Background Information
For over thirty years, the Morgantown Personal Rapid Transit system has provided an efficient means of traveling between West Virginia University’s three campuses. Over the course of a year, PRT vehicles travel over 850,000 miles and transport nearly 2.4 million passengers, all while achieving 98% uptime.

Problem Statement
In this project, students will analyze Morgantown PRT usage and reliability statistics to find patterns in usage and system failures.

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

1. Download the following files onto your computer:
   a. availability.xml – Information on PRT system availability from January 1985 to September 2012.
      
      | Column Name            | Type     | Description                                                  |
      |------------------------|----------|--------------------------------------------------------------|
      | Month                  | Date/Time| Year and month of the data.                                  |
      | System Dependability   | Percentage| Percentage of scheduled hours the system was operating correctly. |
      | Trip Reliability       | Percentage| Percentage of started trips that finished without trouble.   |
      | Scheduled Hours        | Number   | Number of hours the system was scheduled to operate.         |
      | Operated Hours         | Number   | Number of hours the system was actually operational.         |
      | Downtime Events        | Number   | Number of times the system had downtime in the month.        |
   b. usage.xml – Data on PRT usage from January 1985 to September 2012.
      
      | Column Name            | Type     | Description                                                  |
      |------------------------|----------|--------------------------------------------------------------|
      | Month                  | Date/Time| Year and month of the data.                                  |
      | Miles Traveled         | Number   | Number of miles traveled in the month.                       |
      | Passengers             | Number   | Number of passengers in the month.                           |
      | Average Operational    | Number   | Average number of vehicles that operated during the month.   |
      | Vehicles               | Number   |                                                               |
      | Service Days           | Number   | Number of days the system was scheduled to operate in the month. |

2. Begin by creating a new Microsoft Excel workbook named lastname_firstname_mpup.xlsx.
3. We must adjust the sheets in our workbook.
   a. Rename *Sheet1* to *Usage*.
   b. Rename *Sheet2* to *Availability*.
   c. Rename *Sheet3* to *Analysis Questions*.

4. We must import the PRT usage data into the *Usage* sheet.

   Using the **DATA** ribbon, import the data from *usage.xml* and place it starting in cell *A3*. Excel will have to create a schema based on the XML source data. The data will be imported as an XML table.

5. We wish to apply some additional formatting to the *Usage* sheet.
   a. We need to add additional columns to store usage data.
      i. Insert four new table columns to the right of column *E*.
   b. For the table, turn on the **Total Row** option.
   c. Enter text in the cells as indicated below.
      i. *A1*: PRT Usage - Firstname Lastname
      ii. *F3*: Miles Rank
      iii. *G3*: Passengers Rank
      iv. *H3*: Miles per Day
      v. *I3*: Passengers per Day
      vi. *A337*: Average
   d. Merge-and-center cells *A1* through *I1*.
   e. Set the font size to 16-point for cell *A1*.
   f. Format the table using a style of your choice other than the default table style.

6. We need to perform some additional calculations to analyze the *Usage* sheet data.
   a. There is nothing to do for this step. Please proceed to the next step.
   b. In column *F*, use the **RANK()** function to rank each month by the number of miles traveled.
   c. In column *G*, use the **RANK()** function to rank each month by the number of passengers.
   d. There is nothing to do for this step. Please proceed to the next step.
e. In column H, calculate the average distance each day using the formula:
\[
\frac{\text{Miles Traveled}}{\text{Service Days}}
\]

f. In column I, calculate the average number of passengers per day using the formula:
\[
\frac{\text{Passengers}}{\text{Service Days}}
\]

g. There is nothing to do for this step. Please proceed to the next step.

h. In columns H and I, delete the contents of any cell displaying a divide-by-zero error (\#DIV/0). These occur in cases where the PRT was not operational during the month.

i. We would like to summarize our usage data.
   i. There is nothing to do for this step. Please proceed to the next step.
   ii. In the total row, individually find the averages for columns B, C, D, E, H, and I.
   iii. There is nothing to do for this step. Please proceed to the next step.
   iv. There is nothing to do for this step. Please proceed to the next step.

7. We must apply additional formatting to the Usage sheet.
   a. Add borders to the cells as indicated below:
      i. F3 through F337: left – thick solid line
   b. Format the cells as indicated below:
      i. B4 through G337: number with no decimal places, display 1000 separator
      ii. H4 through I337: number with 1 decimal place, display 1000 separator
   c. AutoFit the widths of columns A through I.
   d. Apply conditional formatting to the average number of passengers per day in cells I4 through I336.
      i. If the average number of passengers was at least 10,000 (\( \geq 10000 \)), change the cell fill color to green and the text color to white.
      ii. If the average number of passengers was less than 5,000 (\( < 5000 \)), change the fill color to red and the text color to white.
8. We must import the PRT availability data into the Availability sheet.

