MRA PROJECT- PART- 2

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02/06/24

Contents:

Tables:

FIGURES

1-Problem Statement:

A grocery store shared the transnational data with you. Your job is to conduct a thorough analysis of Point of Sale (POS) data, identify the most commonly occurring sets of items in the customer orders, and provide recommendations through which a grocery store can increase its revenue by popular combo offers & discounts for customers.

2-Data set

	Date	Order_id	Product
0	01-01-2018	1	yogurt
1	01-01-2018	1	pork
2	01-01-2018	1	sandwich bags
3	01-01-2018	1	lunch meat
4	01-01-2018	1	all- purpose

Table-1-Head of data set

3-Statistical summary

	count	unique	top	freq	mean	std	min	25%	50%	75%	max
Date	20641	603	08-02-2019	183	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Order_id	20641.0	NaN	NaN	NaN	575.986289	328.557078	1.0	292.0	581.0	862.0	1139.0
Product	20641	37	poultry	640	NaN	NaN	NaN	NaN	NaN	NaN	NaN

Table-2-Statistical summary

4-Data Dictionary

Date	Date of product sold
Order_id	ID of order
Product	Name of product sold

Table-3-Data Dictionary

5-Summary about data

➢ The data set covers transactions from January 1, 2018, to February 26, 2020.
➢ Total Records: 20,641 rows
➢ Total Features: 3 columns
➢ Missing Values: None
➢ Duplicate Values: 4,730
➢ The aim is to analyze Point of Sale (POS) data to provide recommendations for increasing grocery store revenue through popular combo offers and discounts.
➢ Conducted to gain a clear understanding of the data.
➢ Highlighted key trends and patterns in sales.
➢ Performed using association rules to identify relationships between products purchased by customers.
➢ Helped to determine frequently purchased product combinations.

6-Exploratory Data Analysis

YEARLY ORDER

FIGURE-1-YEARLY ORDERS

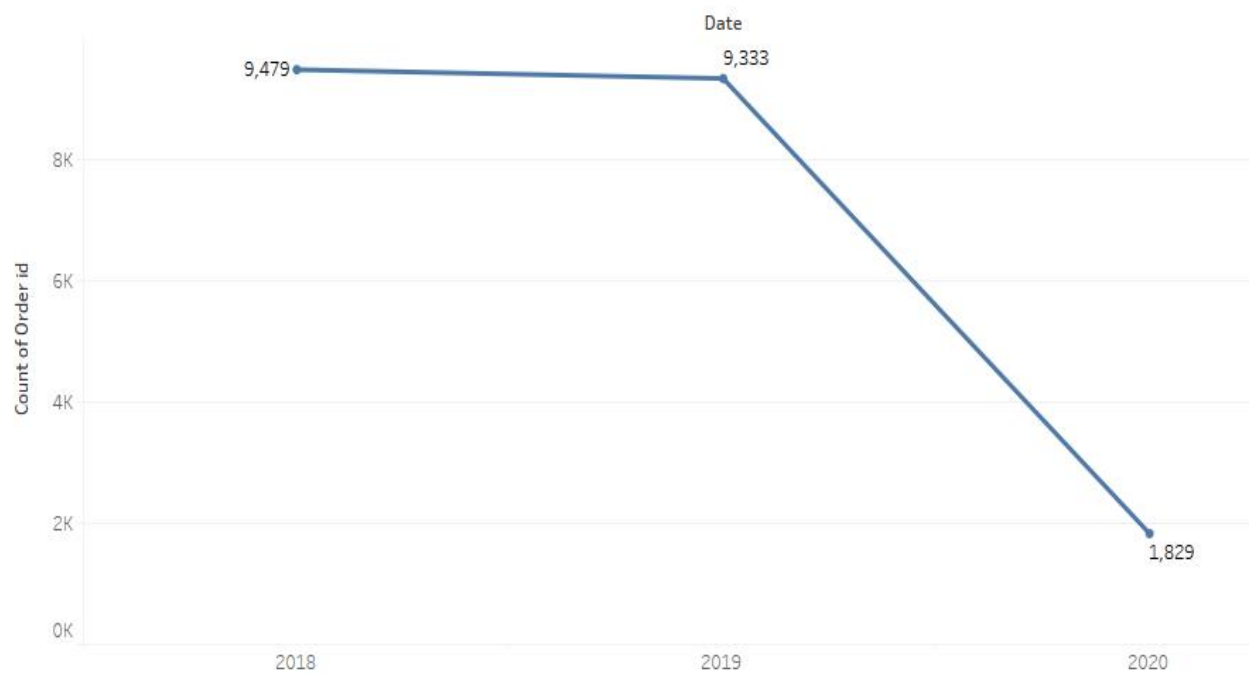Since the data only extends up to February 26, 2020, the count of products sold in 2020 is naturally lower.

