**MPG Regression**

Looking at the MechaCar mpg dataset, weight, AWD, and spoiler angle provided a non-random amount of variance at 0.531, 0.326, and 0.886 respectively. Knowing this we can assume that the datasets are normal distributions. Since AWD is not a continuous numerical value and more of a categorical value I used these values for the linear model:

lm(formula = mpg ~ `vehicle weight` + `vehicle length` + `ground clearance`, data = mechaCar)

**Coefficients:**

**Estimate Std. Error t value Pr(>|t|)**

**(Intercept) -1.000e+02 1.455e+01 -6.874 1.41e-08 \*\*\***

**`vehicle weight` 1.190e-03 6.946e-04 1.714 0.0933 .**

**`vehicle length` 6.196e+00 6.632e-01 9.343 3.37e-12 \*\*\***

**`ground clearance` 3.522e+00 5.299e-01 6.647 3.09e-08 \*\*\***

**---**

**Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1**

**Residual standard error: 8.897 on 46 degrees of freedom**

**Multiple R-squared: 0.6936, Adjusted R-squared: 0.6736**

**F-statistic: 34.7 on 3 and 46 DF, p-value: 7.089e-12**

Looking at our p-values, vehicle length and ground clearance have a significant impact on mpg since they are below 0.05. Our multiple R-squared value is at about 70% so that means 70% of all predictions using this model will be correct. The p-value of our linear regression is

7.09 \* 10-12 which indicates a high degree of correlation so our slope would not be zero.

One issue with this data is that we are not taking into consideration the 2 classes of systems (AWD and non AWD). For further analysis we could filter the data into 2 separate datasets (AWD and non AWD) and take a look again at correlation and to retest our linear model.

Suspension Coil Summary

Total:

If we check the statistics on the suspension coil group as a whole, we don’t exceed our target variance of 100 pounds per inch:

A screenshot of a cell phone

Description automatically generated

However, I did notice there were some larger values in the 3rd lot so I decided to separate the values and check the statistics again:

By Group:

A screenshot of a cell phone

Description automatically generated

The variance in manufacturing lot 3 is around 200 so that group should be avoided so we won’t exceed the 100 pounds per inch threshold.

Suspension Coil T-Test

If we perform a one sample t-test on our suspension coil data and compare to a mean of 1500, our returned p-value is = 0.5117 which is above our significance level of 0.05. Therefore, we do not have sufficient evidence to reject the null hypothesis and would state the 2 means are statistically similar.

**t.test(suspensionCoil$PSI, mu=mean(1500))**

**One Sample t-test**

**data: suspensionCoil$PSI**

**t = -0.65784, df = 149, p-value = 0.5117**

**alternative hypothesis: true mean is not equal to 1500**

**95 percent confidence interval:**

**1498.122 1500.940**

**sample estimates:**

**mean of x**

**1499.531**

Testing by lot groups we still get values above our significance levels with Lot1 at 0.9048, Lot2 at 0.3451 and Lot3 at 0.637 so we can still prove there is still some statistical significance, but we cannot reject our null hypothesis

Design Your Own Study

If we wanted to study how the MechaCar would compete in the marketplace with other cars, I would collect metrics on the types of safety features being sold with cars (driver assist, pedestrian detection, adaptive cruise control, lane departure, etc) and calculate the frequency of adoption to see if there is a demand for these features to be included into the MechaCar. To form a hypothesis these are the 2 questions we would need to ask:

**Null Hypothesis:** Car safety features do not influence the sale of cars

**Alternative Hypothesis:** Car safety feature do influence car sales

To perform a test we would need to gather categorical data on the amount of cars sold by year with the safety features we would want to track. Because we would be performing a categorical test we would use the chi-squared test and compare the frequency of safety features sold by year. If we see an increase in distribution in our tests we can determine which features are important to customers and incorporate these features into the MechaCar.