MINI PROJECT II:
QUANTITATIVE MODELING CHALLENGE

BACKGROUND

The goal of this week is to practice quantitatively modeling business problems.
A quantitative model for a business problem uses equations to break down a business problem into numbers to make a decision, while a qualitative model uses reasoning with words to make a decision.
For example, suppose the question is Should I build a new factory to produce more pencils? In a quantitative model, we break down the question into a few numbers: (1) cost of building a new factory, (2) number of pencils the new factory will produce, (3) revenue for each pencil. In basic terms, if the revenue for each pencil multiplied by the number of pencils that will be produced is greater than the cost of building the factory, we should build the factory.
In a qualitative model, we reason about the question with words. For example, we might reason that "Our factories last for a very long time, so they will eventually pay for themselves. So we should build as many as we can afford."

DIRECTIONS

In this exercise, we will give a business problem and you will quantitatively model the problem to decide the variables that you are interested in. You will then request your company's data analysis department to get the dataset that you wish you had. Finally, you will use this actual data to answer your initial business problem.
In your project groups, together you will work to model a complex business problem in terms of variables and mathematical models. Note: there is an open-ended problem for teams who feel they are advanced in this skill domain.
Your deliverable will be to submit your responses to each question on the course website.

SUPERSTORE PRODUCTION, PLANNING, AND SALES

PART I

BUSINESS PROBLEM

You are a Strategy Analyst working for a big box retailer with in-house production (e.g., your company sells products in a store, but also produces them in factories for sale alongside name-brand products). You want to take a data-driven approach to answering the most important problems for your business.
For each of the following business questions, please list the variables that you would need to build a quantitative model.

- **What is our most popular product?**
  - Hint: How should we define popular (e.g., number of sales, number of product views, etc.)? Based on your chosen definition of popular, how can we calculate the popularity of each product?
- **How can we focus our resources to increase production of our most popular product?**
  - Hint: What resources does our most popular product require to produce? How many of these resources are being used for other products?
- **If we refocus our resources, how much will we be able to increase production?**
  - Hint: If we use all of these resources for our most popular product, how much of our most popular product will we be able to produce?
- **Optional:** For an advanced exploration, ask your team – what is an industry where you think this problem could actually arise? Search the internet (sites like Kaggle and Data.gov are great places to start) to find a real-world dataset to answer these questions with actual data. Past a link to the specific dataset you choose here, then answer these questions (or 2-3 similar questions, if relevant), which you can frame and answer in the same deliverable (see instructions below).

PART II

*Note: Do not view the file here until you have completed Part I

You asked your company's data analysis department to send you numbers to answer the above questions. Here is the file that they sent you.

NUMERICAL TABLE

Now, please provide answers to each of the above questions. You can use the attached Excel spreadsheet to fill in your answers. To do so, you can:

- Create a new tab titled "Calculations" for any calculations you've made that provide the answer
- [Optional] Create a second new tab titled "Reasoning" will cells corresponding to any written information you'd like to provide to explain your answer or process
- [Optional] Create additional tabs to provide answers to the optional advanced exploration exercise above. These tabs can be titled "Advanced"