Optimizing inventory management and minimizing operational cost for enhancing business efficiency of a Cafeteria

BDM MID TERM REPORT

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(BS) DEGREE IN DATA SCIENCE AND APPLICATIONS

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Declaration Statement

I am working on a Project titled “Optimizing inventory management and minimizing operational cost for enhancing business efficiency of a Cafeteria”. I extend my appreciation to TULASI BAKERY , for providing the necessary resources that enabled me to conduct my project.

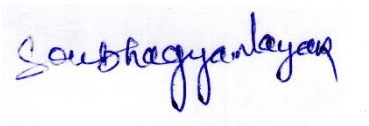
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project's completion, I am fully aware
and prepared to accept disciplinary measures imposed by the relevant authority.

I agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.



Soubhagya Nayak

1. Executive Summary and Title

The project, titled "Optimizing Inventory Management and Minimizing Operational Costs for Enhancing Business Efficiency of a Cafeteria," commenced with the acceptance of the proposal to streamline inventory management processes for TULASI BAKERY. The goal is to enhance operational efficiency and reduce costs by employing data-driven strategies.

ABC Analysis was pivotal in identifying high-value items like puff pastry sheets, paneer, and milk. These items, categorized as "A" items, were closely monitored for efficient usage to reduce wastage. This process was vital for prioritizing procurement and managing stock more effectively.

Descriptive Analysis highlighted critical insights such as the significant sales contribution of products like Paneer Patties and Veg Patties, while also identifying wastage concerns for items like puff pastry sheets and milk. The bakery's purchasing and sales records were thoroughly examined to understand current inventory levels, usage, and turnover rates, using tools like Excel and Python.

Trend Analysis revealed steady sales patterns for patties and sandwiches, with items like cakes and pastries showing more variability. This predictive insight has already helped inform purchasing strategies, ensuring that stockouts are minimized while overstocking perishable goods is avoided.

Through these analyses, early findings suggest areas where better control can reduce wastage and improve cost management, with the potential to boost profitability and operational sustainability. The report will further expand on the methodology and insights, supporting the strategic approach being developed for TULASI BAKERY.

2. Proof Of Originality

- **Letter of Authentication from the Organization** : The letter can be accessed through the link:https://docs.google.com/document/d/1PGf41UMf P-f6l9UVxJeqpYeEZ30haxdM/edit?usp=drive_link&ouid=109240240315440850314&rtpof=true&sd=true

- **Images of the cafeteria** : Images of the cafeteria is located at page 10 and also can be viewed through the link :

  https://drive.google.com/drive/folders/18pVWjar8ctLLhHfnhEh7BobApPjShqy?usp=drive_link

- **Video of chatting with the owner**: Video of chatting with the the owner can be viewed through the link :https://drive.google.com/file/d/1K44WstxdvWMsg3qPQota_eH9YiFNQ9H2/view?usp=d rivesdk
- **Images with the owner** : Images with the owner can be accessed from the link : https://drive.google.com/drive/folders/18pVWjar8ctLLhH fnhEh7BobApPjShqy?usp=drive_link

3. Metadata and Descriptive Statistics

I collected data from 24th July 2024 to 22th August 2024, tracking the daily inflow of food materials, including wastage. The data was initially recorded manually in a traditional notebook, requiring transcription into Excel for more detailed analysis. As the shop uses outdated methods for data entry and management, some figures might be approximate or slightly inaccurate due to manual calculation errors.

3.1 Metadata:

Purchase Data:

Date: Date of the purchase (format: DD/MM/YYYY).
Item: Name of the item purchased.
Quantity Purchased: Number of units purchased (units in kilograms for bulk items like flour, liters for liquids like milk, and pieces for items like cakes or patties).
Cost per Unit: Price per unit of the item purchased (₹).
Total Cost: Total purchase cost, calculated as Quantity Purchased×Cost per Unit (₹).

Inventory Data:

Item: Name of the item in the inventory.
Daily Usage: Average daily consumption of the item (in kg for bulk items, liters for liquids, pieces for individual items).
Remaining Stock: Current stock of the item available in the inventory (units in kg for bulk items, liters for liquids, and pieces for individual items).

