Fish Market Analysis

This notebook analyzes the data of a fish market. Multiple variables are in the dataset, and we have to look for relationships between the data and build a model that fits it the best by predicting weight of fish species.

Expected: An Accuracy of over 0.75 to be considered acceptable.

Importing the libraries

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

Data Preprocessing

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

	Species	Weight	Length1	Length2	Length3	Height	Width
0	Bream	242.0	23.2	25.4	30.0	11.5200	4.0200
1	Bream	290.0	24.0	26.3	31.2	12.4800	4.3056
2	Bream	340.0	23.9	26.5	31.1	12.3778	4.6961
3	Bream	363.0	26.3	29.0	33.5	12.7300	4.4555
4	Bream	430.0	26.5	29.0	34.0	12.4440	5.1340

```
df.tail()
```

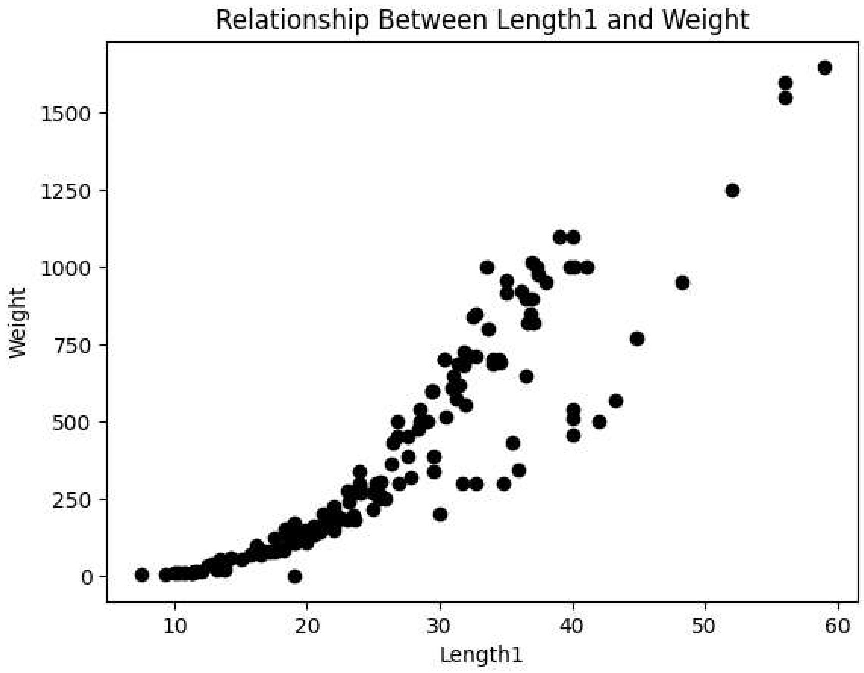
	Species	Weight	Length1	Length2	Length3	Height	Width
154	Smelt	12.2	11.5	12.2	13.4	2.0904	1.3936
155	Smelt	13.4	11.7	12.4	13.5	2.4300	1.2690
156	Smelt	12.2	12.1	13.0	13.8	2.2770	1.2558
157	Smelt	19.7	13.2	14.3	15.2	2.8728	2.0672
158	Smelt	19.9	13.8	15.0	16.2	2.9322	1.8792

```
df.isna()     #check for null values
```

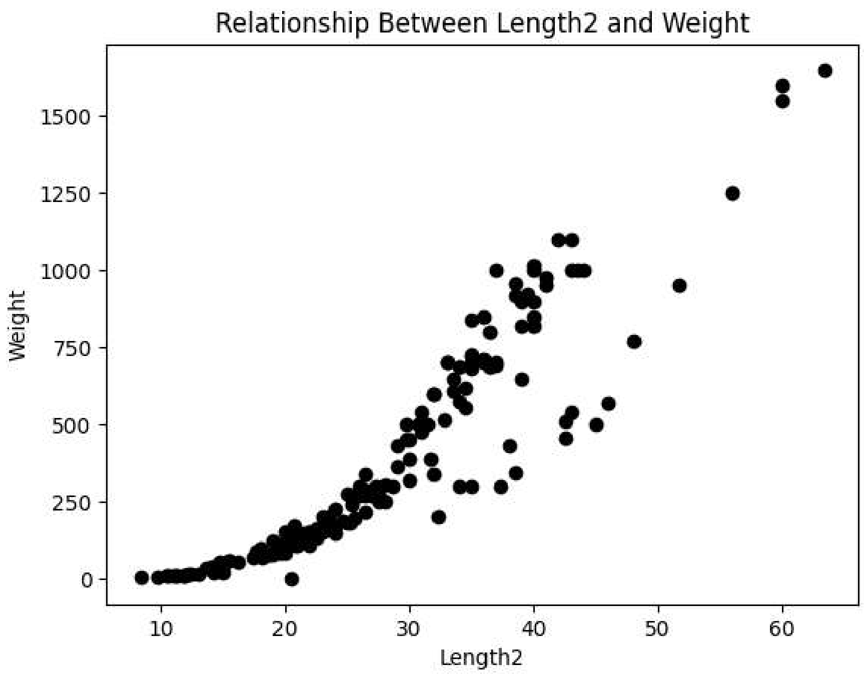
	Species	Weight	Length1	Length2	Length3	Height	Width
0	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False

