Problem set 1

due Monday, September 8, 2025 at 11:59am

Instructions Upload your `.ipynb` notebook to gradescope by 11:59am on the due date. Please include your name, Problem set 1, and any collaborators you worked with in a text cell at the top of your notebook. Please also number your problems in some way and include comments in your code to indicate what part of a problem you are working on.

Problem 1

Suppose you tracked the number of hours you spent each day talking to an AI for a week. Create a vector with the following values and store it as `ai_hours`: 2 3 4 2 5 0 4. Use R's built-in functions to calculate the total number of hours you talked to the AI that week, the average number of hours per day, and the minimum number of hours spent in a single day. Finally, perform a comparison operation on the `ai_hours` vector to determine which days you spent less than two hours talking to the AI.

Problem 2

Create the matrix given below and store it as `my_matrix`. Use an R function to return what type of object `my_matrix` is. Then, perform a mathematical operation on the matrix by multiplying every element by 2. Using the original matrix, perform another operation by adding 10 to every element.

```
     [,1] [,2] [,3]
[1,]   10   13   16
[2,]   11   14   17
[3,]   12   15   18
```
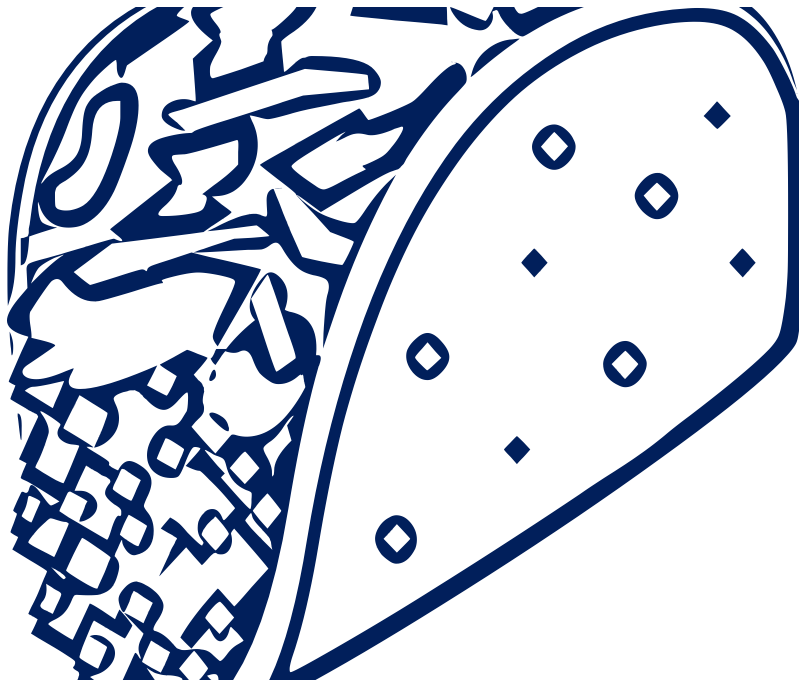
Problem 3

Use `data.frame()` to create the dataframe shown below. Store the dataframe as `syntax`. Return the dataframe. Then use one of R's built in functions to return the structure of the data frame.

```
                    sentence grammatical rt_ms confidence
1      The cat chased the mouse.        TRUE  1200          5
2      The mouse the cat chased.       FALSE  1800          2
3      Chased the cat the mouse.       FALSE  2000          1
4 The cat, it chased the mouse.        TRUE  1500          4
```
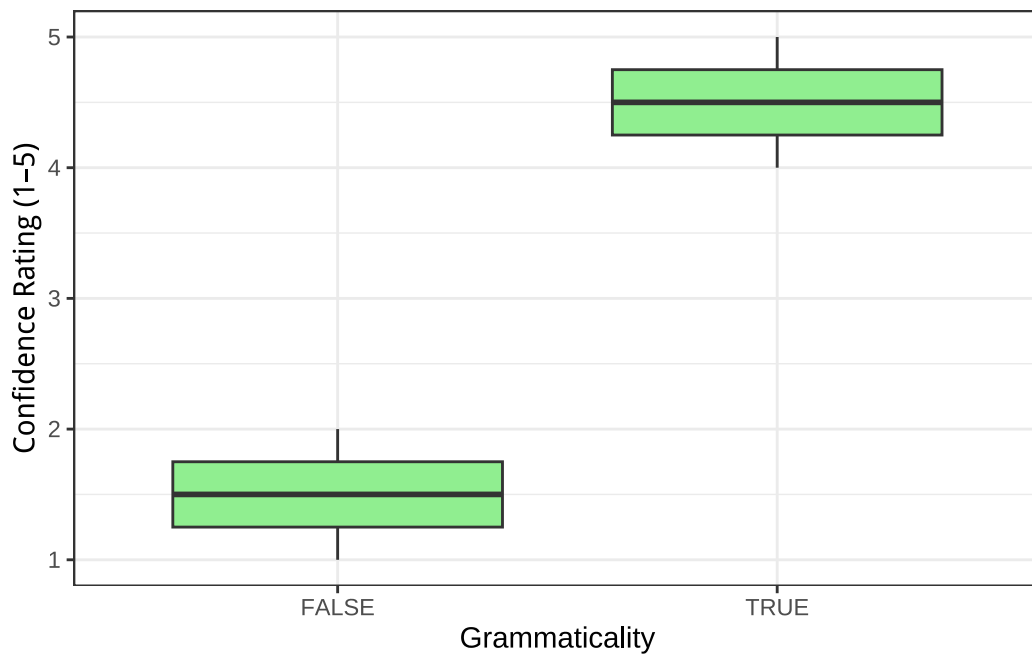
Problem 4

Use `ggplot` and the `emojifont` package to create the following figure! A good place to start is reading the `emojifont` package docs. Also note that the color aesthetic is set to Penn Blue! Find the hex code for that precise color here.

Problem 5

Using the data frame you generated in question 3, recreate the following figure as faithfully as possible. You will need to adjust at least the `fill`, the `theme`, the `base size` of the font, and

some axis `labels`.

Problem 6

Using the data frame you generated in question 3, recreate the following figure as faithfully as possible. You will need to adjust at least the `color` and `size` aesthetics. You'll need to add more than one `geom`. You'll also need to edit the `theme`, the `base size` of the font and many `labels`.

Confidence vs. Reaction Time by Gramma