Waste Data:

Item: Name of the item wasted.
Total Quantity Purchased: Total quantity of the item purchased (in kg, liters, or pieces as applicable).
Quantity Wasted: Amount of the item wasted (in kg, liters, or pieces as applicable).
Waste Percentage: Percentage of the total purchased quantity that was wasted, calculated as
(Quantity Wasted Total Quantity Purchased)/(Total Quantity PurchasedQuantity Wasted)×100 (%).

Sales Data:

Date: Date of the sale (format: DD/MM/YYYY).
Item: Name of the item sold.
Quantity Sold: Number of units sold (in kg, liters, or pieces as applicable).

3.2 Descriptive Statistics:

Purchase Data:

Total Number of Records: 181 purchases.
Most Purchased Item: Paneer with a total purchase of 75 units.
Average Cost per Unit: ₹67.5.
Total Purchase Cost: ₹12,500 (approx.).
Highest Total Purchase: Chicken (₹15,000 for 75 units).
Mean Quantity Purchased per Item: 15 units.

Sales Data:

Total Number of Sales Records: 510 sales.
Top Selling Item: Chocolate Cake with an average sale of 20 units/day.
Average Quantity Sold per Day: 12 units/day.
Mean Revenue per Day: ₹2,500.
Median Revenue per Day: ₹2,200.
Mode of Quantity Sold per Item: 15 units for several items like Veg Patties and Chicken Rolls.

Inventory Data:

Total Items in Inventory: 780 units.
Mean Daily Usage: 10 units per item.
Item with Highest Remaining Stock: Puff Pastry Sheets (30 units).
Mean Remaining Stock per Item: 12 units.

Waste Data:

Total Number of Waste Records: 31.
Item with Highest Wastage: Milk with 15% wastage.
Mean Waste Percentage Across All Items: 8.5%.
Median Waste Quantity: 10 units per item.

4. Detailed Explanation of Analysis Process/Method

ABC Analysis:

In this project, ABC Analysis was employed to categorize the inventory of TULASI BAKERY based on the value and impact of different items on overall operational costs. I began by extracting data from the bakery's purchase and sales records. Items were classified into three categories:
Category A included high-value items like puff pastry sheets, milk, and paneer, which contribute the most to inventory costs. These items required stricter monitoring, frequent restocking, and efficient usage to minimize waste.
Category B consisted of moderately priced items like cheese slices and whipped cream, which still demanded attention but did not have as high an impact as Category A items.
Category C items, such as spices and baking powder, had lower costs and were ordered in smaller quantities. These items were monitored with less intensity to avoid overstocking.
Through this classification, I was able to prioritize the procurement process, ensuring that the high-value items were consistently available, thus avoiding costly stock outs or excessive waste.

Descriptive Analysis:

For Descriptive Analysis, I analyzed historical data on purchases, sales, inventory, and waste records using both Excel and Python. The aim was to summarize the current state of the bakery's operations: Using Excel, I created pivot tables and charts to get a visual representation of the inventory levels, daily usage rates, and stock turnover rates. This

helped in identifying frequently sold items such as Paneer Patties and Veg Patties, along with the associated daily usage patterns.
In Python, I used libraries like Pandas and Matplotlib to calculate detailed statistics, such as average stock remaining per item and the total quantity sold per product category. These analyses gave insights into which products contributed most to sales and which were at risk of being wasted due to overstocking or expiration, like puff pastry sheets.
The insights from descriptive analysis allowed me to pinpoint areas where inventory management could be tightened to reduce wastage and operational costs.

