

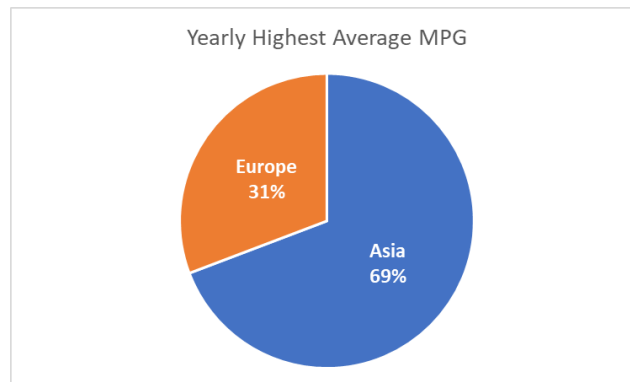
CSC343: Term Project Phase 3

December 3, 2021

Prerak Chaudhari | 1005114760
Jaakulan Subeethakumar | 1005225757

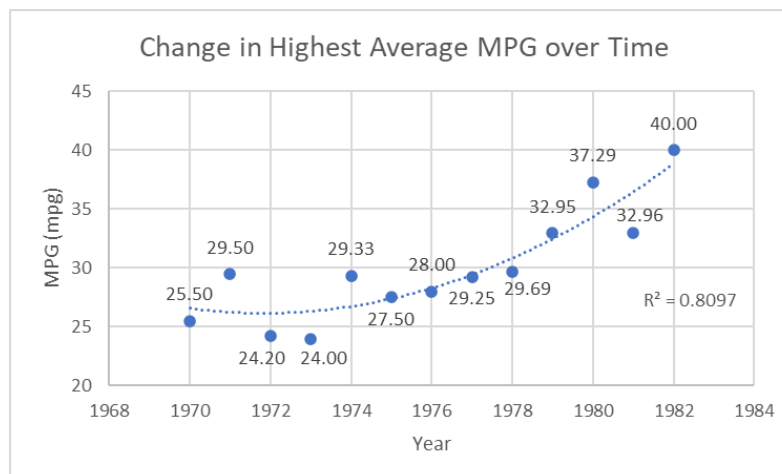
Investigative Question 1

Asia produced cars with the highest average gas mileage 9/13 years in the dataset, with Europe coming in at second place with 4/13. This is not surprising as many modern fuel efficient cars are Asian. These results also show that North American car manufacturers were not focused on making highly fuel efficient cars.

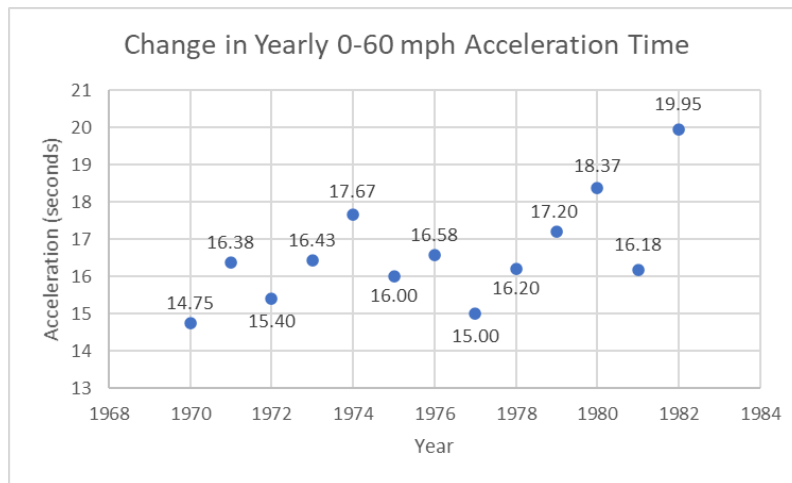


Even though there are over 400 cars in the dataset, Asia only produced 47 cars in these 9 years, and Europe only 22 in 4 years. The overrepresentation of American cars is due to the dataset being created by the American Statistical Association.

From 1970 to 1982, the highest average MPG increased by 14.5. Plotting the yearly highest average MPG and fitting a 2nd-degree polynomial shows an increasing trend of MPG over time. As engine technology got better, car manufacturers would be able to produce more fuel efficient engines.