Visualizing the data

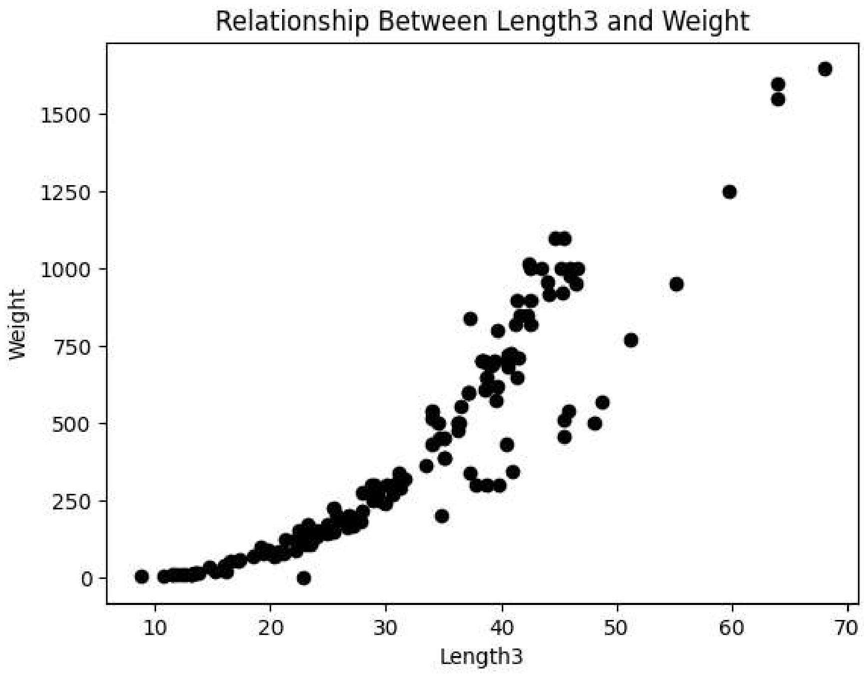
```
plt.scatter(df.Length1.values.tolist(), df.Weight.values.tolist(),color='black')
plt.xlabel('Length1')
plt.ylabel('Weight')
plt.title('Relationship Between Length1 and Weight')
plt.plot()
plt.show()
```



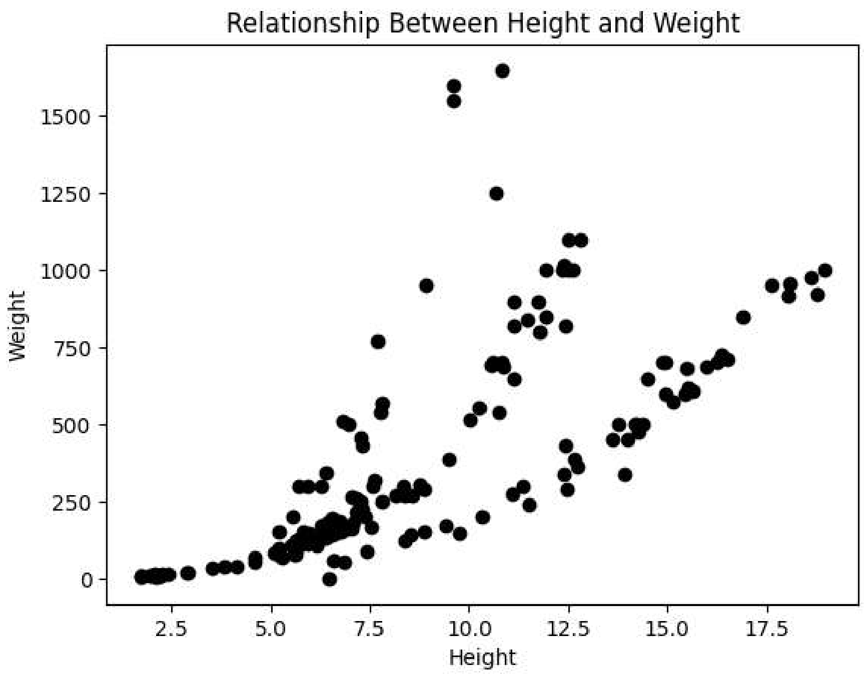

```
plt.scatter(df.Length2.values.tolist(), df.Weight.values.tolist(),color='black')
plt.xlabel('Length2')
plt.ylabel('Weight')
plt.title('Relationship Between Length2 and Weight')
plt.plot()
plt.show()
```