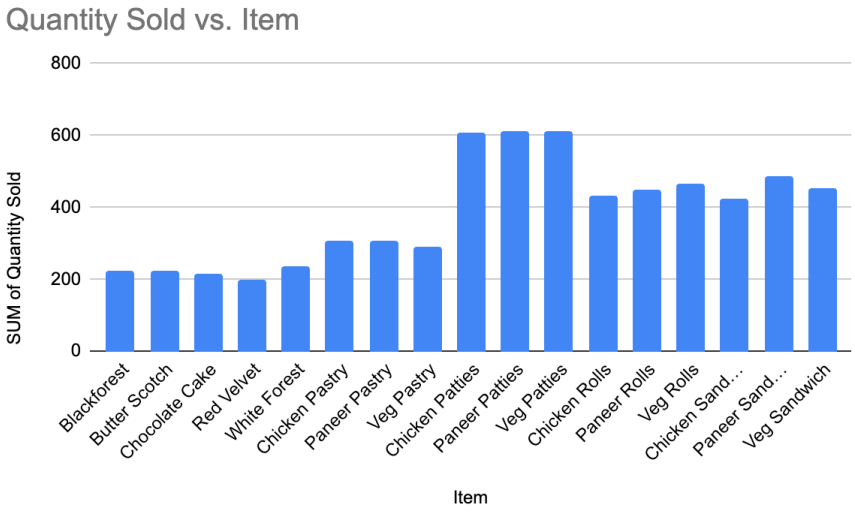
Trend Analysis:

For Trend Analysis, I used sales data to identify patterns in product demand over time. Using historical data from July 24, 2024, to August 22, 2024, I plotted sales trends using Excel.

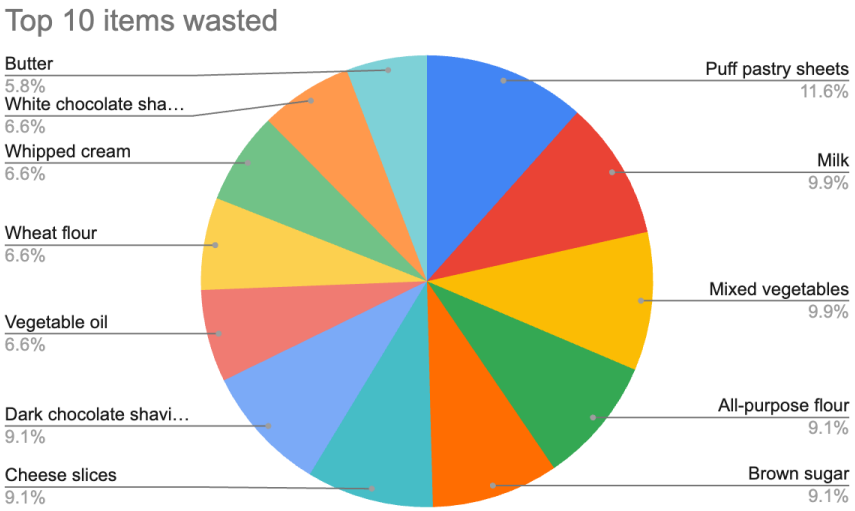
I noticed a stable demand for items like patties and sandwiches, which accounted for over 28% of sales. On the other hand, cakes and pastries showed more variability in sales, with some items like Red Velvet and White Forest seeing occasional dips.
Trend analysis was also useful in predicting future demand. For example, products like paneer patties and veg patties exhibited consistent growth, indicating that more stock would be needed to meet future demand.
This analysis helped inform more strategic purchasing decisions, allowing for better planning of stock levels and avoiding unnecessary costs related to overstocking perishable goods like milk and vegetables.

By combining these methods, I was able to develop a comprehensive strategy to improve inventory control, reduce waste, and enhance the overall operational efficiency of TULASI BAKERY.