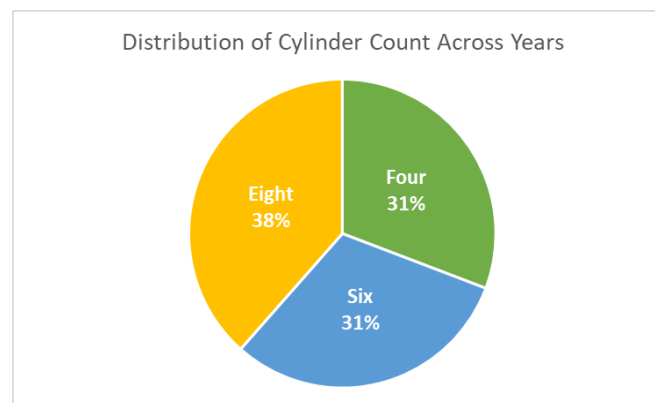
Plotting the yearly average 0-60 mph acceleration time, and comparing the graph with the previous one for yearly highest average MPG, shows that acceleration time was compromised at the expense of maximizing fuel efficiency. Changes in MPG are usually accompanied by an equivalent change in acceleration time. Both MPG and acceleration time increased from 1970 to 1980; then both decreased in 1981; finally, there were massive positive spikes for both in 1982.



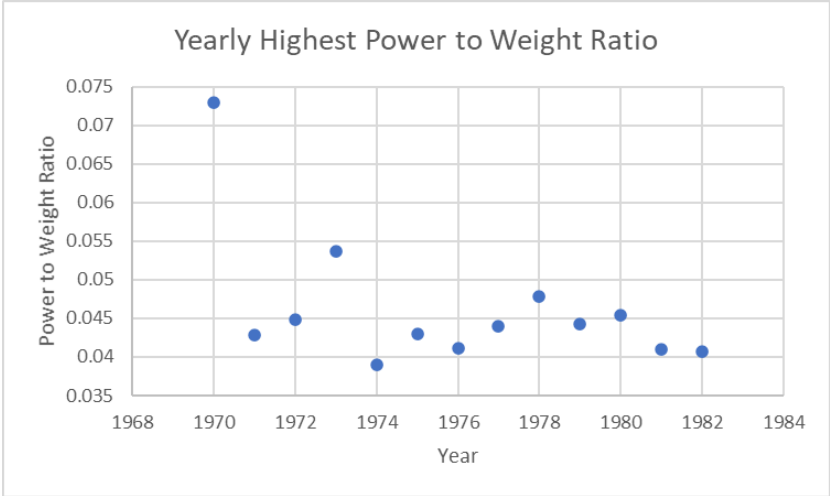
Investigative Question 2

Of the 13 cars found to have the highest power to weight ratio in their respective year, many are made by iconic American car manufacturers. Given that North America never had the highest average MPG for any year in the dataset, we can deduce that American car manufacturers prioritized making highly performant vehicles instead.

Furthermore, of these 13, there are 4 4-cylinders, 4 6-cylinders, and 5 8-cylinders. In the dataset, the cylinder count varies between 3, 4, 5, 6, and 8. Going with the notion that 6 and 8 are “high” cylinder counts, we can see that the majority of these cars have high cylinder counts. This result makes sense because an engine with more cylinders has more pistons simultaneously moving, resulting in more power being generated in less time. If designed correctly, the added weight of introducing more cylinders into an engine would be offset by the gains in horsepower.

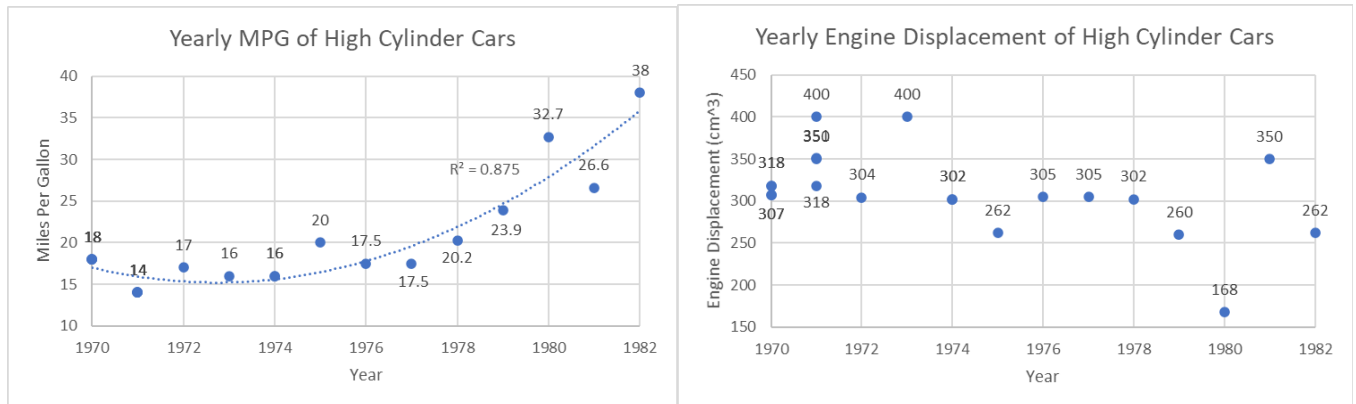


Given we are looking at the power to weight ratio, the individual horsepower and weight of the 13 cars varies greatly. Some are low horsepower, low weight while others are high horsepower, high weight. Plotting the highest power to weight ratio across the years shows that aside from some abnormally high exceptions in 1970 and 1973, it did not greatly change over time. Given that increasing horsepower requires a stronger engine, which in turn increases car weight, it is difficult to see drastic improvements in the power to weight ratio. This tells us that from 1970 to 1982, there likely weren't any drastic changes in steelmaking, manufacturing and other engineering capabilities that would allow car manufacturers to build lighter cars while maintaining horsepower output.



