Assignment - 4
ABALONE AGE PREDICTION

Assignment Date	01 September 2022
Student Name	Bheulah G.L.
Student Roll Number	311819106006
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:

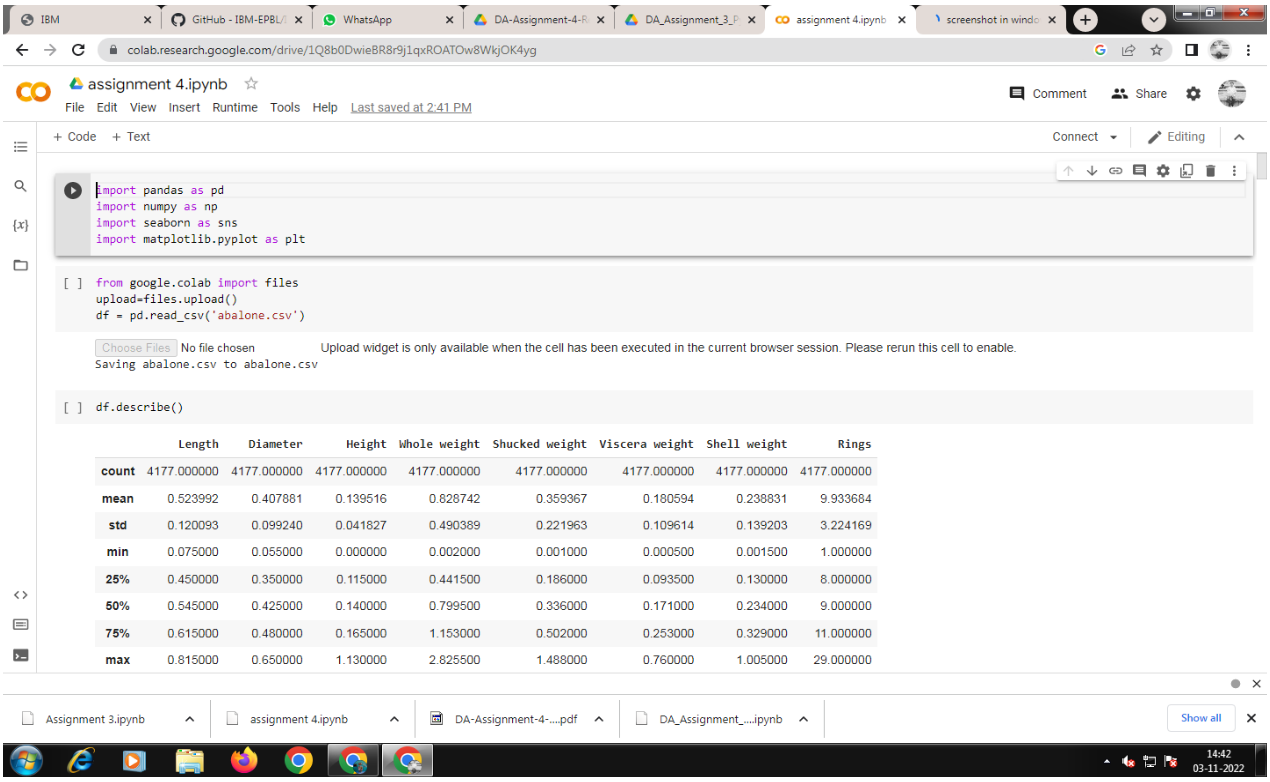
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt

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



CODING:

```
df.head()
```

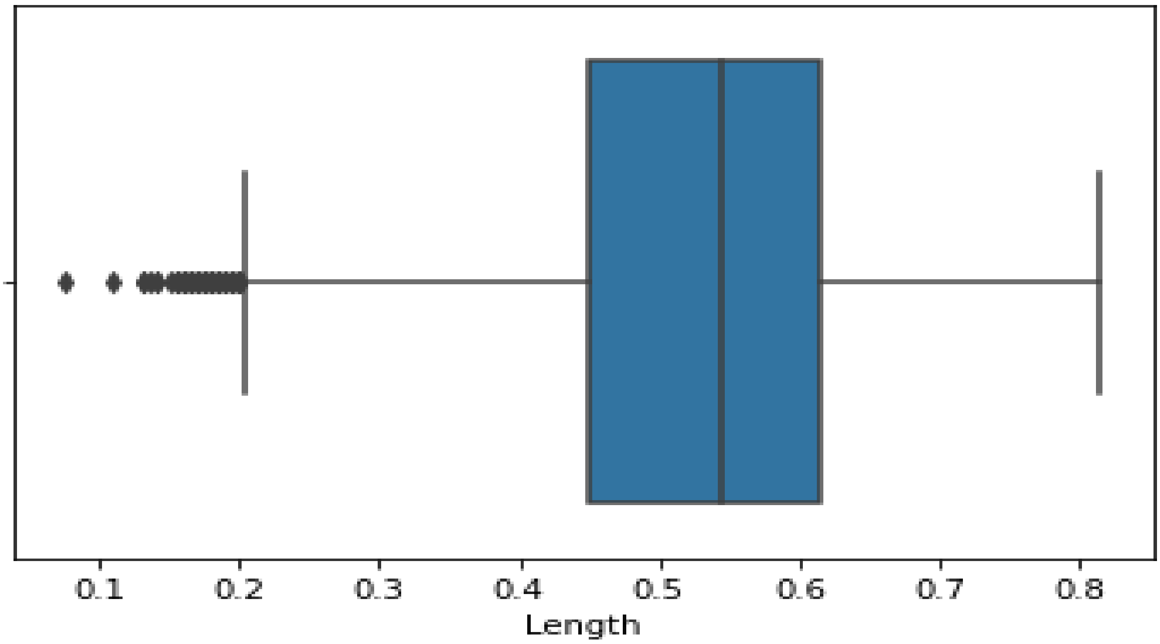
OUTPUT:

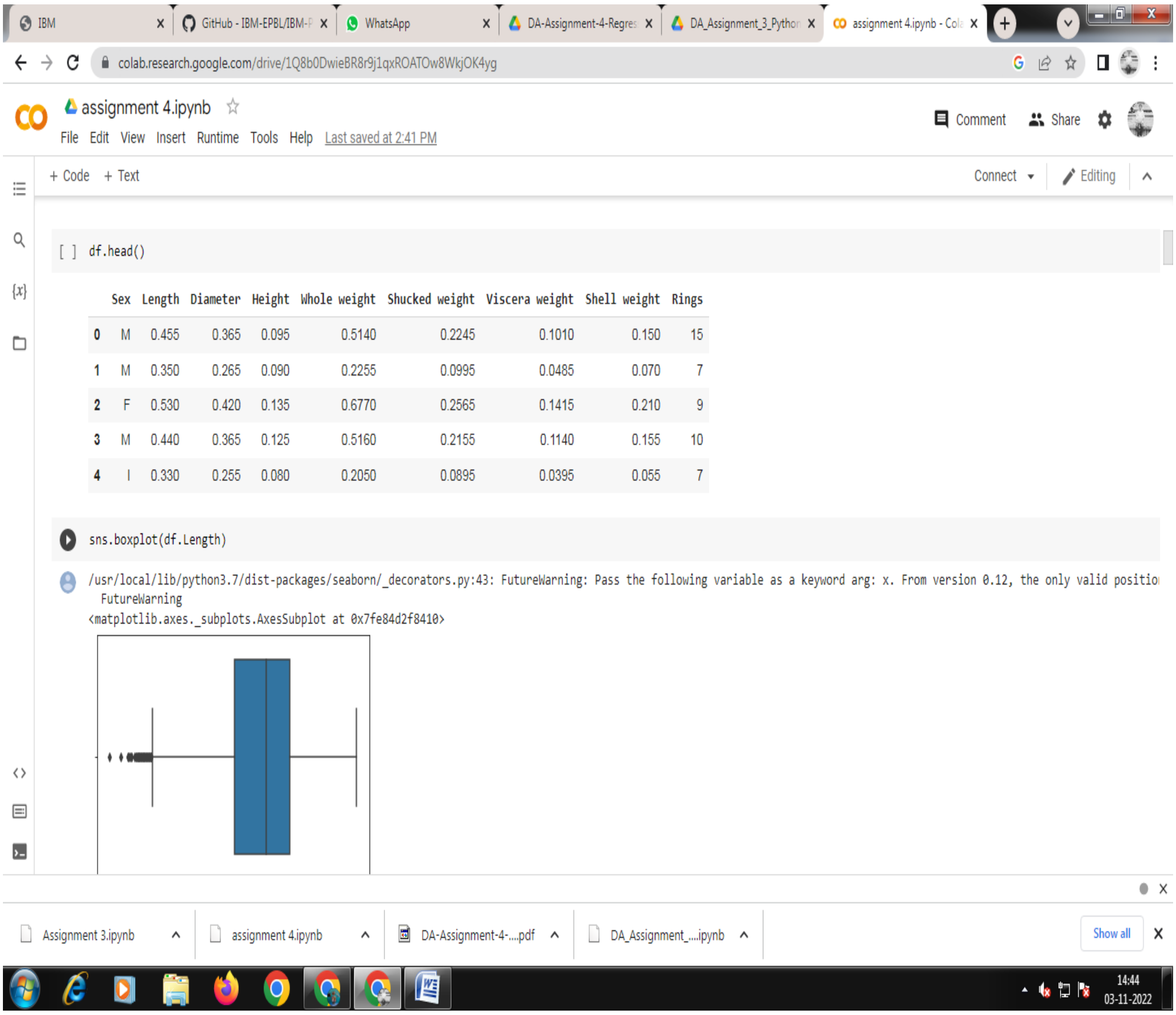
	Sex	Length	Diameter	Height	Whole weight	Shucked weight	Viscera weight	Shell weight	Rings
0	M	0.455	0.365	0.095	0.5140	0.2245	0.1010	0.150	15
1	M	0.350	0.265	0.090	0.2255	0.0995	0.0485	0.070	7
2	F	0.530	0.420	0.135	0.6770	0.2565	0.1415	0.210	9
3	M	0.440	0.365	0.125	0.5160	0.2155	0.1140	0.155	10
4	I	0.330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