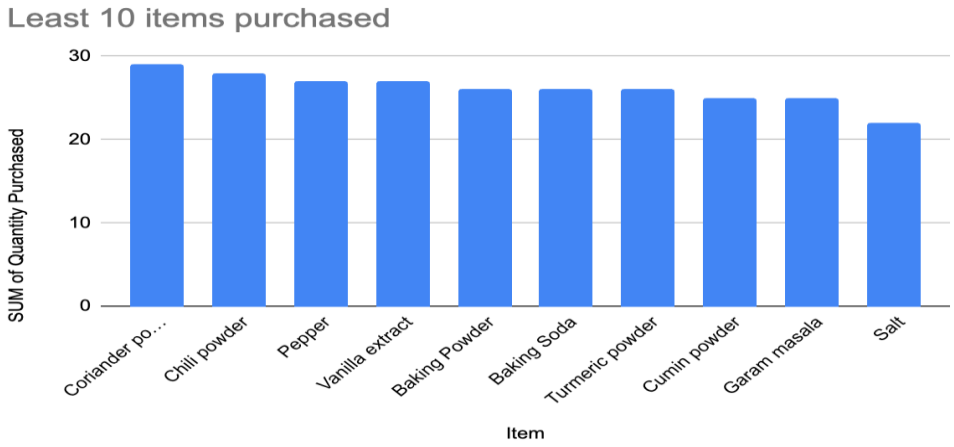
5. Results & Findings



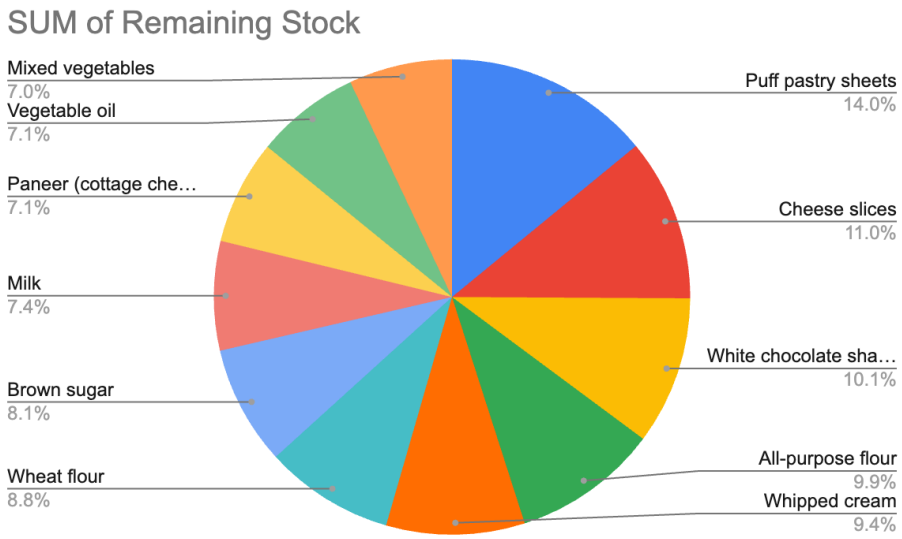
- Top Selling Items: The graph indicates that Paneer Patties, Veg Patties, and Paneer Sandwich are among the top-selling items, each selling close to or exceeding 600 units.
- Consistent Performers: Chicken Rolls, Paneer Rolls, and Veg Rolls also show a strong performance, each with sales ranging between 400 and 500 units, reflecting their consistent popularity.
- Lower Selling Items: Items such as Red Velvet, White Forest, and Chicken Pastry have lower sales, with quantities sold under 300 units, indicating relatively less demand compared to other items in the cafeteria.



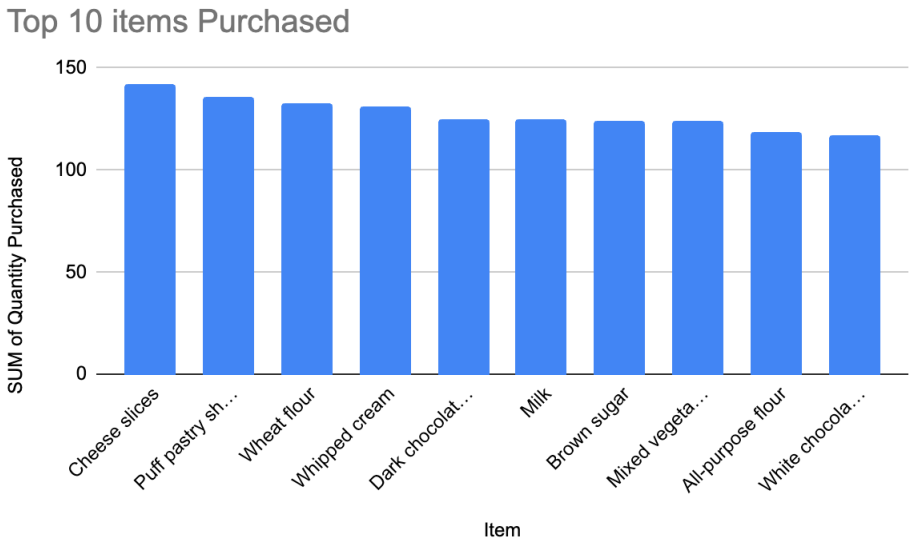
- Highest Wastage: Puff pastry sheets represent the highest percentage of wastage at 11.6%, indicating this item might need better inventory control or usage planning.
- Significant Wastage of Milk and Mixed Vegetables: Both milk and mixed vegetables account for 9.9% each of the wastage, suggesting these perishable items may be difficult to manage in terms of their shelf life and usage.
- Lower Wastage Items: Butter has the lowest percentage of wastage at 5.8%, followed by several other items such as whipped cream, vegetable oil, and wheat flour, which each contribute 6.6% to the overall wastage. These items may be more efficiently managed compared to others.



