

Analysis Report: MRA PART(B)

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Introduction

- In the competitive landscape of retail, maximizing revenue and enhancing customer satisfaction are paramount objectives for any business. One of the most valuable assets at the disposal of a grocery store is its transactional data, often captured through Point of Sale (POS) systems. This data holds a wealth of insights waiting to be unearthed, offering the potential to drive revenue growth through informed decision-making and strategic planning.

Problem Statement

- Our grocery store has provided us with transactional data, prompting us to delve deep into its intricacies to identify patterns, trends, and associations that can inform our strategies for revenue optimization. Specifically, we aim to uncover the most commonly occurring sets of items in customer orders and devise recommendations for enticing combo offers and discounts.

Importance of Analysing POS Data

- Analysing POS data goes beyond mere transactional records; it provides a window into consumer behaviour, preferences, and purchasing patterns. By harnessing the power of data analytics, businesses can gain actionable insights to:

Enhance Customer Experience:

- Understanding customer preferences allows us to tailor offerings, personalize experiences, and foster customer loyalty.

Optimize Inventory Management:

- Insights derived from POS data enable us to streamline inventory management, reduce stock outs, and minimize overstocking, leading to cost savings and improved operational efficiency.
- Drive Revenue Growth: By identifying cross-selling opportunities, optimizing pricing strategies, and crafting targeted promotions, we can boost sales and maximize revenue.
- Mitigate Risks: Anticipating market trends and consumer demands helps us mitigate risks associated with changing market dynamics and evolving customer preferences.
- In essence, analysing POS data empowers us to make data-driven decisions, thereby gaining a competitive edge in the dynamic retail landscape.

Exploratory Analysis

- Overview of the Dataset

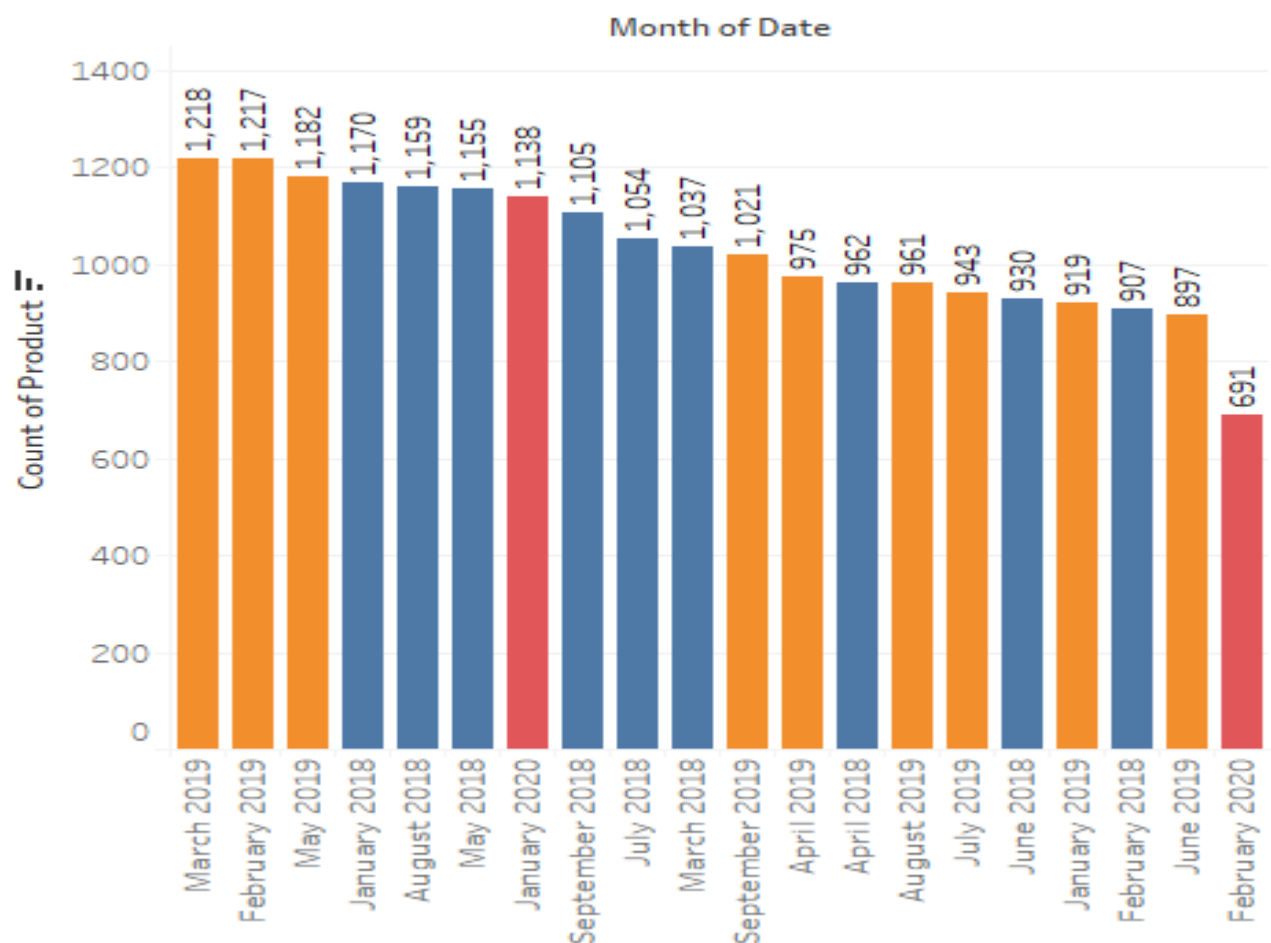
The dataset comprises transactional data from a grocery store, including the date of the transaction, order ID, and the products purchased. Here's a snapshot of the dataset:

