**Data Analysis Conclusion Summary**

**Overview**

There are many factors that contribute to the cost of purchasing a vehicle, for example, interest rates are higher than they have been and can make a vehicle payment much higher. The cost of manufacturing a vehicle has also risen due to Vehicle Manufacturing strikes, along with parts inventory during the pandemic. Other factors that can affect purchasing a vehicle is remote work caused by the pandemic, and how most families went down to one vehicle per household due to remote work. However, post pandemic, the need for an additional vehicle is rising due to hybrid work. We wanted to look at affordability of purchasing a new vehicle because a few of our project members related to the situation when looking for a new vehicle due to growing families. We have outlined the project goals below:

**What is the average median household income for each region?​**

**What is the average vehicle price for each manufacturer (which make/models)?​**

**Which manufacturer has the most affordable car line/model?​**

**Based on the price of the vehicle, what would the monthly payment be?​**

**Based on the median household income, which vehicles would be affordable assuming the monthly payment is 10% of their gross monthly income?**

**Overview of Data Collection, Exploration, and Cleanup Process**

This project came about unexpectedly, since we were originally looking at baseball data, but we could not find a data set that we liked. So, we decided to look at vehicle prices and began to look at the affordability of purchasing a vehicle in 2023. Once we had some questions, we agreed that we needed to use the Census Data to look at the Average Household Income. We also had to use some vehicle data from the Office of Energy Efficiency and merge it with our 2023 vehicle data.

The collection of the data was done by one project member, since we used one API key, and the cleanup and exploration of the data was done as a collective from the project members.

**Group Approach**

Our group analyzed the data through a series of functions, including using data frames to collect specific data, and adding and merging data from other data sources. Our project group decided that bar charts were able to tell the story much better than other charts.

Minor issues arose during the coding process, in particular to formatting of the charts. As a team, we were able to troubleshoot and go over the code to figure out the issue. The team was very diligent and paid attention to detail if we saw something that was out of place with our codes.

**Results/Conclusion of Analysis**

* **What is the average median household income for each region?​**
  + To understand what the average median household income is, we had to look at the average median age to gauge what the average American family looks like. The median age was already broken down by state in the Census Data, but we wanted to consolidate the average median age by region. Looking at the data, we find that the average median age are Millennials. It was assumed that the households with the average median age listed in the data may have young families, therefore, it was important to look at the affordability of vehicles by type to accommodate growing families. (see additional figures, Fig1 in Figures folder)

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* + When we looked at the average median household income, we decided to compare the per capita income by state and region, so that we can compare the differences between a one-person income and a multiple household income. We also know that some families have more than one vehicle per household, so it was easier to see how much one person could afford a vehicle from our calculations. (see additional figures, Fig2, and Fig3 in Figures folder)

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* **What is the average vehicle price for each manufacturer (which make/models)?​**
  + From our calculations, the average vehicle price per manufacturer ranges from $29k to $160k (for full table, see the vehicle analysis folder. Since we are looking at affordability, it was decided to drop the most expensive vehicle manufacturers from the list, which included Bentley, Rolls Royce, McLaren, Ferrari Lamborghini, Aston Martin, and the most expensive, Bugatti. (see additional figures, average\_by\_make, and average\_by\_type in Figures folder)

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* **Which manufacturer has the most affordable car line/model?​**
  + We took the list from above and showed the top 5 cheapest vehicle manufacturers, that have the most affordable vehicles by average price, and those are Honda, Hyundai, MINI, Fiat, and Mazda. Then, we compared the average price and median price of the top 7 cheapest manufacturers, and there is a small difference in the affordability of the vehicles.

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* **Based on the price of the vehicle, what would the monthly payment be?​**
  + When we look at the Household income by region, the monthly payment for a vehicle, ranges from $459 to $615. However, when we look at the monthly payment for a vehicle by state, the payments range from $400 to $726. For families whose household income may not be able to afford a minimum of $400 for a vehicle, will find it hard to buy a new car. (see additional figures, Fig4, and Fig5 in Figures folder)

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* **Based on the median household income, which vehicles would be affordable assuming the monthly payment is 10% of their gross monthly income?**
  + Since the data is large, we decided to focus on the Average Household Income from the state of Maryland and the Southeast region and calculate the monthly payment based off 10% of their gross monthly income. (see additional figures, Maryland\_afford\_per\_make, Maryland\_afford\_per\_vclass, Southeast\_afford\_per\_make, Southeast\_afford\_per\_vclass in Figures folder)

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The takeaways from analyzing this data is that the most affordable cars by type are not likely fit for growing families that need spacious cars, for example, minivans, large cars, midsize wagons, so the options are limited. We also see that based on the Average Household Income, you have to have an income higher than $55k to afford a new vehicle.

**Next Steps**

With this data, we found that there are so many ways that we can continue to ask questions. Some of the examples of additional ways we can use this data are below:

* Turn the analysis into a time study.​
* Understand the growth rate of vehicle prices vs. income.​
* Identify trends and see if any states/regions are impacted more severely than others.​
* Analyze the need for car (absence of public transportation) in different regions.​
* Analyze Owning vs. Leasing a vehicle.
* Analysis of the used car market.​
* Deeper analysis on sizes and ages of households.​
* How the shift in hybrid and electric vehicles will have an effect in households’ electrical bills.