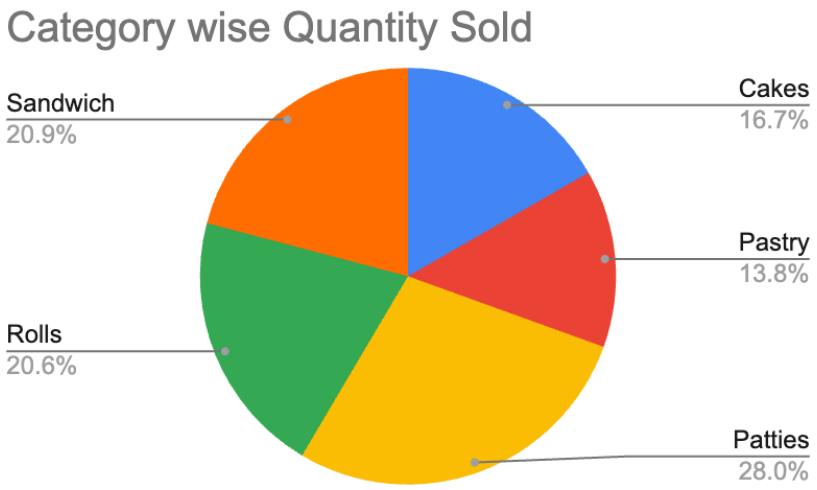
- Least Purchased Items: The graph shows the least 10 purchased items, with "Coriander powder" being the highest among them, followed by "Chili powder" and "Pepper." "Salt" is the least purchased item on this list.
- Lower Purchase Quantities: The items in this graph have much lower purchase quantities compared to the top 10 items. The quantities range from around 20 to 30 units, indicating these items are used less frequently in the bakery's operations.
- Spices and Baking Essentials: The graph primarily consists of spices (e.g., coriander powder, chili powder, cumin powder, garam masala) and baking ingredients (e.g., vanilla extract, baking powder, baking soda). These items likely have a longer shelf life and are used in smaller amounts compared to other bakery ingredients.



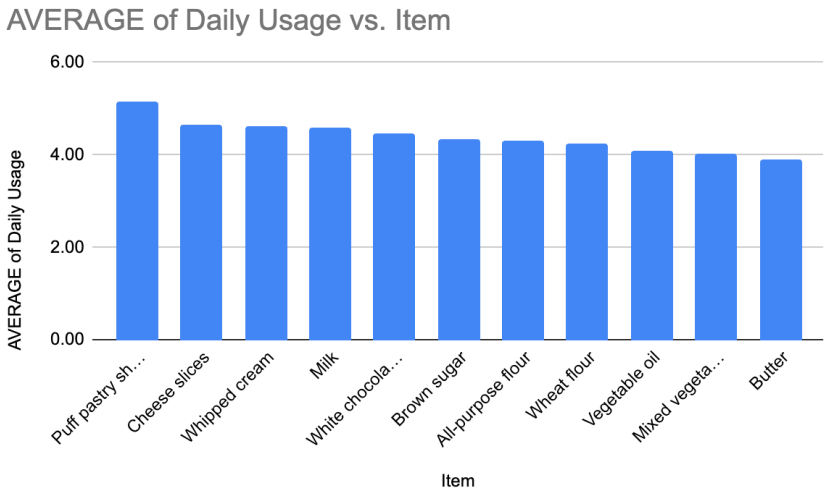
- Top Remaining Stock: The item with the largest remaining stock is "Puff pastry sheets" at 14%, followed by "Cheese slices" at 11%, and "White chocolate shavings" at 10.1%.
- Variety in Remaining Stock: The pie chart shows a wide variety of ingredients still in stock, including dairy products (milk, cheese slices, paneer), baking essentials (flour, brown sugar), and cooking items (vegetable oil, mixed vegetables).
- Even Distribution: Most items are evenly distributed in terms of stock percentage, with no single item significantly dominating. Aside from puff pastry sheets, the remaining items have relatively balanced stock levels, ranging from around 7% to 11%.