Date	Order ID	Product
01-01-2018	1	Yogurt
01-01-2018	1	Pork
01-01-2018	1	Sandwich Bags
...

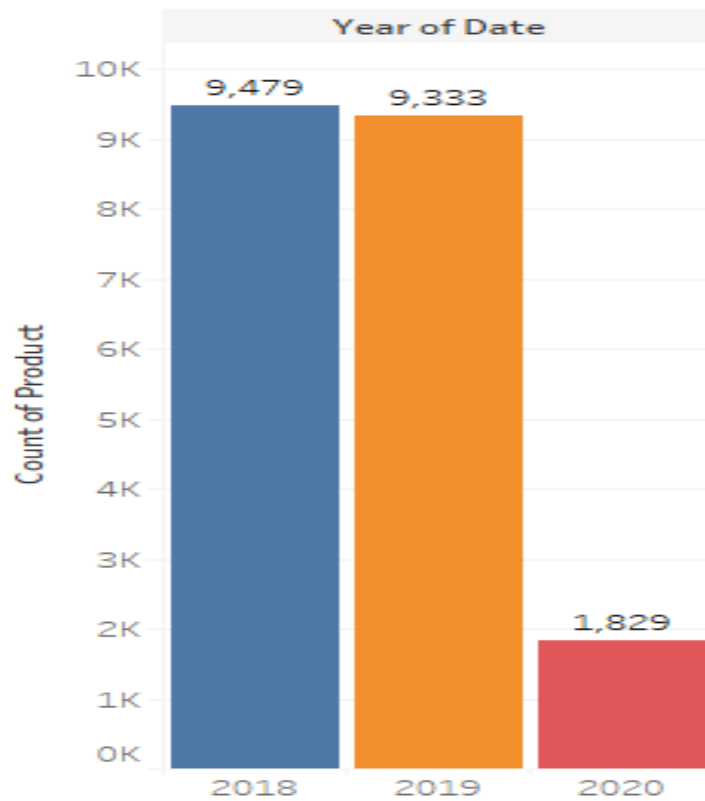
- Trends Across Months, Years, Quarters, and Days

To analyse trends across different time periods, we'll aggregate the data accordingly:

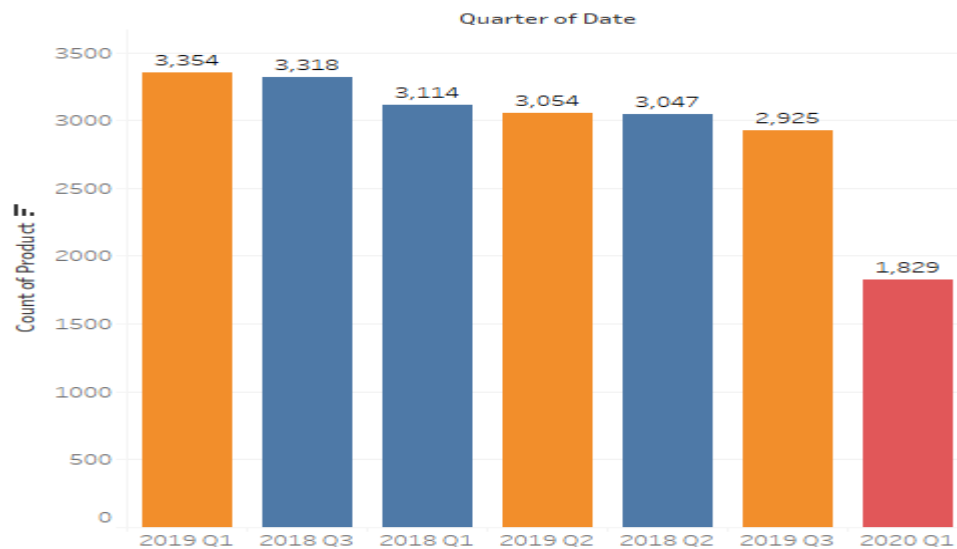
Months: We'll examine the total number of transactions and popular products sold each month to identify any seasonal trends.



