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Exercise Set 28: Assessing Fitness; Prediction Intervals

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ENGR 1330 ES-28 - Homework

Exercise 1

Consumer Reports once tabulated the list of vehicle weights versus overall gasoline mileage for several different sizes and types of cars:

Weight (lbs)	Mileage (mpg)
2775	33
2495	27
2405	29
2545	28
2270	34
2560	24
3050	23
3710	24
3085	23
2940	21
2395	26
3325	20
3200	21
3450	19
3515	21
3495	19
4010	19
4205	17
2900	24
2555	28

Weight (lbs)	Mileage (mpg)
2790	21
2190	34

Fit a linear data model to the data, plot the data and model. Determine the equation of the data model and the corresponding RMSE and R^2 value.

Based on your results, how well are the data modeled by a linear data model? How might a better data model be obtained?

In [17]:

```
import pandas as pd
import numpy as np
import math
import matplotlib.pyplot as plt
import statistics
import statsmodels.formula.api as smf

df=pd.read_csv('lab28.csv')
df
```

Out[17]:

	Weight	Mileage
0	2775	33
1	2495	27
2	2405	29
3	2545	28
4	2270	34
5	2560	24
6	3050	23
7	3710	24
8	3085	23
9	2940	21
10	2395	26
11	3325	20
12	3200	21
13	3450	19
14	3515	21
15	3495	19
16	4010	19
17	4205	17
18	2900	24
19	2555	28

	Weight	Mileage
20	2790	21
21	2190	34

In [21]:

```
df.describe()
```

Out[21]:

	Weight	Mileage
count	22.000000	22.000000
mean	2993.863636	24.318182
std	565.455846	5.008434
min	2190.000000	17.000000
25%	2547.500000	21.000000
50%	2920.000000	23.500000
75%	3418.750000	27.750000
max	4205.000000	34.000000

In [22]:

```
weight = df['Weight'].tolist()
print(weight)
milage = df['Mileage'].tolist()
print(milage)
```

```
[2775, 2495, 2405, 2545, 2270, 2560, 3050, 3710, 3085, 2940, 2395, 3325, 3200, 3450, 351
5, 3495, 4010, 4205, 2900, 2555, 2790, 2190]
[33, 27, 29, 28, 34, 24, 23, 24, 23, 21, 26, 20, 21, 19, 21, 19, 19, 17, 24, 28, 21, 34]
```

In [24]:

```
model = smf.ols('Mileage ~ Weight', data=df)
model = model.fit()

slope = model.params[1]
Rsquare = model.rsquared
RMSE = math.sqrt(model.mse_total)
print('The RMSE is:',RMSE,'\nThe R^2 is:',Rsquare)
```

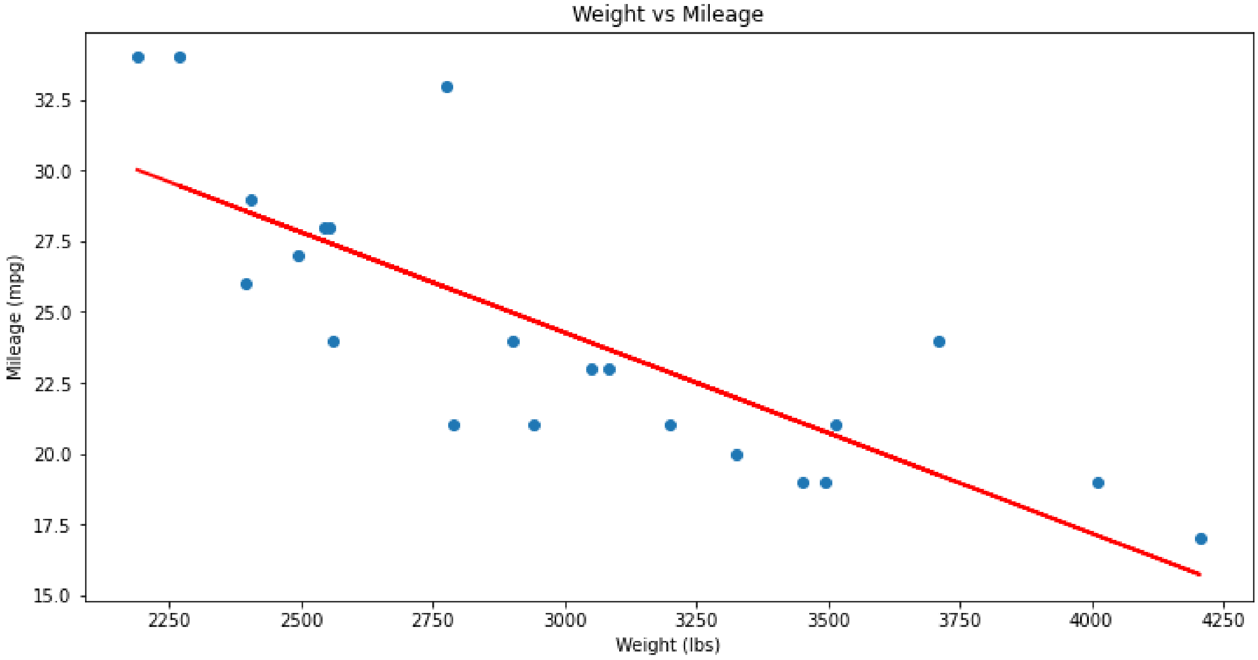
```
The RMSE is: 5.008434444445623
The R^2 is: 0.6422518727541691
```

In [27]:

```
mP = model.predict()


plt.figure(figsize=(12, 6))
plt.plot(df['Weight'], df['Mileage'], 'o')
plt.plot(df['Weight'], mP, 'r', linewidth=2)
plt.xlabel('Weight (lbs)')
plt.ylabel('Mileage (mpg)')
plt.title('Weight vs Mileage')

plt.show()
```



The fit could be improved by the use of prediction bounds along with CI

However overall the fit is great considering the amount of outliers.

```
In [ ]:
```