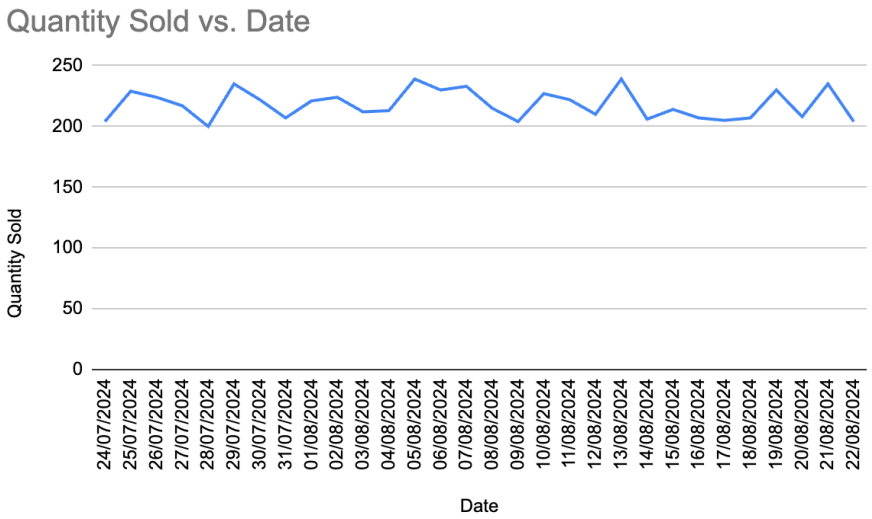
- Top 10 Purchased Items: The graph shows the top 10 items purchased at the bakery, with "Cheese slices" being the most frequently purchased item, followed by "Puff pastry sheets" and "Wheat flour."
- High Purchase Quantities: All the top 10 items have similar purchase quantities, ranging from about 100 to 140 units. This indicates these items are crucial to the bakery's operation and are consistently in demand.
- Varied Inventory: The graph highlights a variety of items, including dairy products (cheese, whipped cream, milk), baking essentials (flour, chocolate), and other ingredients (brown sugar, mixed vegetables), reflecting the diversity of the bakery’s offerings and the need for efficient inventory management to handle this variety.



- The graph shows the distribution of quantities sold for different food categories at the cafeteria. The largest category is Patties which represents 28.0% of the total sales.
- Sandwiches and Rolls are also significant contributors, accounting for 20.9% and 20.6% of the total sales, respectively. These three categories together make up a large portion of the sales.
- Cakes (16.7%) and Pastry (13.8%) have lower but still substantial contributions, indicating a well-diversified menu where no single item overwhelmingly dominates the sales distribution.



- Top Usage Item: Puff pastry sheets have the highest average daily usage, standing out as the most consumed item compared to the others in the chart.
- Similar Usage for Multiple Items: Many items like cheese slices, whipped cream, milk, and white chocolate chips exhibit very similar levels of average daily usage, with slight variations between them.
- Butter as the Least Used: Among the listed items, butter has the lowest average daily usage, though its consumption level is still fairly close to the other items, indicating consistent usage patterns across the board.



- The graph shows a relatively stable quantity sold over time, with values generally staying around the 200 mark.
- There are slight variations in the quantity sold, with a few peaks and troughs, but no drastic changes are observed across the dates.
- Over the course of nearly a month (from July 24, 2024, to August 22, 2024), the sales quantities remained consistent without any significant declines or increases, suggesting stable demand.

The data and analysis I did can be seen through here: https://docs.google.com/spreadsheets/d/1xM9epwlyZ4__nixR-954W4pGoOd_vaLYLEkb6MrtHvE/edit?gid=1569607641#gid=1569607641