, 0.245, 0.09, ..., 0., 1., 0. ],
       [0.65, 0.5, 0.17, ..., 1., 0., 0. ]])

y_train
813      5
3150    10
2485     8
2307    16
844      8
..
1298    10
500     12
1174     9
651      6
3740    11
Name: age, Length: 3112, dtype: int64
```

## CODING:

```
from sklearn import linear_model as lm from
```

```
sklearn.linear_model import LinearRegression
```

```
model=lm.LinearRegression()
```

```
results=model.fit(X_train,y_train) ccuracy =
```



```
model.score(X_train, y_train) print('Accuracy of the  
model:', accuracy)
```

### OUTPUT:

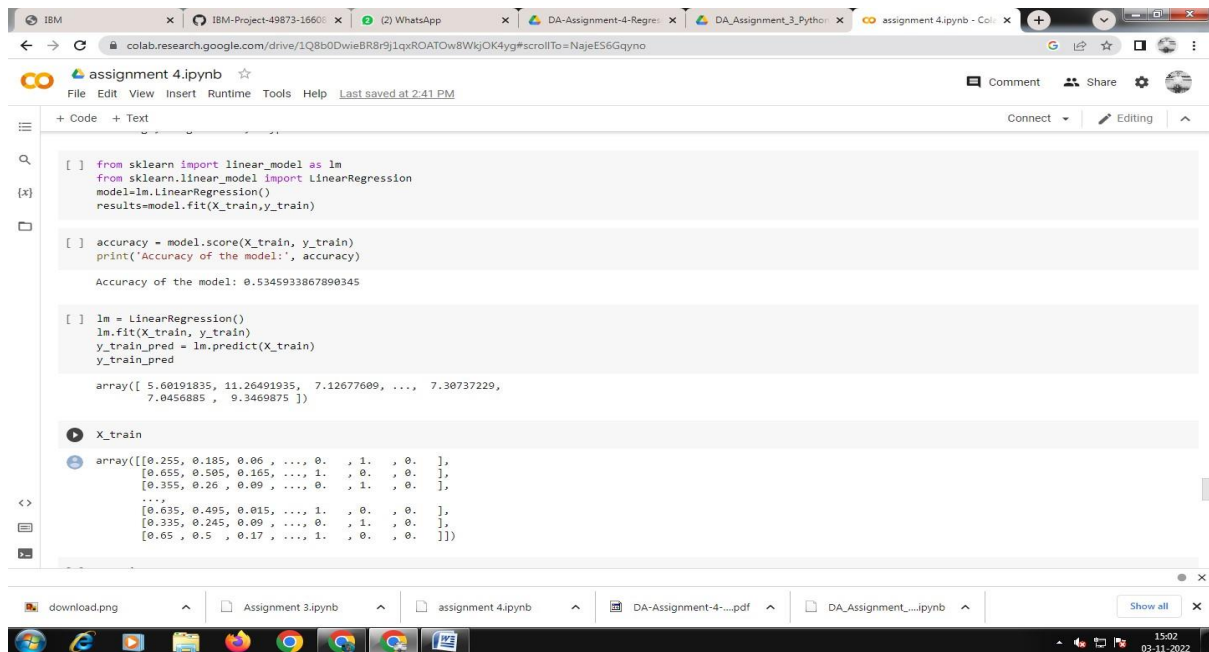
Accuracy of the model: 0.5345933867890345

### CODING:

```
lm = LinearRegression()  
  
lm.fit(X_train, y_train) y_train_pred  
  
= lm.predict(X_train) y_train_pred
```

### OUTPUT:

```
array([ 5.60191835, 11.26491935, 7.12677609, ..., 7.30737229,  
       7.0456885 , 9.3469875 ])
```



### CODING:

X\_train

### OUTPUT:

```
array([[0.255, 0.185, 0.06 , ..., 0. , 1. , 0. ],
       [0.655, 0.505, 0.165, ..., 1. , 0. , 0. ],
       [0.355, 0.26 , 0.09 , ..., 0. , 1. , 0. ],
       ...,
       [0.635, 0.495, 0.015, ..., 1. , 0. , 0. ],
       [0.335, 0.245, 0.09 , ..., 0. , 1. , 0. ],
       [0.65 , 0.5 , 0.17 , ..., 1. , 0. , 0. ]])
```

### CODING:

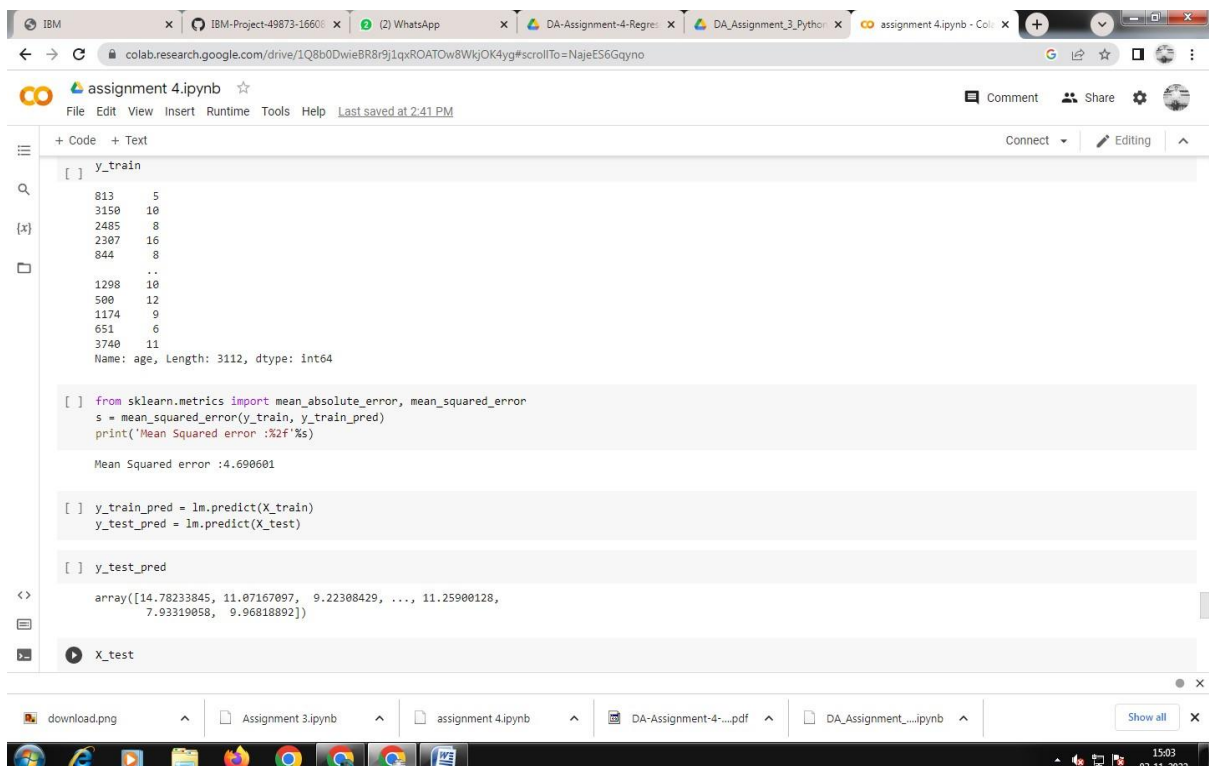
```
y_train from sklearn.metrics import mean_absolute_error,
mean_squared_error s = mean_squared_error(y_train, y_train_pred)
print('Mean Squared error :%2f'%s) OUTPUT:
```

Mean Squared error :4.690601 **CODING:**

```
y_train_pred = lm.predict(X_train)
y_test_pred = lm.predict(X_test) y_test_pred
```

### OUTPUT:

```
array([14.78233845, 11.07167097, 9.22308429, ..., 11.25900128, 7.93319058, 9.96818892])
```



**CODING:**

X\_test

**OUTPUT:**