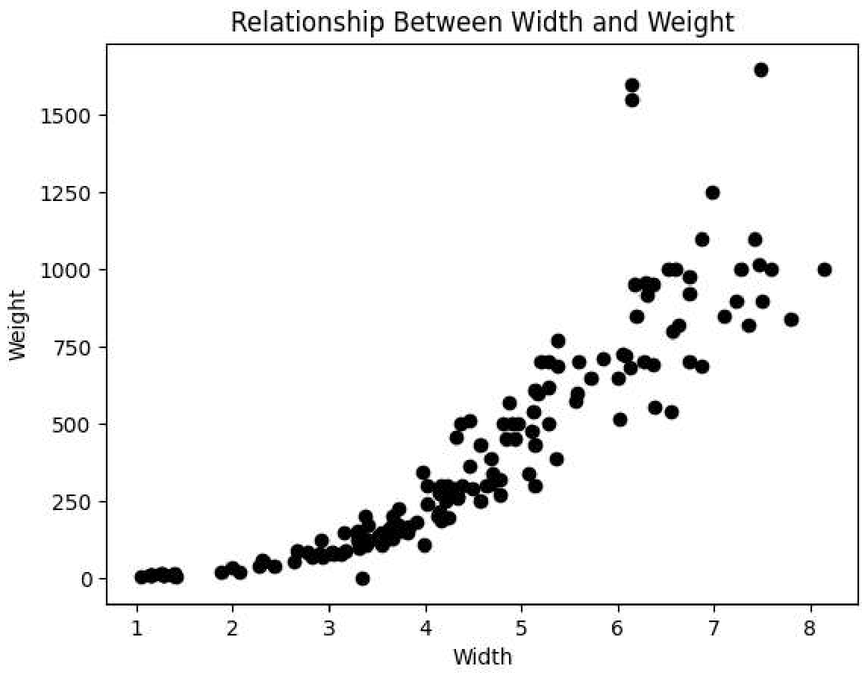
```
plt.scatter(df.Length3.values.tolist(), df.Weight.values.tolist(),color='black')
plt.xlabel('Length3')
plt.ylabel('Weight')
plt.title('Relationship Between Length3 and Weight')
plt.plot()
plt.show()
```




```
plt.scatter(df.Height.values.tolist(), df.Weight.values.tolist(),color='black')
plt.xlabel('Height')
plt.ylabel('Weight')
plt.title('Relationship Between Height and Weight')
plt.plot()
plt.show()
```




```
plt.scatter(df.Width.values.tolist(), df.Weight.values.tolist(),color='black')
plt.xlabel('Width')
plt.ylabel('Weight')
plt.title('Relationship Between Width and Weight')
plt.plot()
plt.show()
```



Quick Sanity check for the dataframe

```
df.head()
```

	Species	Weight	Length1	Length2	Length3	Height	Width
0	Bream	242.0	23.2	25.4	30.0	11.5200	4.0200
1	Bream	290.0	24.0	26.3	31.2	12.4800	4.3056
2	Bream	340.0	23.9	26.5	31.1	12.3778	4.6961
3	Bream	363.0	26.3	29.0	33.5	12.7300	4.4555
4	Bream	430.0	26.5	29.0	34.0	12.4440	5.1340

Re-ordering the features and dependent variables

```
orders_cols = ["Species", "Length1", "Length2","Length3", "Height", "Width","Weight"]
df=df.reindex(columns=orders_cols)
df.head()
```

	Species	Length1	Length2	Length3	Height	Width	Weight
0	Bream	23.2	25.4	30.0	11.5200	4.0200	242.0
1	Bream	24.0	26.3	31.2	12.4800	4.3056	290.0
2	Bream	23.9	26.5	31.1	12.3778	4.6961	340.0
3	Bream	26.3	29.0	33.5	12.7300	4.4555	363.0
4	Bream	26.5	29.0	34.0	12.4440	5.1340	430.0

Perfect. Now, on towards building the model. Species column is the categorical data.