CODING:

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

OUTPUT:

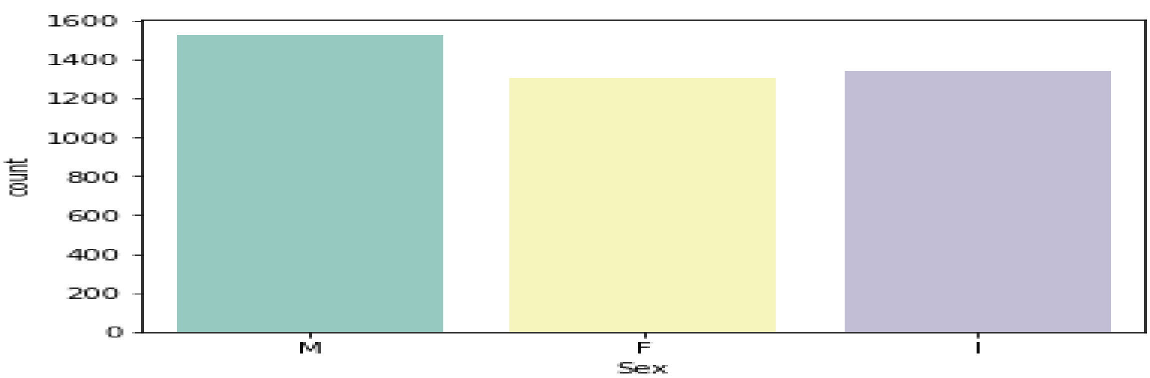


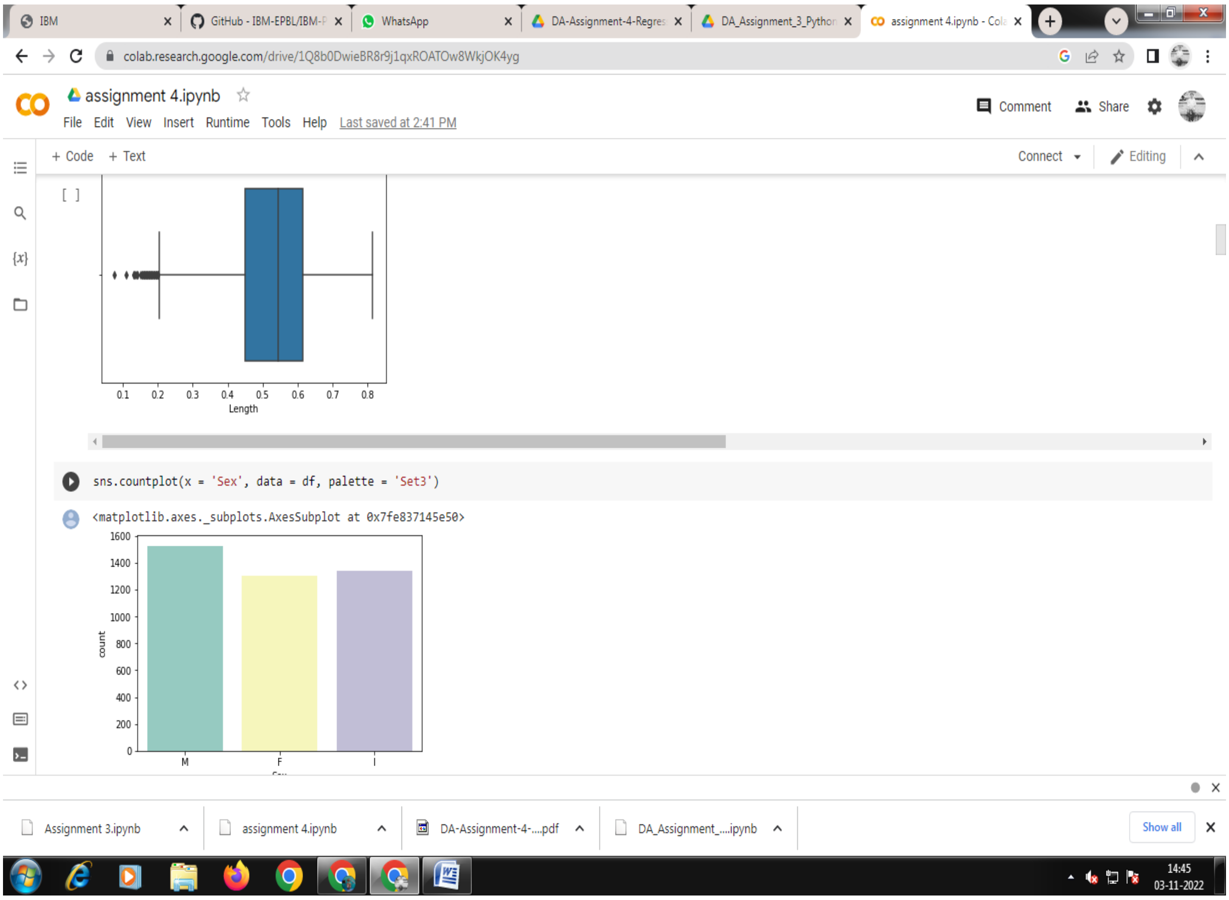


CODING:

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

OUTPUT:



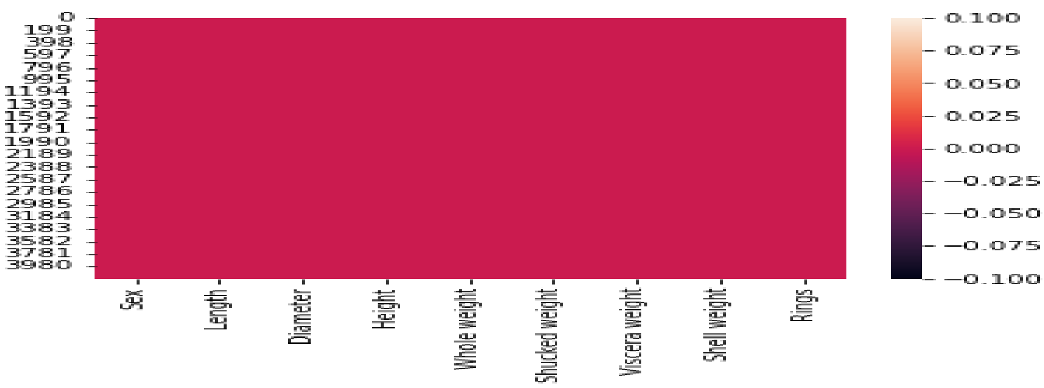


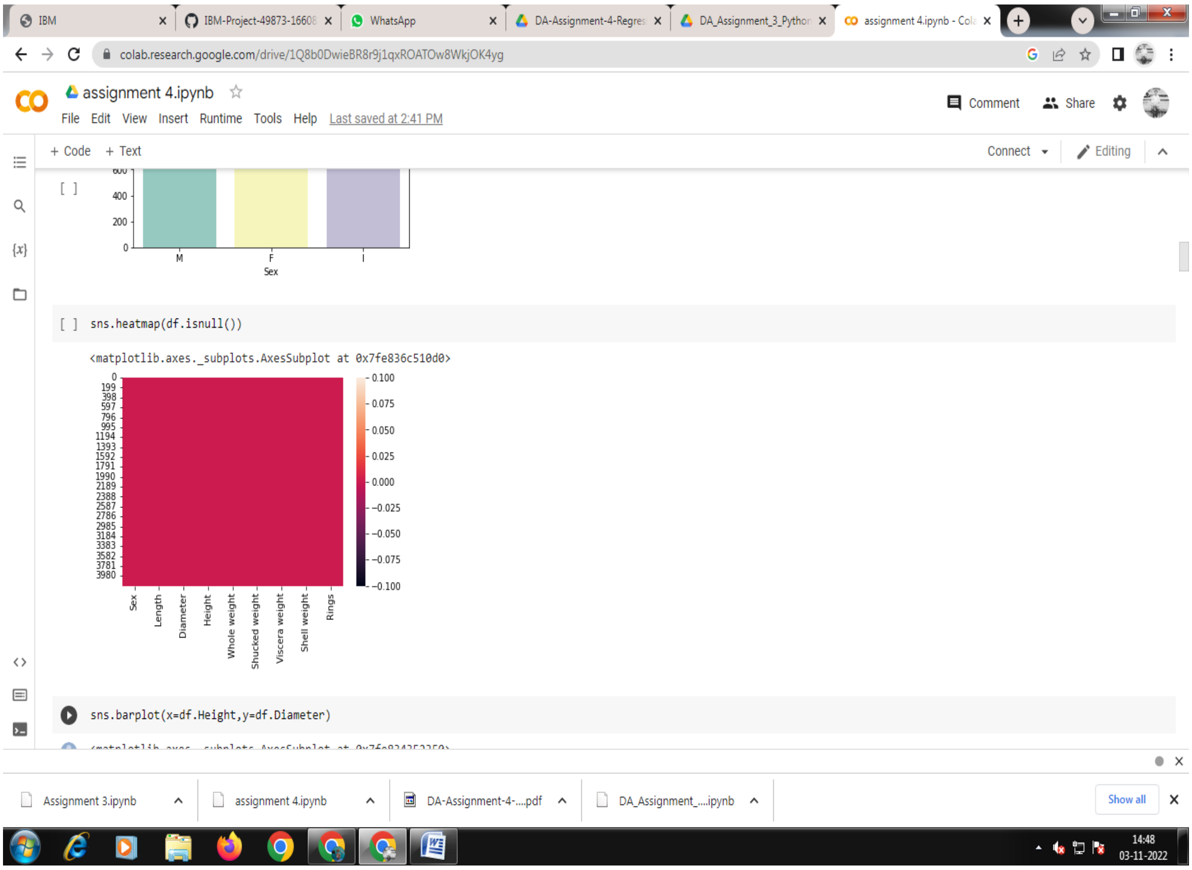
CODING:

sns.heatmap(df.isnull())

