Challenge 15

Deliverable 1: ## Linear Regression to Predict MPG

Screenshot – here

Deliverable 2: ## Summary Statistics on Suspension Coils

Screenshot – here 2x

Deliverable 3: ## T-Tests on Suspension Coils

1. Screenshot – here 1x

2. Screenshot – here 3x

# MechaCar Statistical Analysis

## Linear Regression to Predict MPG

- The most non-random amount of variance in the evaluation of mpg is observed in vehicle length and ground clearance variables

- The slope of the linear model is non-zero as a result of the characteristics that are evaluated on mpg -they have a positive slope.

- Does this linear model predict mpg of MechaCar prototypes effectively? Why or why not?

- There are only two factors that affect the mpg of MechaCar prototypes. Those factors are vehicle length and ground clearance. The rest have random amounts of variance in determining mpg.

## Summary Statistics on Suspension Coils

- The design specifications for the MechaCar suspension coils suggest that the variance of the suspension coils should not exceed 100 pounds per square inch. Does the current manufacturing data meet this design specification for all manufacturing lots in total and each lot individually? Why or why not?

- The overall production data show no issue. See below:

![summary psi](https://user-images.githubusercontent.com/104734224/190880143-3c90cbda-a467-43ff-8f8d-5dcb52e54911.png)

- For each lot; however, there is a huge difference in the variance of Lot 3 particularly. It is over 100 pounds per square inch and for that reason it should be look into. See below:

![lot summary](https://user-images.githubusercontent.com/104734224/190880181-cd58ba57-df3e-4471-8b83-35932576e70b.png)

## T-Tests on Suspension Coils

* All of the means were not equal to the population mean of 1500.

- Overall, the average was prety close the population mean, as shown below:

![overall ttest](https://user-images.githubusercontent.com/104734224/190880367-e4b06882-74e2-4e00-9652-74911d4747b7.png)

- However, as mentioned before, lot 3 threw off the mean of the overall lots. Lot 1 had the closest mean to the population mean. See below:

![lot1 ttest](https://user-images.githubusercontent.com/104734224/190880411-0f1de9be-54ab-492e-a3a5-202dbe42619b.png)

![lot 2 ttest](https://user-images.githubusercontent.com/104734224/190880417-5f1831a8-260f-4f2a-b806-4e57a80113e4.png)

![lot 3 ttest](https://user-images.githubusercontent.com/104734224/190880429-dcee5228-4c1d-43c0-9d9f-db95ecaf478b.png)

## Study Design: MechaCar vs Competition

- What metric or metrics are you going to test?

- For this test, I would like to compare how the price of a vehicle is correlated with highway and city fuel efficient miles a vehicle gets.

- What is the null hypothesis or alternative hypothesis?

- To do this, I would set my null hypothesis as: If the MechaCar is not fuel efficient on highways or in cities, the cost of the vehicle will be lower the average vehicle in it's marketshare. The alternative hypothesis would then be: if the MechaCar is fuel efficient on highways and in cities, the the cost of the vehicle will be higher than the average vehicle in it's marketshare.

- What statistical test would you use to test the hypothesis? And why?

- I would run a correlation/linear regression test on this comparing the prices of vehicles in the marketshare for the MechaCar, including the MechaCar, with the number of fuel efficent miles each vehicle gets. The independent variable in this case would be the vehicle price and the dependent variable would be the number of fuel efficient miles each vehicle gets. Given the assumpution made in the null and alternative hypothesis, we would hope to see a positive correlation and a upward sloping linar regression in this model.

- What data is needed to run the statistical test?

- The data needed for this would be the fuel efficient miles (both city and highway) for all the vehicles (regardless of make or model) that are in the same marketshare as the MechaCar. Additionally, this analysis would call for the prices of those vehicles too. It would be interesting to have listed the make and model of each car as well that way we could compare certains makes against one another and develop more in depth analysis.