- **Years:** Analysing the yearly sales growth or decline can provide insights into long-term performance and market trends.

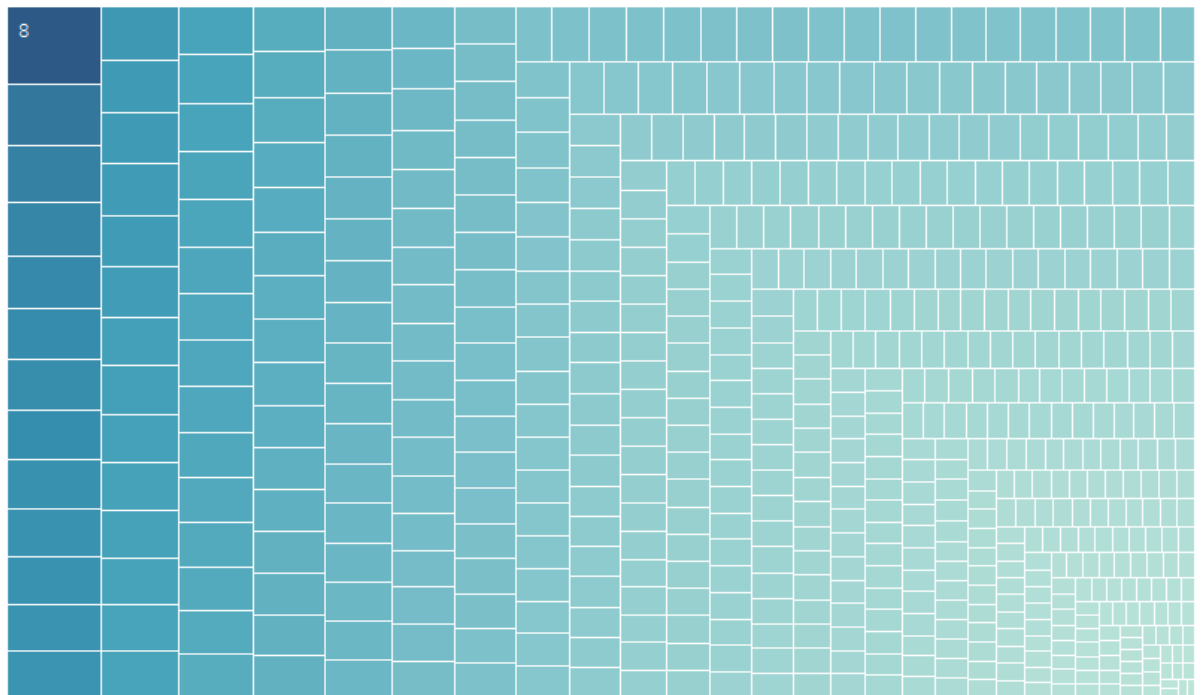


- **Quarters:** Aggregating data by quarters allows us to assess sales performance within each quarter and identify any quarterly fluctuations.