OUTPUT:

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



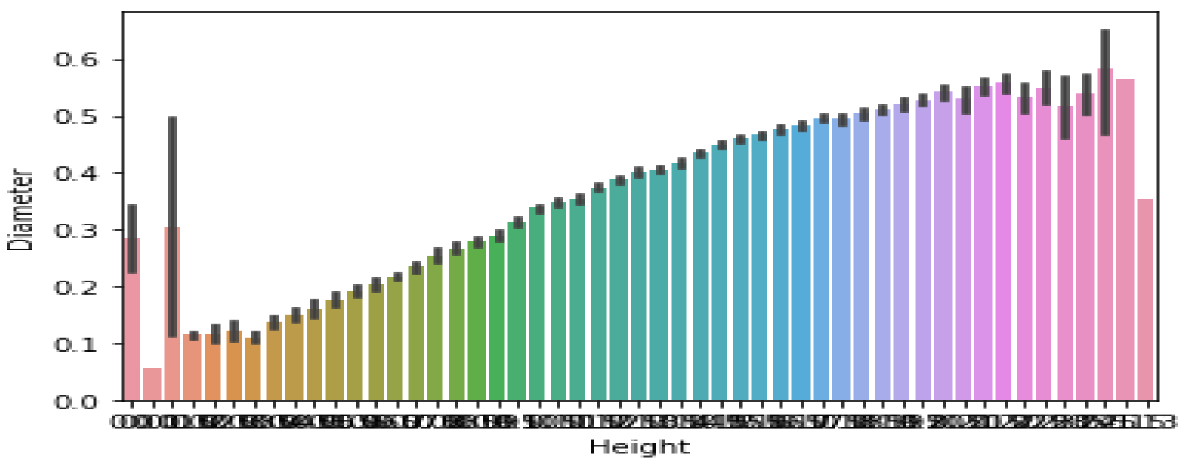


CODING:

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

OUTPUT:

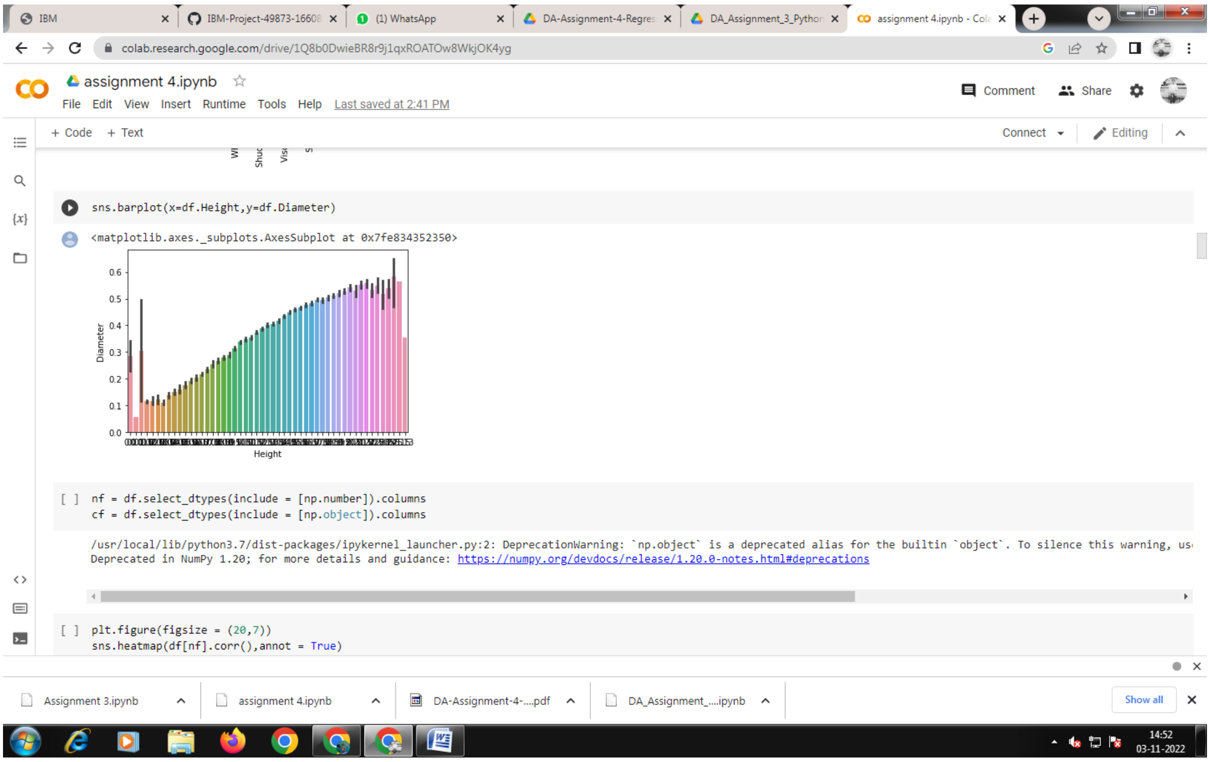
<matplotlib.axes._subplots.AxesSubplot at 0x7fe834352350>



CODING:

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

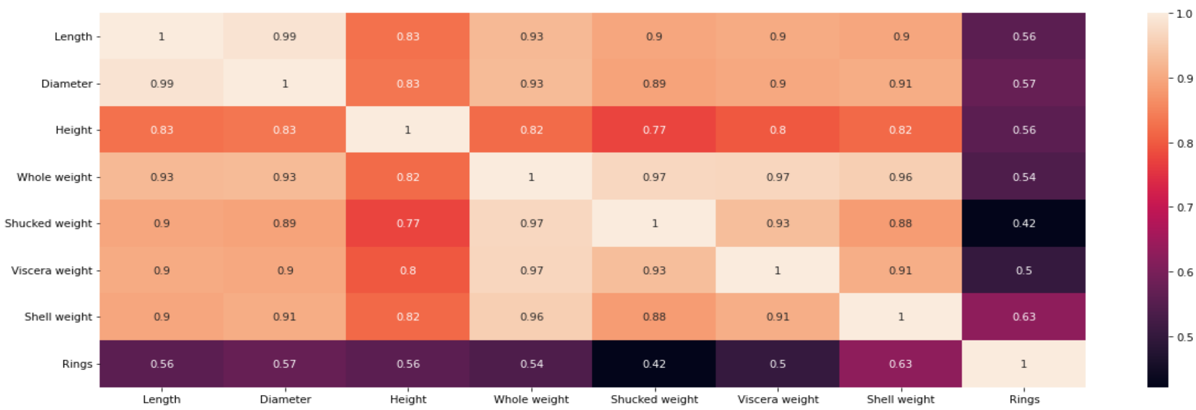
cf = df.select_dtypes(include = [np.object]).columns



plt.figure(figsize = (20,7))

sns.heatmap(df[nf].corr(),annot = True)

OUTPUT:

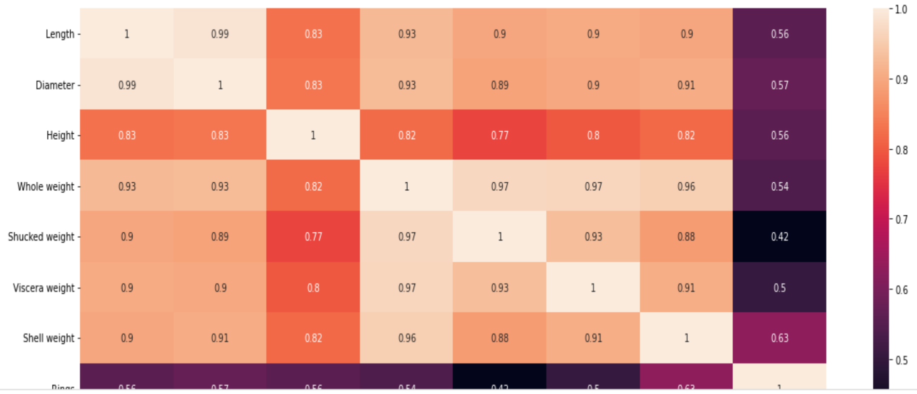


```
nf = df.select_dtypes(include = [np.number]).columns
cf = df.select_dtypes(include = [np.object]).columns
```

```
/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, us
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
```

