



Background Information

Each year, Americans drive trillions of miles in their vehicles. Until recently, the number of miles driven increased steadily each year. This drop-off in growth has raised questions if America's car-centric culture is changing.



Problem Statement

In this project, students will project vehicle miles traveled based on different growth rates. The generated values will be compared with statistics from the Federal Highway Administration.

Instructions

IMPORTANT: This is not the actual Exam for your section. You will not receive any credit for completing this project.

IMPORTANT: Complete the steps below in the order they are given. Completing the steps out of order may complicate the assignment or result in an incorrect result.

1. Download and extract the provided Data Files ZIP file. It contains the following files for use in this assignment:
 - a. **mileage.csv** – Federal Highway Administration vehicle miles traveled statistics for the years 1975 through 2015 [1].

Column Name	Type	Description
Year	Number	Year of the data.
Vehicle Miles Traveled	Number	FHWA estimate of vehicle miles traveled (VMT).
1.0% Rate	Number	Projected VMT assuming a 1.0% annual growth rate.
1.5% Rate	Number	Projected VMT assuming a 1.5% annual growth rate.
2.0% Rate	Number	Projected VMT assuming a 2.0% annual growth rate.
2.5% Rate	Number	Projected VMT assuming a 2.5% annual growth rate.
3.0% Rate	Number	Projected VMT assuming a 3.0% annual growth rate.
Average	Number	Empty column.
Maximum	Number	Empty column.
Minimum	Number	Empty column.
Class	Number	Empty column.

2. Begin by creating a new Microsoft Excel workbook named **lastname_firstname_er1_vmt.xlsx**.



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3. We must adjust the sheets in our workbook.
 - a. Rename *Sheet1* to *Mileage*.
 - b. Add a new sheet named *Analysis Questions*.
4. Import the following item into the workbook:
 - a. **mileage.csv** file – Import starting in cell **A4** of the *Mileage* sheet. The file is comma-delimited and has headers.
5. We wish to apply formatting to the *Mileage* sheet.
 - a. Create a table based on cells **A4** through **K45** using a style of your choice. The table has headers.

The table will overlap external data ranges. Convert the selection to a table and remove all external connections.
 - b. For the table, turn on the **Total Row** option.
 - c. Enter text in the cells as indicated below:
 - i. **A1**: Vehicle Miles Traveled
 - ii. **A3**: Annual Growth Rate:
 - iii. **C3**: 1.0%
 - iv. **D3**: 1.5%
 - v. **E3**: 2.0%
 - vi. **F3**: 2.5%
 - vii. **G3**: 3.0%
 - viii. **A46**: Average
 - d. Merge-and-center cells **A1** through **K1**.
 - e. Merge (but not center) cells **A3** through **B3**.
 - f. Apply the *Title* cell style to cell **A1**.
6. We need to perform calculations to analyze the *Mileage* sheet.
 - a. We would like to summarize the vehicle miles traveled and projections.
 - i. In the total row, individually average columns **B** through **G**.
 - ii. In the total row, do not display any statistics in columns **H** through **K**.



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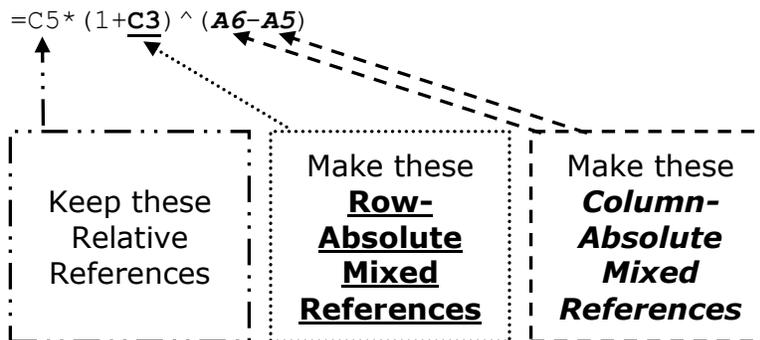
7. On the *Mileage* sheet, we wish to calculate vehicle mileage estimates with different assumptions about the carrying capacity and growth rate.
- We want to estimate future vehicle miles traveled.
 - Enter the formula into the cell as indicated below.

HINT: To avoid errors, copy-and-paste the provided formula.

(1) **C6:** =C5*(1+C3)^(A6-A5)

- We must adjust the future values formula so its cell references are correct when the formula is copied.

In cell **C6**, modify the cell references so they are column-absolute mixed, row-absolute mixed, or relative references as indicated:



- We will now AutoFill the modified formula. Enter the formula into the cells as indicated below:
 - C6** through **G45**: AutoFill the formula from cell **C6**.
- In column **H**, write a formula that, for each year, uses a function to find the average of the projected vehicle miles traveled. Compare each year's projections from columns **C** through **G**.
- In column **I**, write a formula that, for each year, uses a function to find the highest of the projected vehicle miles traveled. Compare each year's projections from columns **C** through **G**.
- In column **J**, write a formula that, for each year, uses a function to find the lowest of the projected vehicle miles traveled. Compare each year's projections from columns **C** through **G**.