   Using the DATA ribbon, import the data from availability.xml and place it starting in cell A3. Excel will have to create a schema based on the XML source data. The data will be imported as an XML table.

9. We also wish to apply some formatting to the Availability sheet.
   a. Insert one new table column to the right of column F.
   b. Enter text in the cells as indicated below:
      i. A1: PRT Availability
      ii. G3: Average Downtime Duration
   c. Merge (but do not center) cells A1 through G1.
   d. Apply the Title formatting style to cell A1.
   e. Format the table using a style of your choice other than the default table style.

10. On the Availability sheet, we wish to calculate availability statistics.
    a. In column G, calculate the average downtime duration using the formula:
       \[
       \frac{([\text{Scheduled Hours}] - [\text{Operated Hours}])}{[\text{Downtime Events}]}
       \]
    b. In column G, delete the contents of any cell displaying a divide-by-zero error (\#DIV/0). These occur in cases where there were no downtime events.

11. We must apply additional formatting to the Availability sheet.
    a. Format the cells as indicated below:
       i. B4 through C336: percentage with 1 decimal place
       ii. D4 through E336: number with 1 decimal place
       iii. F4 through F336: number with no decimal places
       iv. G4 through G336: number with 2 decimal places
    b. AutoFit the widths of columns A through G.

12. 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.

d. Set the height for rows 2 through 5 to 110.

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.

13. Beginning in cell B2 on the Analysis Questions sheet, type your answers to four of the five below questions. Respond to one question per row and indicate which question you are answering in column A.

a. In recent years, system dependability has tended to be worse in the winter than in other times of the year. Why might this be the case?

b. There are normally more passengers riding the PRT during Fall semesters than Spring semesters. Why might this be the case?

c. During high usage periods, PRT cars travel directly from one station to another while bypassing intermediate stations. During lower usage periods on nights, weekends, and summers, however, it operates as a circulator and stops at each station. What might be an advantage to this circulator mode?

d. System dependability measures the percentage of time that the PRT was functioning as designed. Trip reliability refers to the likelihood that a trip between stations would finish without encountering problems. Why is the trip reliability so much better than the system dependability?

e. Currently, PRT riders who are not WVU students or employees must pay $0.50 per trip. Assume that this charge was eliminated. Aside from not receiving the $0.50 for each trip, what might be the financial impact of this change?

Curriculum Information

Project Type
Microsoft Excel spreadsheet

Relationship to GEC Objective 2
In this assignment, students perform data management and analysis on statistics related to the Morgantown PRT. They explore the data to understand usage trends and the reasons for them, as well as possible impacts of changing PRT operations.

Relationship to GEC Objective 4
The PRT provides WVU students with a cost-efficient alternative to traveling between the various campuses. The PRT and public transit usage in general has a variety of spin-off effects on the Morgantown area. In this problem, students try to
understand how the PRT is used now and how it could be more effectively applied to help improve transportation in the community.

**Grading Rubric**

This project is worth 60 points and will be graded based upon the following components. The instructor may adjust the below values as he or she feels appropriate:

<table>
<thead>
<tr>
<th>Steps 3a-c</th>
<th>2 points total</th>
<th>Steps 7d(i)-(ii)</th>
<th>5 points total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 4</td>
<td>3 points</td>
<td>Step 8</td>
<td>3 points</td>
</tr>
<tr>
<td>Steps 5a-f</td>
<td>4 points total</td>
<td>Steps 9a-e</td>
<td>3 points total</td>
</tr>
<tr>
<td>Steps 6a-d</td>
<td>6 points total</td>
<td>Steps 10a-b</td>
<td>4.5 points total</td>
</tr>
<tr>
<td>Steps 6e-h</td>
<td>6 points total</td>
<td>Steps 11a-b</td>
<td>1.5 points total</td>
</tr>
<tr>
<td>Steps 6i(i)-(iv)</td>
<td>4.5 points total</td>
<td>Steps 12a-f</td>
<td>3.5 points total</td>
</tr>
<tr>
<td>Steps 7a-c</td>
<td>2 points total</td>
<td>Steps 13a-e (pick 4 of 5)</td>
<td>3 points each</td>
</tr>
</tbody>
</table>