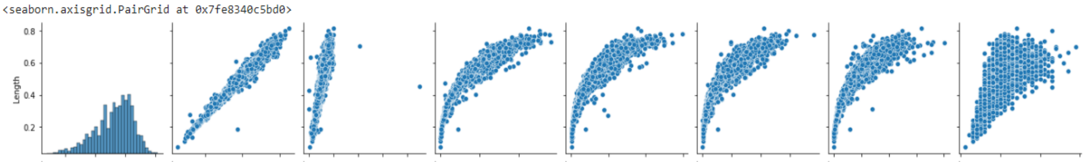
```
plt.figure(figsize = (20,7))
sns.heatmap(df[nf].corr(),annot = True)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe834062250>
```




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

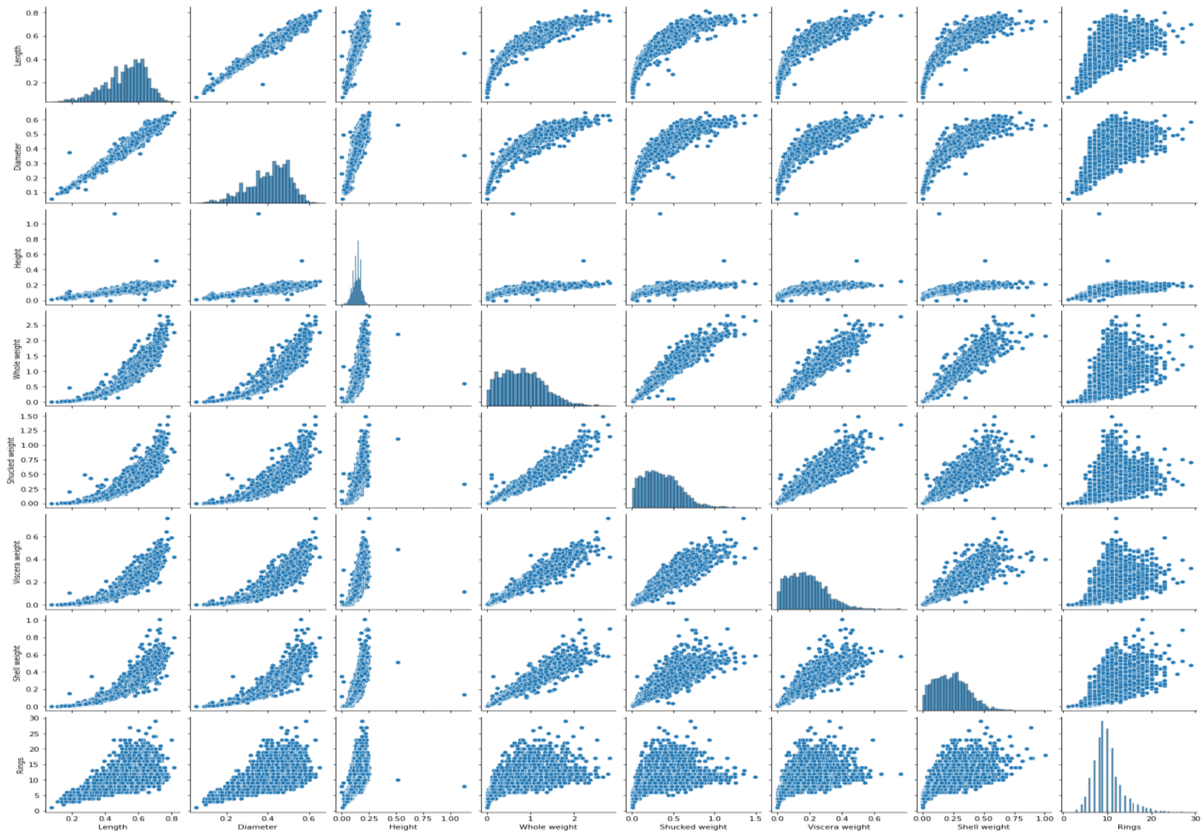
```
<seaborn.axisgrid.PairGrid at 0x7fe8340c5bd0>
```

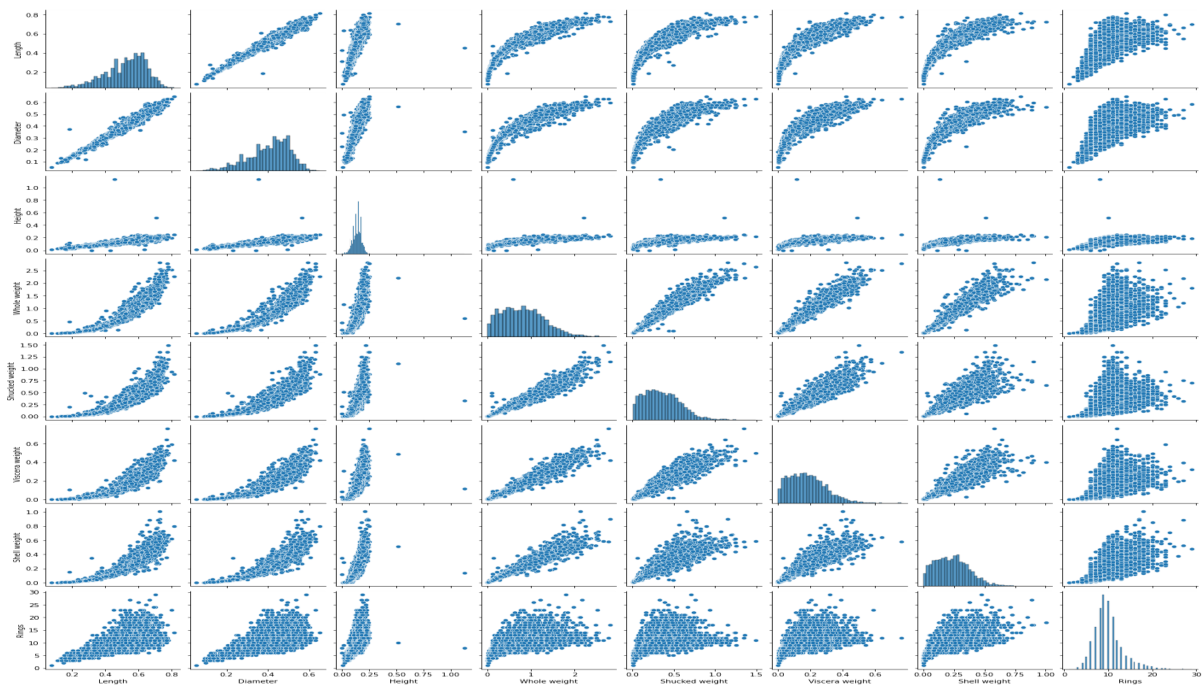


CODING:

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

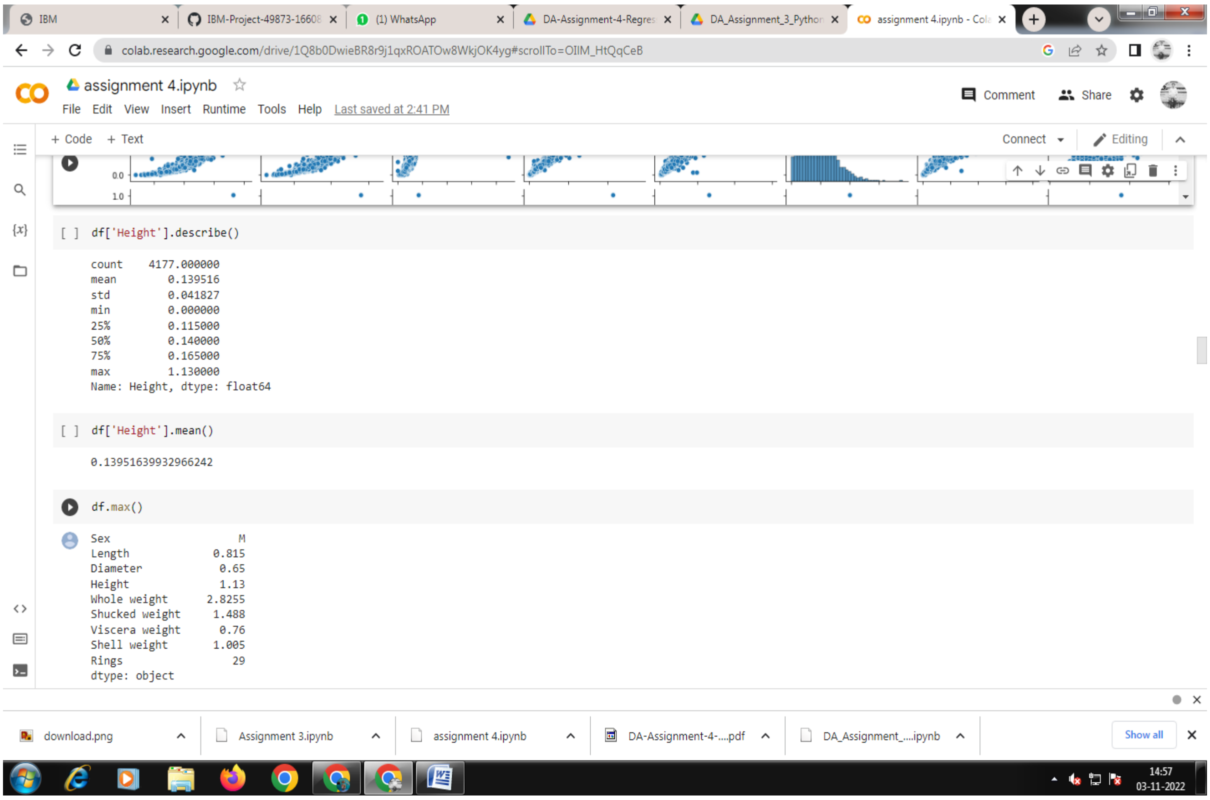
Shucked weight 1.488

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	Rings
1257	I	0.430	0.34	0.0	0.428	0.2065	0.0860	0.1150	8
3996	I	0.315	0.23	0.0	0.134	0.0575	0.0285	0.3505	6