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- e. In column **K**, calculate the vehicle mileage class by nesting `IF()` functions to display a class according to the following rules:
 - i. Class of **A** if the average of projected vehicle miles traveled was more than 3,000,000,000,000.
 - ii. Class of **B** if the average of projected vehicle miles traveled was between 2,000,000,000,000 and 3,000,000,000,000.
 - iii. Class of **C** if the average of projected vehicle miles traveled was less than 2,000,000,000,000.
8. We must apply additional formatting to the *Mileage* sheet.
 - a. Format the cells as indicated below:
 - i. **B5** through **J46**: number with no decimal places, use 1000 separator
 - b. AutoFit the widths of columns **A** through **K**.
 - c. Apply the *Green-Yellow-Red* color scale conditional formatting option to cells **B5** through **G45**.
9. We would like to create a chart to plot the vehicle miles traveled over time.
 - a. Create a 2-D line chart based on cells **A4** through **B45** of the *Mileage* sheet. Move the chart to a new sheet named *Mileage Chart*.

Ensure that the years are shown as labels for the horizontal (category) axis, not plotted as chart data. Specify appropriate chart and axis titles.
 - b. Add a trendline based on the average vehicle miles traveled. Use the trendline type that best fits the data and project the values forward 20 periods (through the year 2035). Display the **R-squared** value on the chart.

NOTE: You cannot use the *Moving Average* type for your trendline.
10. To better understand our data, we wish to create a PivotTable.
 - a. Create a new PivotTable based on the data in cells **A4** through **K45** of the *Mileage* sheet. Place the PivotTable on a new sheet named *Mileage PivotTable*.
 - b. On the PivotTable do the following:
 - i. Add the year as a **Rows** field.
 - ii. Add the vehicle miles traveled as a **Values** field.



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- c. We need to perform formatting on our PivotTable.
 - i. Group the years into sets of 10 starting at 1975.
 - ii. Summarize the vehicle miles traveled by averaging them.
 - iii. Format the cells as indicated below:
 - (1) **Average of Vehicle Miles Traveled field**: number with no decimal places, use 1000 separator
11. We need to setup the *Analysis Questions* sheet so that it can store responses to the analysis questions.
 - a. Enter text in the cells as indicated below:
 - i. **A1**: Question Number
 - ii. **B1**: Response
 - b. Bold the contents of row **1**.
 - c. AutoFit the width of column **A**. Set the width of column **B** to 100 (8.39”).
 - d. Set the height for rows **2** through **5** to 110 (1.53”).
 - e. Change the vertical alignment setting for columns **A** and **B** so that the text is displayed at the top of each row.
 - f. Turn on text wrapping for column **B**.
12. Starting in row **2** of the *Analysis Questions* sheet, answer four of the five analysis questions below. Respond to one question per row.
 - a. Which trendline type did you use on *Mileage Chart*? Why did you choose this type of trendline?
 - b. Despite some drop-offs in growth of vehicle mileage, there is a steady increase in annual vehicle miles driven over time. What do you think is the main reason behind this?
 - c. The annual growth rate for vehicle miles traveled has slowed in recent years. The average annual increase from 1975 to 1985 was 3.0% but was only 0.5% from 2005 to 2015. What are some potential reasons for this slowed growth?
 - d. Vehicle mileage experienced the greatest drop-offs in 1980 (-1.7%) and 2009 (-1.5%). What is a possible reason for these downturns? Provide at least one such reason.
 - e. Of our projections, which growth rate best matches the vehicle miles traveled between 1975 and 2015? Do you think the growth rate is still a reasonable fit going forward into the future? Explain your answer.



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Grading Rubric

This is a practice assignment and is worth no points. A comparable Exam would be worth 100 points and graded using this rubric, with partial credit awarded as appropriate:

Steps 3a-b	3 points total	Steps 8a-c	6 points total
Step 4	5 points	Step 9a	6 points
Steps 5a-f	8 points total	Step 9b	4.5 points
Step 6a	5 points	Steps 10a-c	7.5 points total
Step 7a	15 points	Steps 11a-f	5 points total
Steps 7b-e	15 points total	Steps 12a-e (pick 4 of 5)	5 points each

The analysis questions in Steps 12a-e will be evaluated using this rubric:

Standard	Meets Requirements (2.5 points)	Does Not Meet Requirements (0 points)
Answer is reasonable.	Answer addresses the question prompt and is factually correct or a reasonable interpretation of available data.	Answer does not address the question prompt, is factually incorrect, or is an unreasonable interpretation of available data.
Answer is supported.	Logical rationale is provided to support the given answer.	Logical rationale is not provided to support the given answer.

Acknowledgments

The image in the introduction appears courtesy of KVAL [2].

References

- [1] "Moving 12-Month Total Vehicle Miles Traveled," *Federal Reserve Bank of St. Louis*, Sep. 16, 2016. Available: <https://fred.stlouisfed.org/series/M12MTVUSM227NFWA>.
- [2] *Odometer*. Available: http://media.kval.com/images/070220_odometer.jpg.