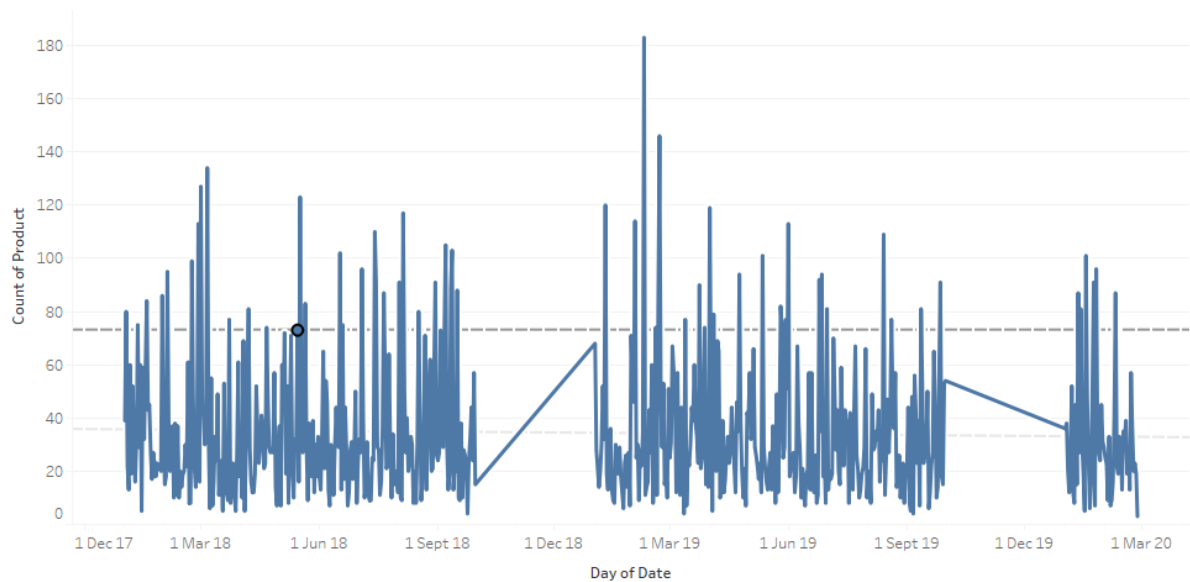


- **Days:** We'll explore daily transaction volumes and popular products to understand daily shopping patterns.

DAY WISE SELL



- **Graphical Representation of Trends**



Market Basket Analysis (Association Rules)

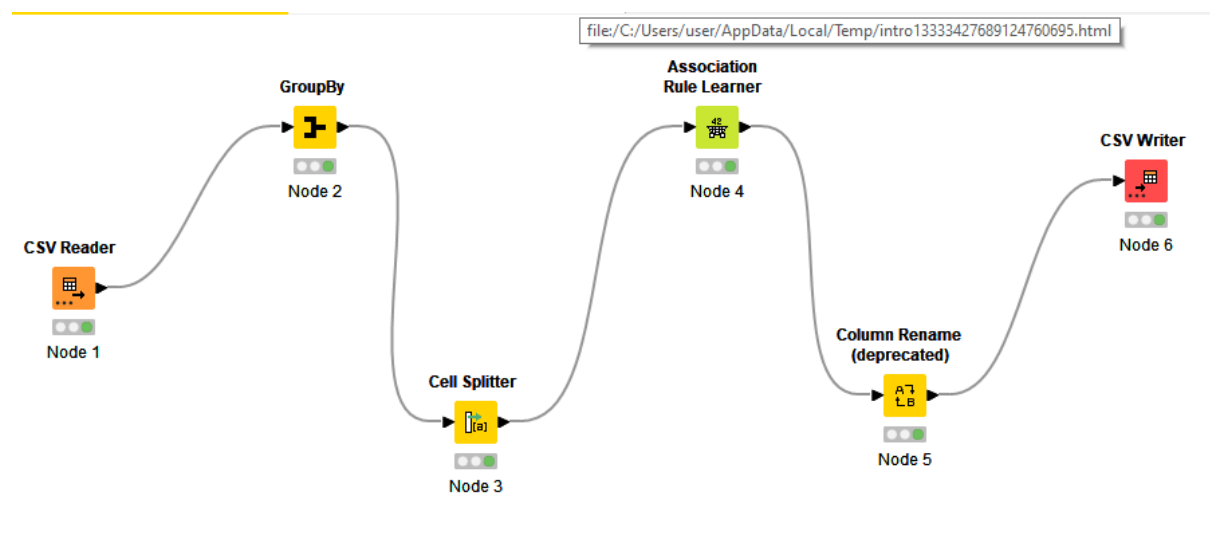
- **Explanation of Association Rules and Their Relevance**

Association rules in Market Basket Analysis reveal relationships between items frequently purchased together in transactions. These rules are essential for understanding customer behaviour and preferences, which in turn helps businesses optimize product placement, create targeted promotions, and improve overall customer satisfaction.

For example, the association rule "Juice ---> [Yogurt, Toilet Paper, and Aluminium Foil]" with a confidence of 0.64 indicates that there's a 64% likelihood of customers purchasing yogurt, toilet paper, and aluminium foil alongside juice. This insight can be leveraged by the grocery store to strategically place these items together on shelves or create bundled promotions to encourage additional purchases.