CODING:

df['Shucked weight'].kurtosis()

OUTPUT:

0.5951236783694207

CODING:

df['Diameter'].median()

OUTPUT:

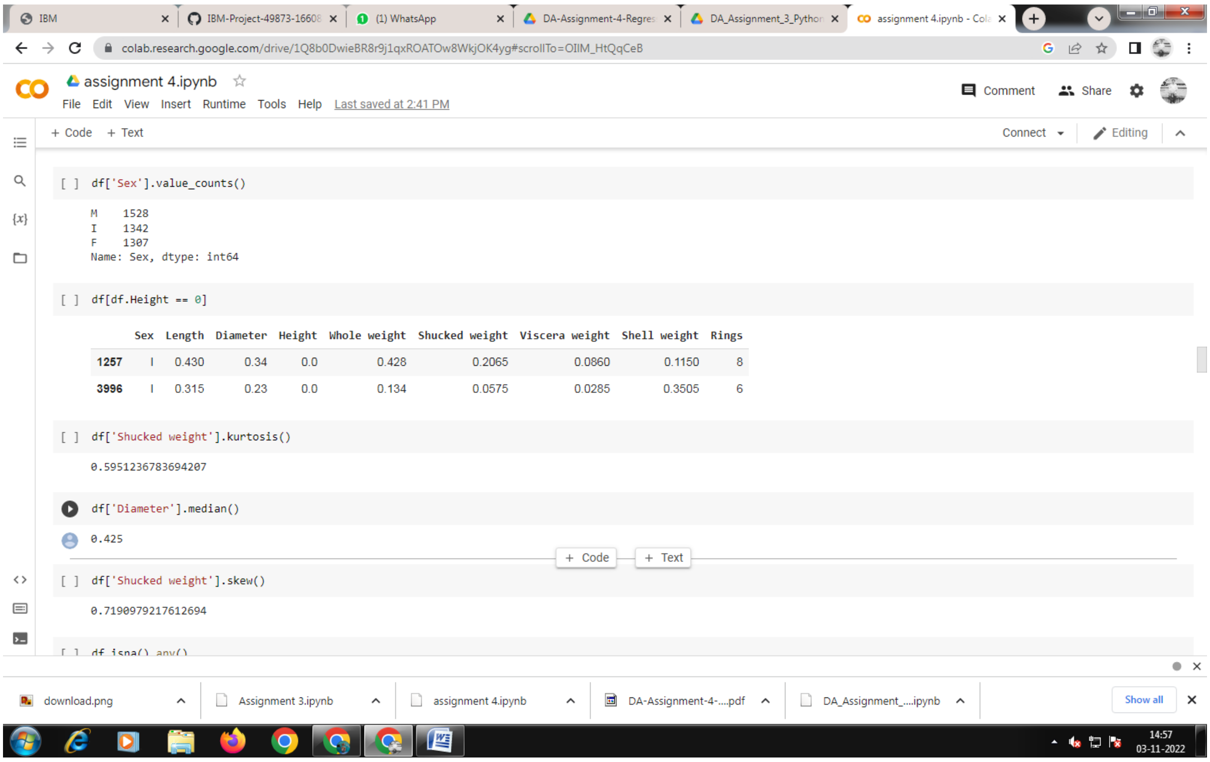
0.425

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

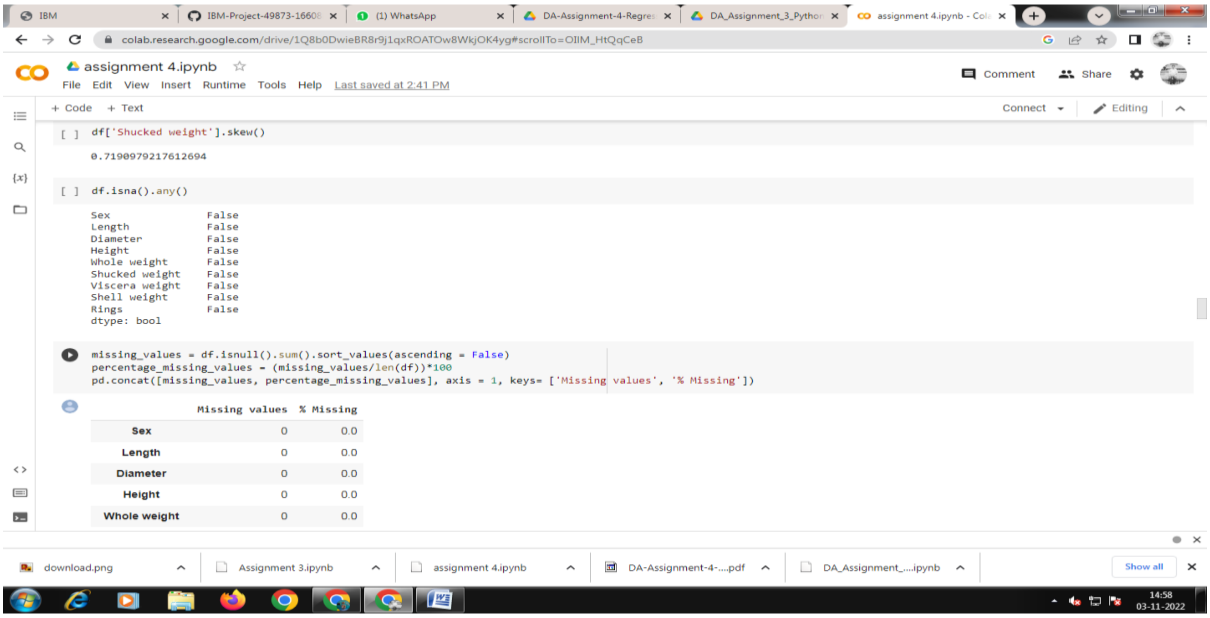
CODING:

```
q1=df.Rings.quantile(0.25)

q2=df.Rings.quantile(0.75)

iqr=q2-q1

print(iqr)
```



OUTPUT:

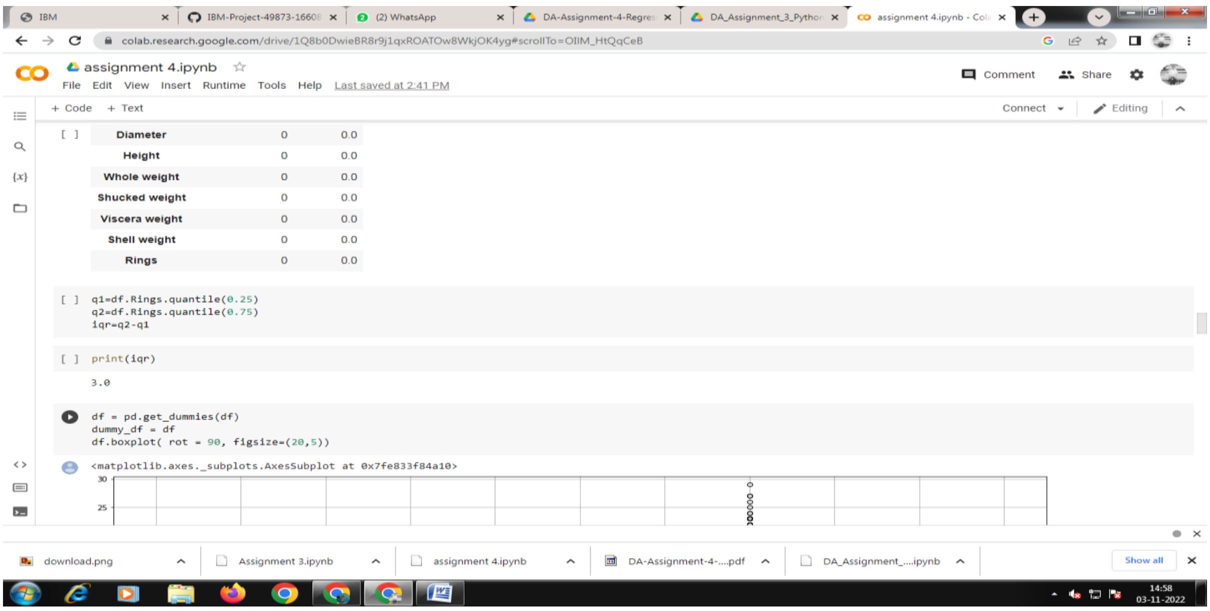
3.0

CODING:

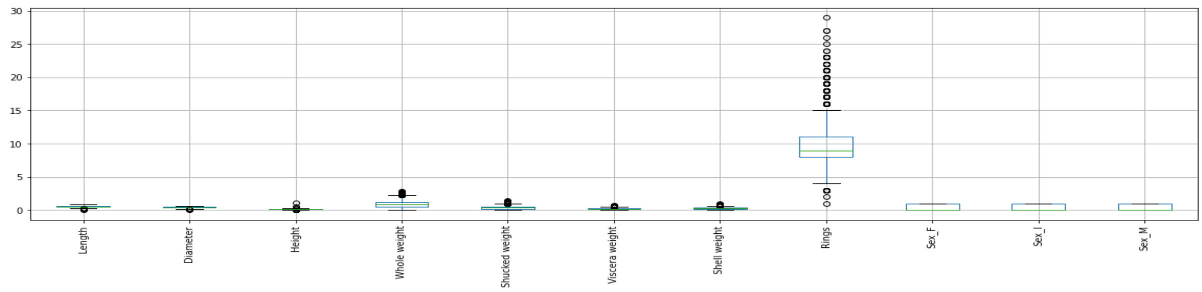
df = pd.get_dummies(df)

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)

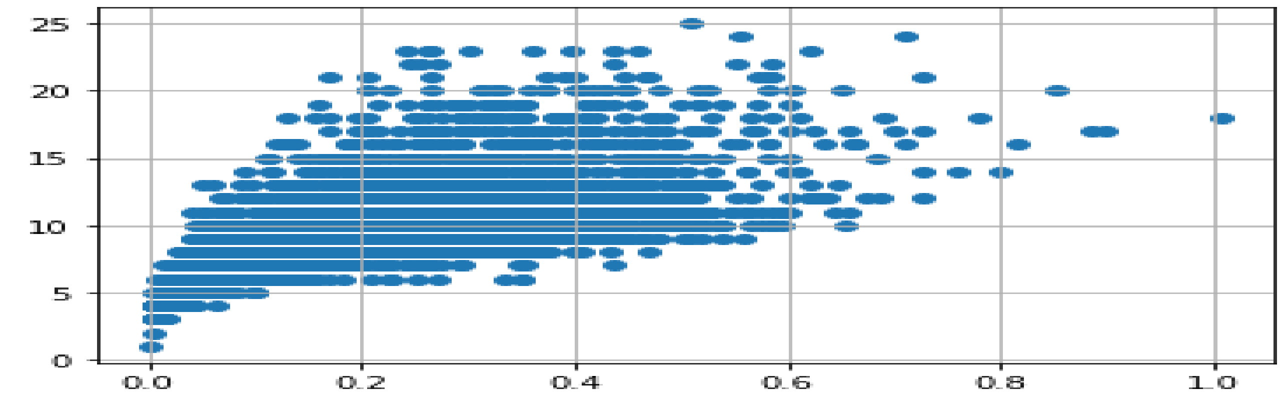
df.drop(df[(df['Viscera weight']<0.5) & (df['age'] > 25)].index, inplace=True)

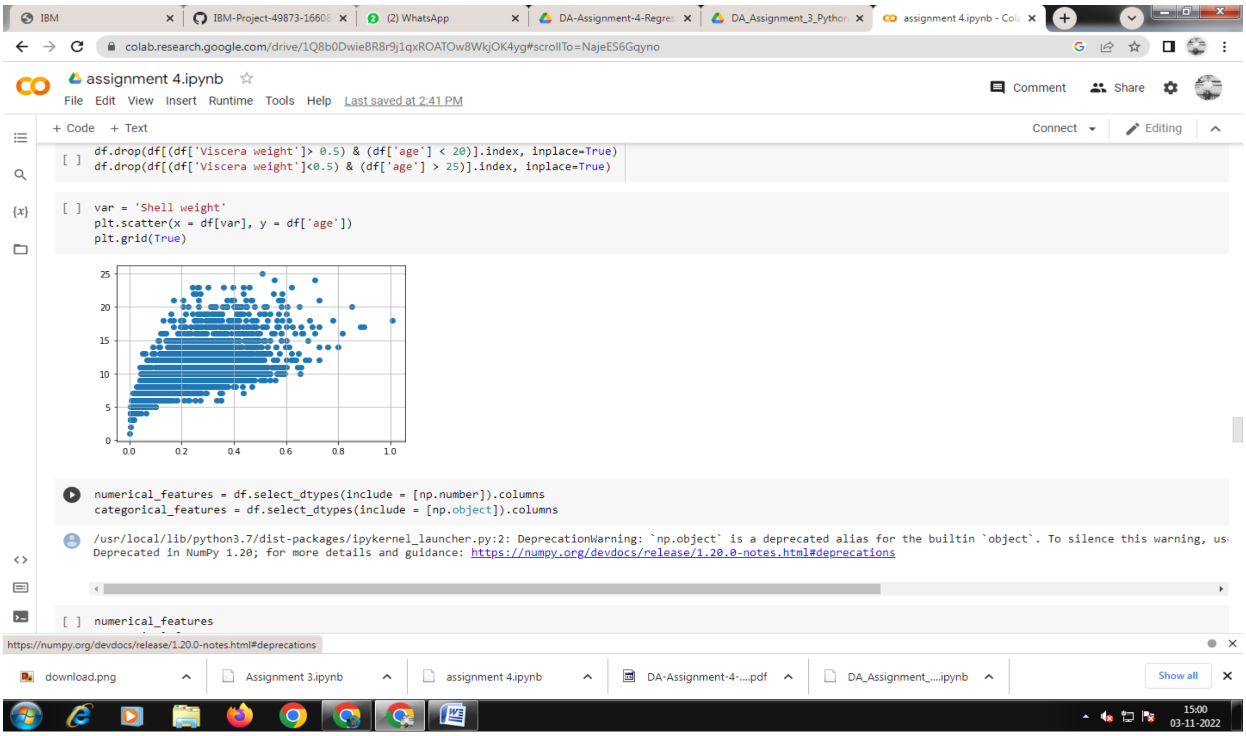
var = 'Shell weight'

plt.scatter(x = df[var], y = df['age'])

plt.grid(True)

OUTPUT:





CODING:

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

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

OUTPUT:

Index([], dtype='object')

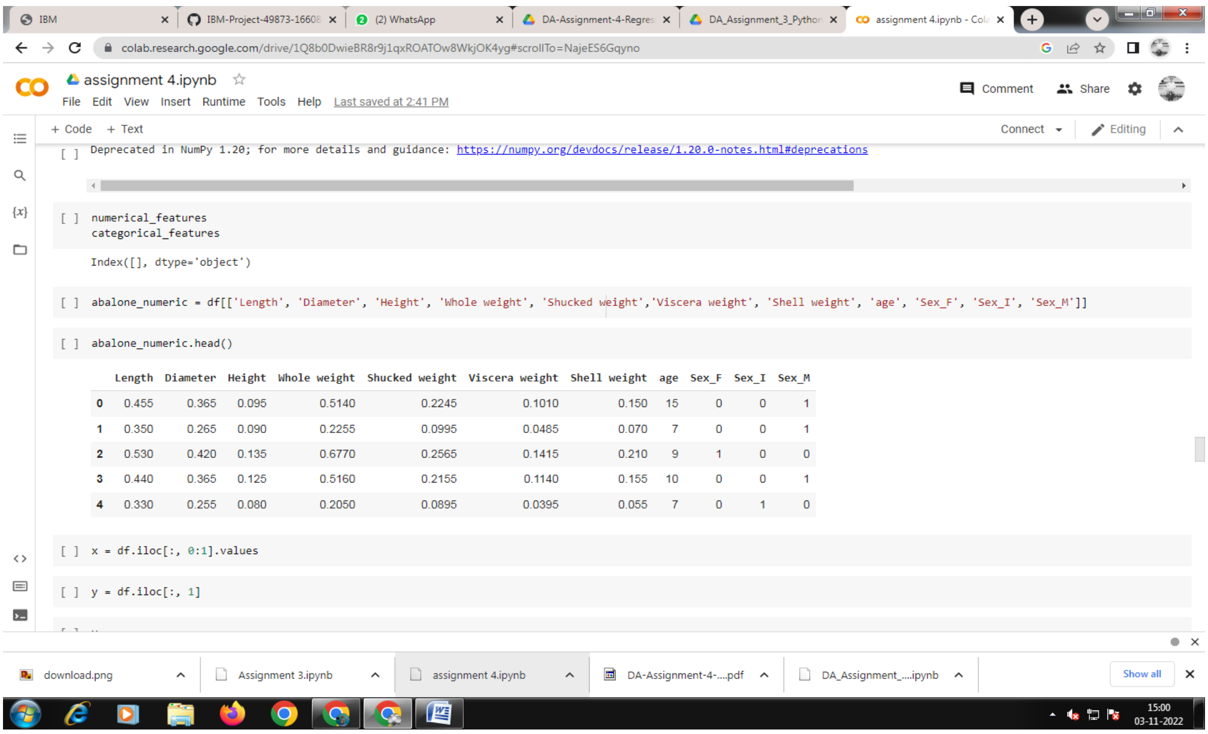
CODING:

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

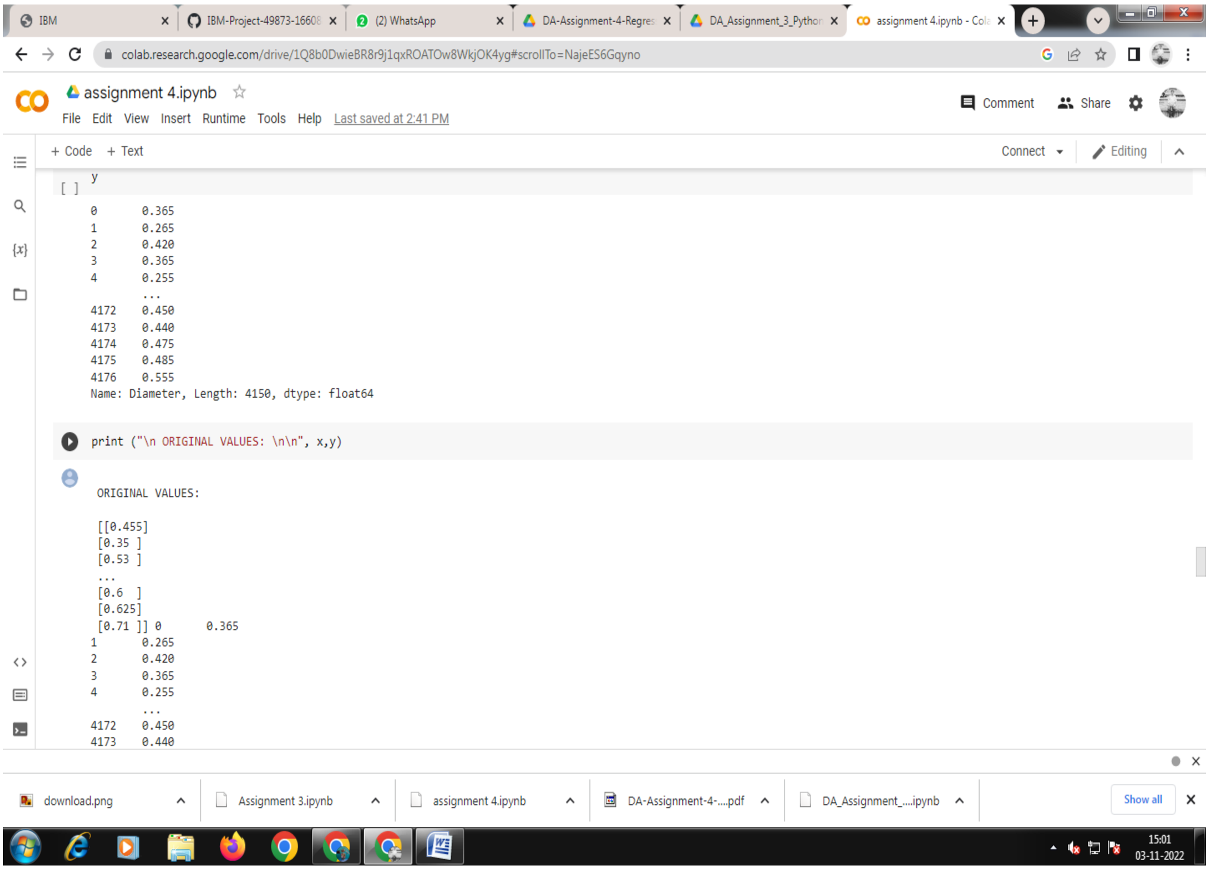
4173 0.440

4174 0.475

4175 0.485

4176 0.555

Name: Diameter, Length: 4150, dtype: float64



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:

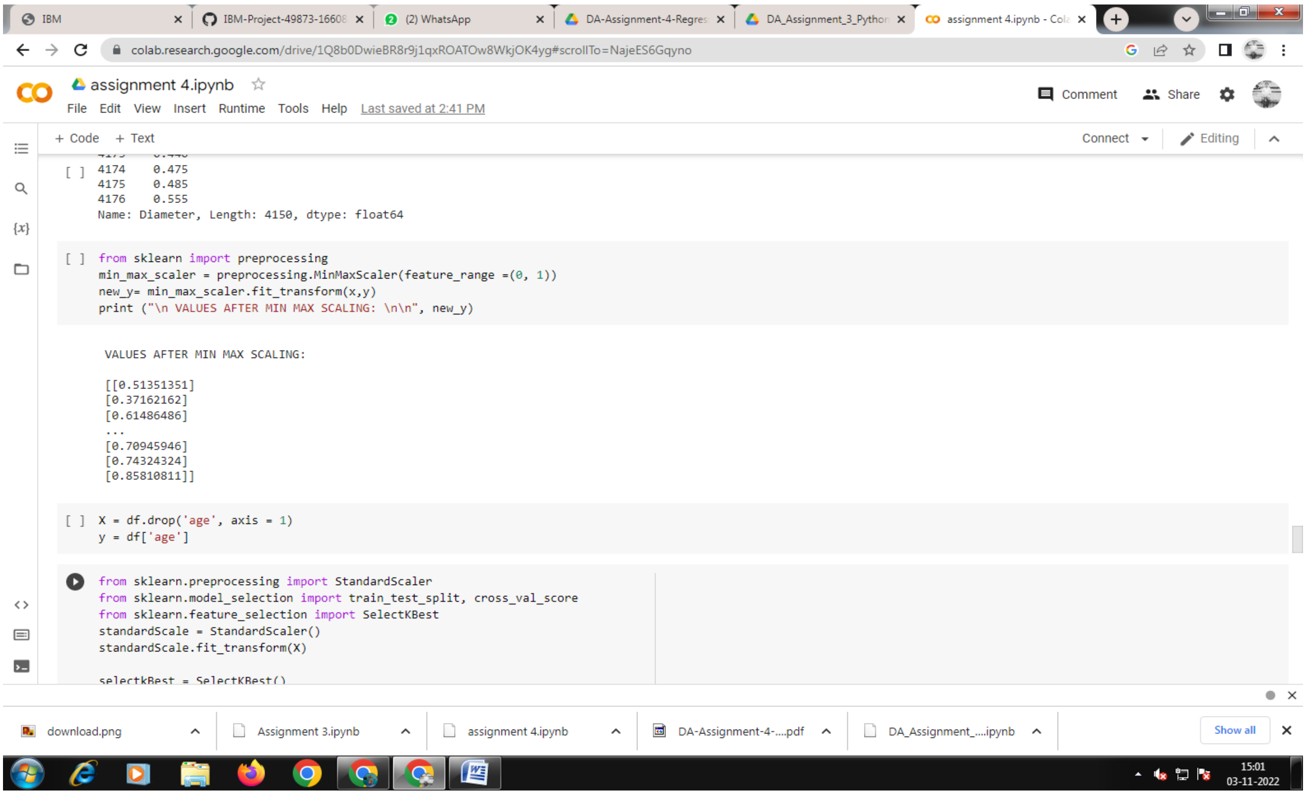
```
[[0.51351351]
 [0.37162162]
 [0.61486486]
 [0.70945946]
 [0.74324324]
 [0.85810811]]
```

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

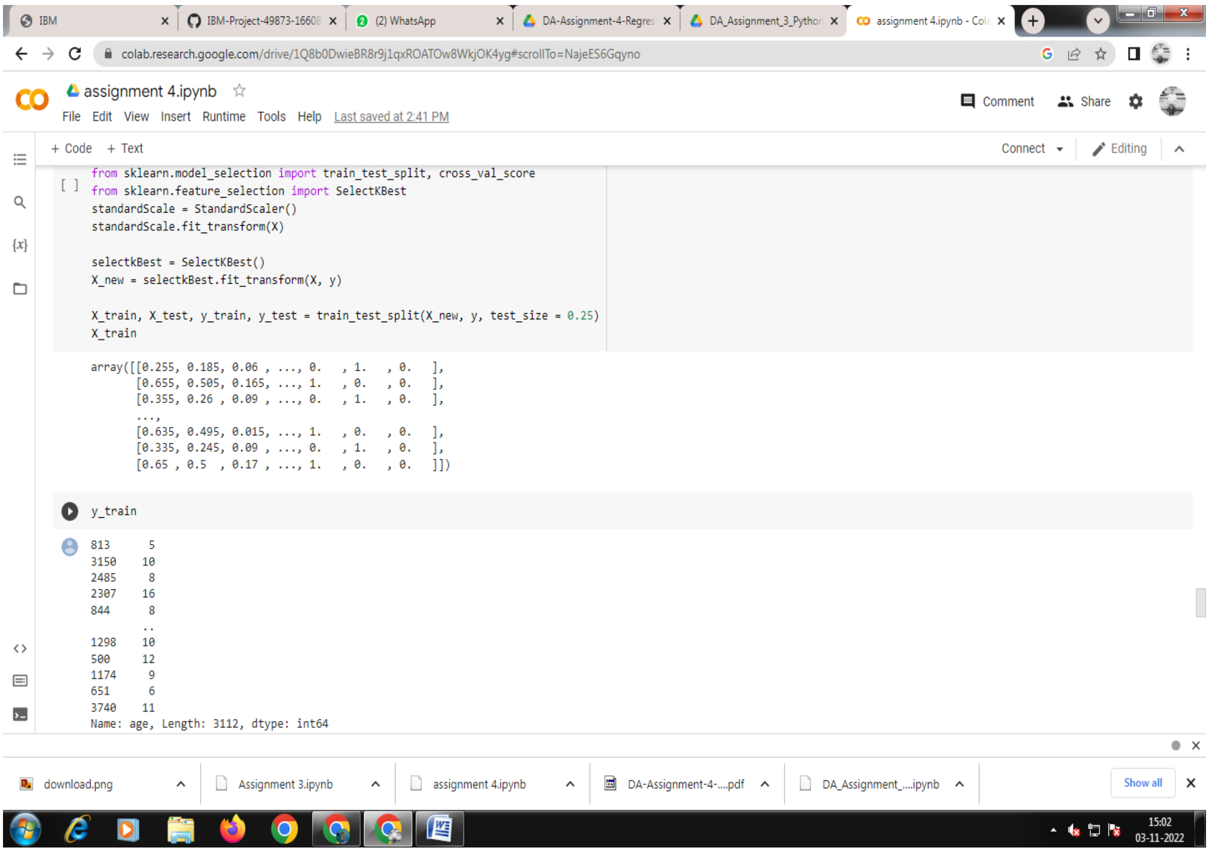
500 12

1174 9

651 6

3740 11

Name: age, Length: 3112, dtype: int64



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)