```
array([[0.61, 0.5, 0.165, ..., 0., 0., 1. ],
       [0.63, 0.49, 0.19, ..., 0., 0., 1. ],
       [0.505, 0.395, 0.125, ..., 0., 0., 1. ],
       [0.65, 0.515, 0.175, ..., 0., 0., 1. ],
       [0.395, 0.3, 0.12, ..., 0., 1., 0. ],
       [0.535, 0.435, 0.15, ..., 0., 0., 1. ]])
```

**CODING:**

y\_test

**OUTPUT:**

2156 12

376 11

3155 9

3019 8

4092 11

43 5

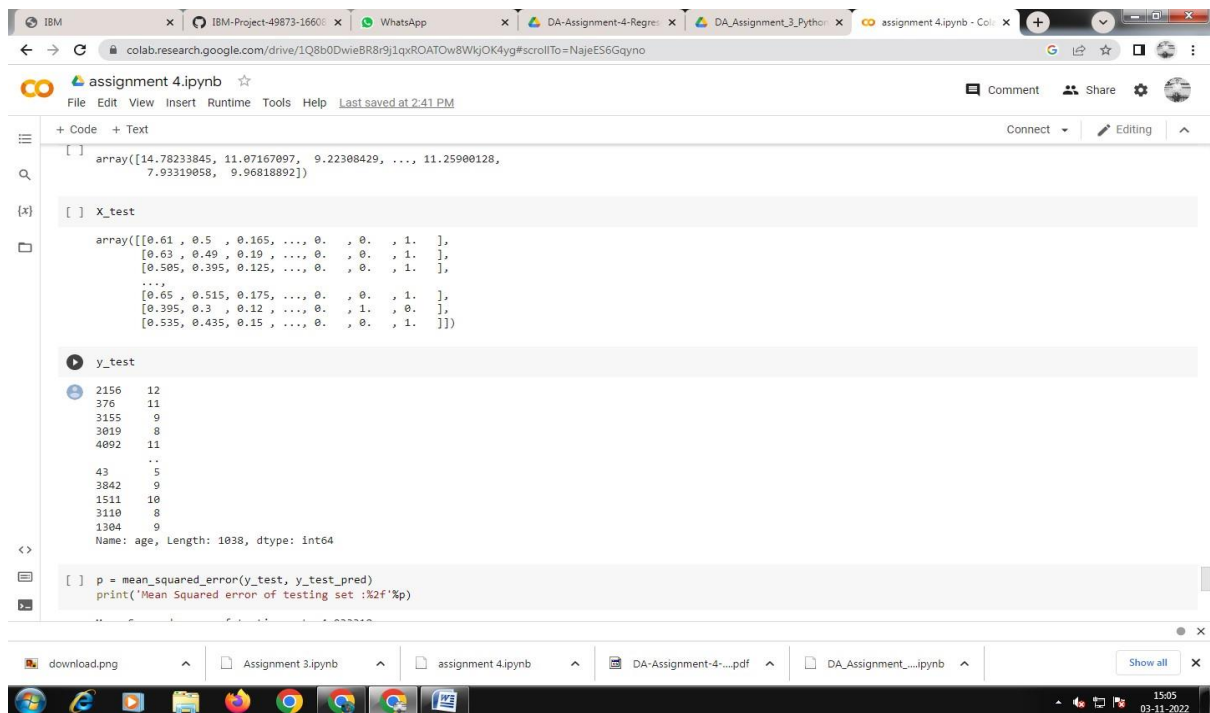
3842 9

1511 10

3110 8

1304 9

Name: age, Length: 1038, dtype: int64



## CODING:

```
p = mean_squared_error(y_test, y_test_pred) print('Mean
Squared error of testing set :%2f'%p)
```

## OUTPUT:

Mean Squared error of testing set :4.933318

## CODING:

```
from sklearn.metrics import r2_score s
= r2_score(y_train, y_train_pred)
print('R2 Score of training set:%.2f'%s)
```

## OUTPUT:

R2 Score of training set:0.53

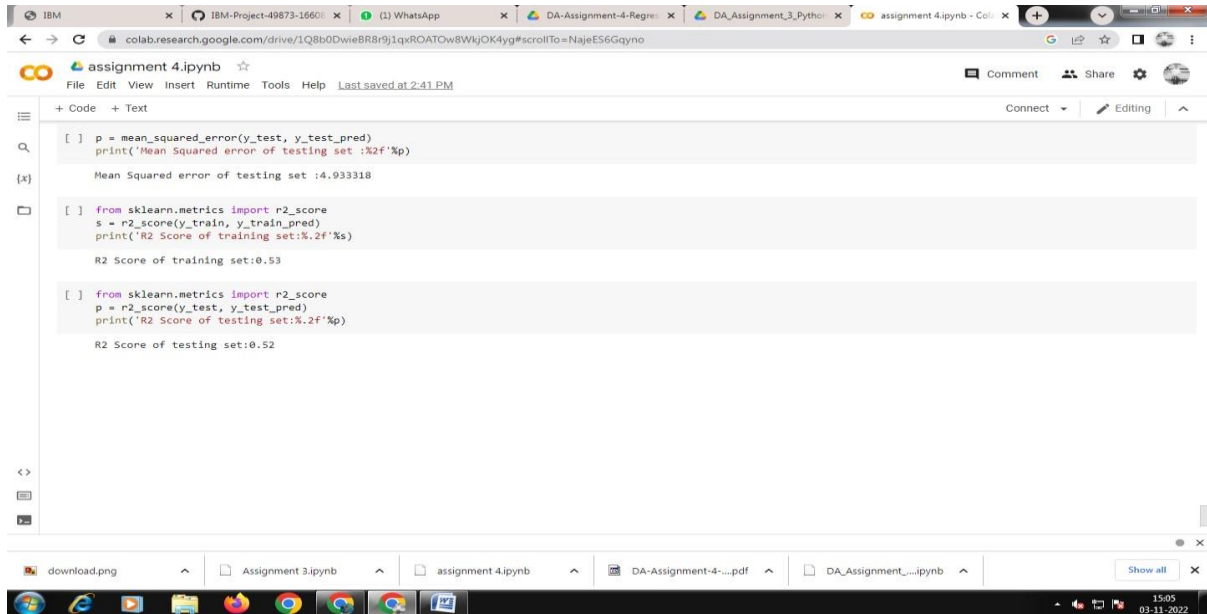
## CODING:

```
from sklearn.metrics import r2_score p
= r2_score(y_test, y_test_pred)

print('R2 Score of testing set:%.2f'%p)
```

## OUTPUT:

R2 Score of testing set:0.52



The screenshot shows a Google Colab notebook titled "assignment 4.ipynb". The notebook contains three code cells. The first cell calculates the Mean Squared Error (MSE) of the testing set and prints it as 4.933318. The second cell imports the `r2_score` function from `sklearn.metrics`, calculates the R2 score for the training set, and prints it as 0.53. The third cell also imports `r2_score`, calculates the R2 score for the testing set, and prints it as 0.52. The notebook interface includes a menu bar (File, Edit, View, Insert, Runtime, Tools, Help), a toolbar with icons for code and text, and a sidebar with a file explorer showing the notebook's location in Google Drive. The bottom of the image shows a Windows taskbar with various application icons and a system clock indicating 15:05 on 03-11-2022.

```
[ ] p = mean_squared_error(y_test, y_test_pred)
    print('Mean Squared error of testing set :%.2f'%p)

Mean Squared error of testing set :4.933318

[ ] from sklearn.metrics import r2_score
    s = r2_score(y_train, y_train_pred)
    print('R2 Score of training set:%.2f'%s)

R2 Score of training set:0.53

[ ] from sklearn.metrics import r2_score
    p = r2_score(y_test, y_test_pred)
    print('R2 Score of testing set:%.2f'%p)

R2 Score of testing set:0.52
```