- **Introduction to KNIME Workflow**

KNIME (Konstanz Information Miner) is a powerful open-source data analytics platform that supports Market Basket Analysis and other data mining tasks. Here's a brief overview of the workflow for performing Market Basket Analysis using KNIME:



Explanation of Support and Confidence Thresholds

Support and confidence thresholds are important parameters in association rule mining that determine the significance of discovered rules:

- **Support:** Represents the proportion of transactions containing a particular item set. A higher support threshold yields fewer but more reliable association rules.
- **Confidence:** Measures the reliability of the association rule. It's the conditional probability of finding the consequent item(s) in a transaction given the antecedent item(s) are present. A higher confidence threshold ensures that only strong associations are identified.

Associations Identified

- **Tabular presentation of associations**

Here's a tabular presentation of the associations derived from the Market Basket Analysis:

Support	Confidence	Lift	Recommended_item	Recommended_with	Items_list
0.050043898	0.640449438	1.700400723	juice	<---	[yogurt, toilet paper, aluminum foil]
0.050043898	0.619565217	1.644952873	juice	<---	[yogurt, poultry, aluminum foil]
0.050043898	0.612903226	1.615964755	coffee/tea	<---	[yogurt, cheeses, cereals]
0.050043898	0.6	1.42375	poultry	<---	[dishwashing liquid/detergent, laundry detergent, mixes]
0.050921861	0.630434783	1.677722471	mixes	<---	[yogurt, poultry, aluminum foil]
0.050921861	0.610526316	1.659640749	sandwich bags	<---	[cheeses, bagels, cereals]
0.050921861	0.674418605	1.726208518	cheeses	<---	[bagels, cereals, sandwich bags]
0.050921861	0.617021277	1.55828655	cereals	<---	[cheeses, bagels, sandwich bags]
0.050921861	0.630434783	1.620914712	dinner rolls	<---	[spaghetti sauce, poultry, cereals]
0.050921861	0.637362637	1.512408425	poultry	<---	[dinner rolls, spaghetti sauce, cereals]
0.050921861	0.604166667	1.589251347	milk	<---	[poultry, laundry detergent, cereals]
0.051799824	0.627659574	1.610144719	eggs	<---	[dinner rolls, poultry, soda]
0.051799824	0.641304348	1.648861517	dinner rolls	<---	[spaghetti sauce, poultry, ice cream]
0.051799824	0.686046512	1.627931202	poultry	<---	[dinner rolls, spaghetti sauce, ice cream]
0.051799824	0.627659574	1.613779357	dinner rolls	<---	[spaghetti sauce, poultry, juice]
0.051799824	0.602040816	1.428592687	poultry	<---	[dinner rolls, spaghetti sauce, juice]
0.051799824	0.634408602	1.627458103	eggs	<---	[paper towels, dinner rolls, pasta]
0.051799824	0.602040816	1.621098085	pasta	<---	[paper towels, eggs, dinner rolls]
0.053555751	0.642105263	1.650920756	dinner rolls	<---	[spaghetti sauce, poultry, laundry detergent]
0.053555751	0.655913978	1.556429211	poultry	<---	[dinner rolls, spaghetti sauce, laundry detergent]
0.055311677	0.623762376	1.564901644	ice cream	<---	[paper towels, eggs, pasta]
0.055311677	0.63	1.616148649	eggs	<---	[paper towels, ice cream, pasta]

- **Explanation of Support, Confidence, and Lift Values**

- **Support:** Represents the proportion of transactions containing a specific itemset. In the context of the association rule "Juice ---> [Yogurt, Toilet Paper, Aluminum Foil]" with a support of 0.050, it means that 5% of transactions include both juice, yogurt, toilet paper, and aluminum foil.
- **Confidence:** Indicates the likelihood of the consequent item(s) being purchased given the antecedent item(s) are purchased. For instance, in the association rule "Juice ---> [Yogurt, Toilet Paper, Aluminum Foil]" with a confidence of 0.640, it means that there's a 64% chance that customers who purchase yogurt, toilet paper, and aluminum foil also purchase juice.
- **Lift:** Measures the strength of association between antecedent and consequent items, considering the support of both items individually. A lift value greater than 1 indicates a positive association. In the same example, the lift value of 1.700 suggests that the likelihood of purchasing juice and the recommended items together is 1.700 times higher than would be expected if their occurrence were independent.