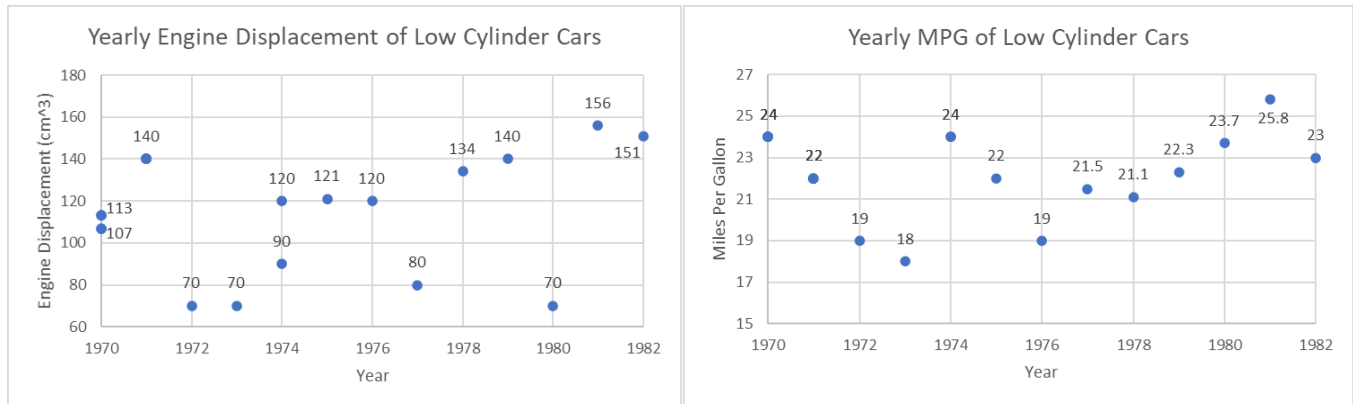
Investigative Question 3

Plotting the engine displacement and gas mileage of the most fuel efficient highest cylinder cars per year shows us that engines have become more fuel efficient over time. Firstly, looking at the MPG graph, with the fitted 2nd-degree polynomial, there is a strong increasing trend, showcasing the improvement in gas mileage as engine technology got better over time.



Secondly, looking at engine displacement, there is a lot of fluctuation year to year, but the massive decreases in 1979, 1980 and 1982 directly correspond to the respective increases in MPG in those same years. This is further proof that car engines were better engineered to use less gas and travel further distances.

Plotting the engine displacement and gas mileage of the least fuel efficient lowest cylinder cars per year shows that there was no significant improvement in raising the fuel efficiency baseline of low cylinder cars. Engine displacement varies from year to year but there seems to be a trend of increasing engine displacement over time. There weren't any significant improvements in gas mileage. MPG continuously decreased from 1970-1973 and 1974-1976 and starting from 1977, there seems to be an increasing trend of MPG over time until the minor dip in 1982.



Plotting the yearly MPG difference between the least fuel efficient low cylinder and most fuel efficient high cylinder cars shows us that up until 1978, all low cylinder cars had better gas mileage than the most fuel efficient high cylinder car. Starting from 1979, the most fuel efficient high cylinder car would have better gas mileage than the least fuel efficient low cylinder car, with significant improvements in the gas mileage differential in 1980 and 1982. This correlates cylinder count and fuel efficiency, showing that lower cylinders make it easier to design a more fuel efficient car. Aside from the -9 and -15 spikes in 1980 and 1982, the negative differentials were very small and since we are comparing fuel efficiency extremes, this just means that high cylinder cars will not always perform worse than low cylinder cars in terms of gas mileage. Shoppers prioritizing fuel efficiency would be looking at lower cylinder cars. On the other hand, the -9 and -15 spikes indicate massive changes in engine technology which enabled building more fuel efficient high cylinder cars. Thus, these same car shoppers, if interested in higher cylinder models, could find a compromise.

Plotting the yearly engine displacement difference between the least fuel efficient low cylinder and most fuel efficient high cylinder cars shows that lower cylinder cars have a significantly lower engine displacement than higher cylinder cars throughout the years. From prior knowledge through phase 1, it is known that the amount of cylinders a car has directly correlates with engine displacement (the amount of fuel outputed for use by the engine) so it makes sense why lower cylinder cars are predisposed for offering better gas mileage on average than higher cylinder cars.