The Model

The model we will use is a multiple linear regression model to predict the weight. At the end, we will compare the weights of our test sets and the ones out model predicted for the test set.

```
# Split into matrix of features and dependant variables
X = df.iloc[: , :-1].values
```

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

Encoding the Categorical Data

```
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import ColumnTransformer
ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), ([0]))], remainder='passthrough')
X = np.array(ct.fit_transform(X))
```

```
print(X)
```

```
[[1.0 0.0 0.0 ... 30.0 11.52 4.02]
 [1.0 0.0 0.0 ... 31.2 12.48 4.3056]
 [1.0 0.0 0.0 ... 31.1 12.3778 4.6961]
 ...
 [0.0 0.0 0.0 ... 13.8 2.277 1.2558]
 [0.0 0.0 0.0 ... 15.2 2.8728 2.0672]
 [0.0 0.0 0.0 ... 16.2 2.9322 1.8792]]
```

Splitting into train and test sets

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3, random_state=0)
```

Training the model

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

```
▾ LinearRegression
LinearRegression()
```

Checking predictions for test sets

```
y_pred = regressor.predict(X_test)
np.set_printoptions(precision=0)
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

```
[[ 398.  390.]
 [ 130.    0.]
 [ 209.  170.]
 [ 210.  160.]
 [ 686.  556.]
 [ 872.  900.]
 [ 663.  800.]
 [ 420.  300.]
 [1004.  975.]
 [ 142.  115.]
 [ 287.  200.]
 [ 526.  456.]
 [ 720. 1000.]
 [1018. 1000.]
 [-115.   60.]
 [  27.   78.]
 [ 164.  145.]
 [ 957. 1600.]
 [ 183.  130.]
 [ 733.  720.]
 [-104.   55.]
 [ 512.  390.]
```

```
 [ 168.  120.]
 [1126. 1650.]
 [ -26.   90.]
 [ 477.  450.]
 [ 708.  700.]
 [ 241.  270.]
 [ 888.  850.]
 [  14.   10.]
 [ 586.  650.]
 [ 166.  110.]
 [ 957. 1550.]
 [ 343.  300.]
 [ 580.  700.]
 [ 271.  225.]
 [ 377.  300.]
 [ 652.  620.]
 [ 708.  700.]
 [ 161.  135.]
 [ 656.  514.]
 [ -98.   40.]
 [ 225.  145.]
 [ 756.  714.]
 [ 146.   20.]
 [ 281.  197.]
 [ 231.  180.]
 [ 289.  218.]]
```

The Model is overfit. Something needs to be done. Hmmm.

```
# Feature Elimination
```

Feature Elimination

```
df.drop('Species',inplace=True,axis=1)
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 159 entries, 0 to 158
Data columns (total 6 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   Length1  159 non-null    float64
 1   Length2  159 non-null    float64
 2   Length3  159 non-null    float64
 3   Height   159 non-null    float64
 4   Width    159 non-null    float64
 5   Weight   159 non-null    float64
dtypes: float64(6)
memory usage: 7.6 KB
```

```
# Running the Model again
X = df.iloc[: , :-1].values
# y is the same dependant variable

X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.3, random_state=0)
reg_model = LinearRegression()
reg_model.fit(X_train, y_train)

score = reg_model.score(X_test, y_test)
print(f"Regression Model Score: {score}")
```

```
Regression Model Score: 0.8136987517934344
```

```
y_pred = reg_model.predict(X_test)
comparison_df = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
print("\nPredicted vs Actual:")
print(comparison_df.head())
```

```
Predicted vs Actual:
   Actual   Predicted
0   390.0  462.904976
1     0.0  176.797928
2   170.0  226.624847
3   160.0  185.662045
4   556.0  663.314987
```

Accuracy of the model

The accuracy of the model comes out to be 0.81 .