Recommendations for Combos with Lucrative Offers

To capitalize on the associations identified through Market Basket Analysis and drive increased sales and customer satisfaction, the grocery store can implement the following strategies for discount offers and combos:

- **Strategies for discount offers and combos**

- **Bundled Offers:** Create bundled offers that package associated items together at a discounted price. For example:

Buy Yogurt, Toilet Paper, and Aluminum Foil together and get a discount on Juice.

Purchase Bagels, Cereals, and Sandwich Bags as a bundle and receive a discount on Cheeses.

- **Cross-Promotions:** Promote complementary items together to encourage additional purchases. For instance:

Display Poultry and Spaghetti Sauce alongside Dinner Rolls to encourage customers to buy all three items together.

Place Eggs and Ice Cream near Paper Towels and Pasta to prompt customers to purchase these items as a meal solution.

- **Volume Discounts:** Offer discounts for purchasing multiple units of associated items. For example:

Buy two packs of Mixes and get a discount.

Purchase multiple units of Juice and receive a discount on each additional unit.

Special Promotions: Introduce limited-time promotions or seasonal offers based on popular associations. For instance:

- **Seasonal promotion:** Buy Juice and Yogurt together and receive a free pack of Aluminum Foil during summer months.
- **Weekend special:** Get a discount on Dinner Rolls when you purchase Spaghetti Sauce and Poultry on weekends.
- **Customized Offers:** Personalize offers based on customer purchase history and preferences. Utilize loyalty programs or customer segmentation to tailor promotions to individual shoppers' needs.

Examples of Potential Offers Based on Association Rules

Morning Breakfast Combo: Offer a breakfast combo consisting of Yogurt, Cereals, and Juice at a discounted price during morning hours.

Family Dinner Deal: Create a family dinner deal including Poultry, Spaghetti Sauce, and Dinner Rolls with a discount on Ice Cream for dessert.

Weekend BBQ Bundle: Promote a weekend BBQ bundle with Beef, Pork, and Charcoal at a special price, paired with a discount on Soda.

Healthy Snack Pack: Introduce a healthy snack pack containing Cheese, Bagels, and Sandwich Bags with a discounted offer on Yogurt.

Pasta Night Promotion: Encourage pasta night with a promotion offering Pasta, Eggs, and Paper Towels together with a discount on Pasta Sauce.

By implementing these recommendations, the grocery store can effectively leverage association rules to drive sales, enhance customer satisfaction, and increase overall profitability. Additionally, monitoring the effectiveness of these offers and continuously refining strategies based on customer feedback and market trends is essential for long-term success.

Conclusion

In conclusion, the Market Basket Analysis conducted on the grocery store transaction data has provided valuable insights into customer purchasing behaviour and potential strategies for revenue optimization. Here's a summary of the key findings and implications for revenue optimization:

- **Summary of Key Findings:**

Association Patterns: Through association rules, we identified significant relationships between items frequently purchased together. These associations include items such as Juice with Yogurt, Toilet Paper, and Aluminium Foil, and Poultry with Dinner Rolls and Spaghetti Sauce.

Support, Confidence, and Lift: The support, confidence, and lift values associated with each rule provide quantitative measures of the strength and significance of the associations. Higher confidence and lift values indicate stronger relationships between items.

Popular Combos: Based on the associations identified, we uncovered opportunities to create bundled offers, cross-promotions, and volume discounts to incentivize customers to purchase complementary items together.

- **Implications for Revenue Optimization:**

Strategic Product Placement: By strategically placing associated items together on shelves or in promotional displays, the grocery store can encourage impulse purchases and increase average transaction value.

Promotional Strategies: Implementing targeted promotions and discount offers based on association rules can attract customers and drive sales. Promotions such as bundled offers and volume discounts can help increase customer loyalty and satisfaction.

Customer Experience Enhancement: By offering convenient and value-driven combos, the grocery store can enhance the overall shopping experience for customers, leading to repeat business and positive word-of-mouth referrals.

Data-Driven Decision-Making: Leveraging insights from Market Basket Analysis enables data-driven decision-making for optimizing inventory management, marketing strategies, and product assortment to meet customer demands effectively.

In conclusion, Market Basket Analysis provides actionable insights for revenue optimization by identifying association patterns and guiding promotional strategies. By leveraging these insights, the grocery store can enhance customer satisfaction, increase sales, and maximize profitability in a competitive market landscape. Continued monitoring and analysis of customer behaviour will be essential for adapting strategies to evolving consumer preferences and market dynamics.