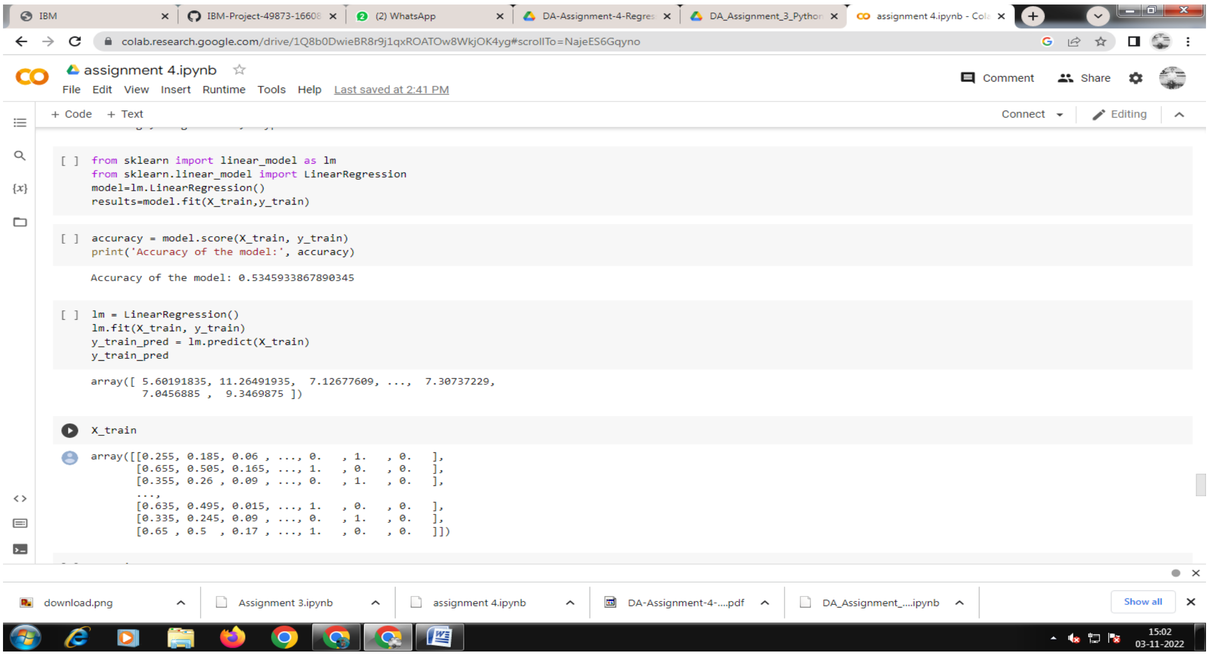
y_train_pred = lm.predict(X_train)

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:

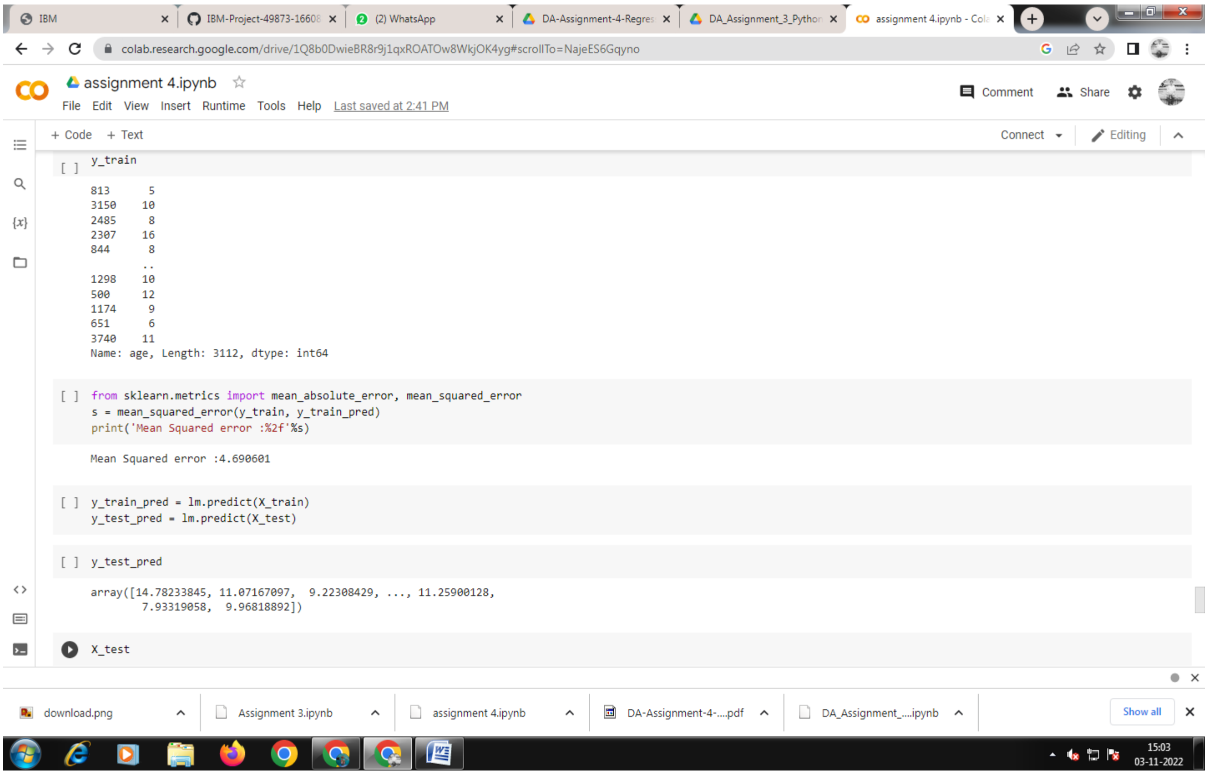
```
Mean Squared error :4.690601
```

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

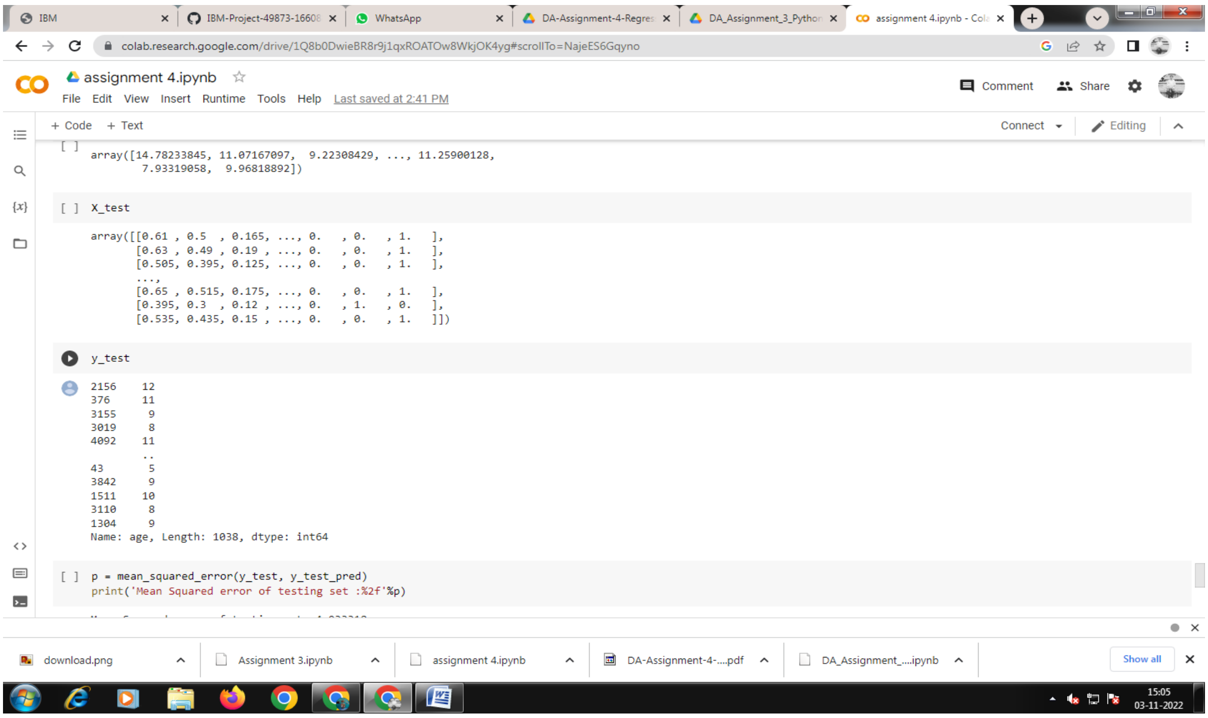
3842   9

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