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].

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

2. Create a new Microsoft Excel workbook named lastname_firstname_er1_vmtpt.xlsx.
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:

5. We wish to apply formatting to the Mileage sheet.
   a. We must setup a table to store data on vehicle mileage.
      i. If a table does not already exist in cells A4 through K45, create one using a style of your choice. The table has headers and will overlap external data ranges. If prompted, convert the selection to a table and remove all external connections.
      ii. If a table already exists in cells A4 through K45, format the table using a style of your choice other than the default table style.
   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
   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.
7. On the *Mileage* sheet, we wish to calculate vehicle mileage estimates with different assumptions about the carrying capacity and growth rate.

a. We want to estimate future vehicle miles traveled.
   
   i. 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)

   ii. 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:

   ![Diagram of cell references]

   iii. We will now AutoFill the modified formula. Enter the formula into the cells as indicated below:

   (1) **C6 through G45:** AutoFill the formula from cell **C6**.

b. 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**.

c. 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**.

d. 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**.
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 $R^2$ 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.
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.
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:

<table>
<thead>
<tr>
<th>Steps</th>
<th>3 points total</th>
<th>Steps</th>
<th>6 points total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a-b</td>
<td></td>
<td>8a-c</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>9a</td>
<td></td>
</tr>
<tr>
<td>5a-f</td>
<td></td>
<td>9b</td>
<td></td>
</tr>
<tr>
<td>6a</td>
<td></td>
<td>10a-c</td>
<td></td>
</tr>
<tr>
<td>7a</td>
<td></td>
<td>11a-f</td>
<td></td>
</tr>
<tr>
<td>7b-e</td>
<td></td>
<td>12a-e (pick 4 of 5)</td>
<td>5 points each</td>
</tr>
</tbody>
</table>

Steps 5a-f 8 points total
Steps 10a-c 7.5 points total
Steps 11a-f 5 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:

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

Acknowledgments

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

References