QUARTERLY ORDER

FIGURE-2-QUARTERLY ORDERS

➢ Due to the data set ending on February 26, 2020, the product sales count for Q1 2020 is notably higher.
➢ Q1 2019 had the highest sales.
➢ Q3 2018 had the highest sales.
➢ Product sales in Q2 were approximately the same in both 2018 and 2019.

FIGURE-3-MONTHLY ORDERS

➢ In 2018, the highest product sales occurred in January, while February saw the lowest sales this same as 2020

➢ In 2019, March had the highest product sales, with January experiencing the lowest sales.
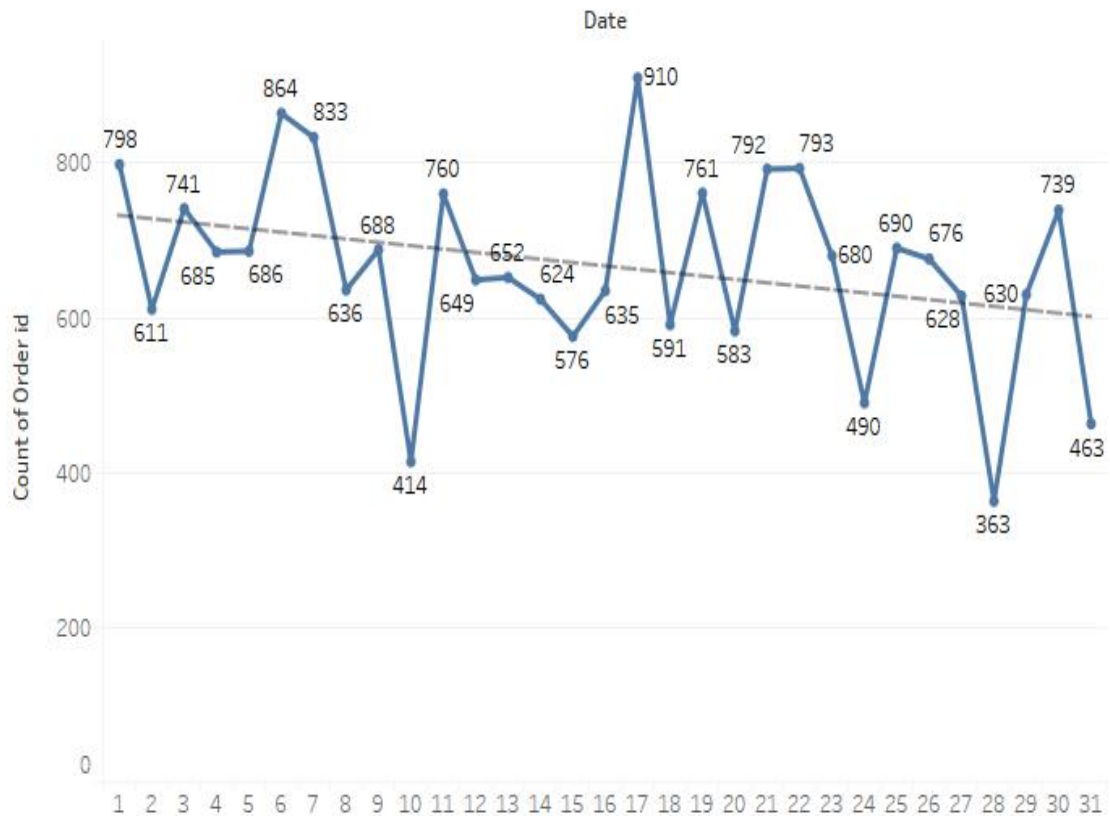
DAY ORDERS

➢ Most of the products were sold on 17 Th of month.
➢ Least products were sold on 28 Th of month.

WEEK DAY ORDERS

FIGURE-5-WEEKLY ORDERS

- ➢ The highest product sales occurred on Sundays.
- ➢ The lowest product sales occurred on Mondays.
- ➢ Sales remained consistent on the other days of the week.
- ➢

YEAR WISE ORDER

YEAR(Date)
- 2018
- 2019
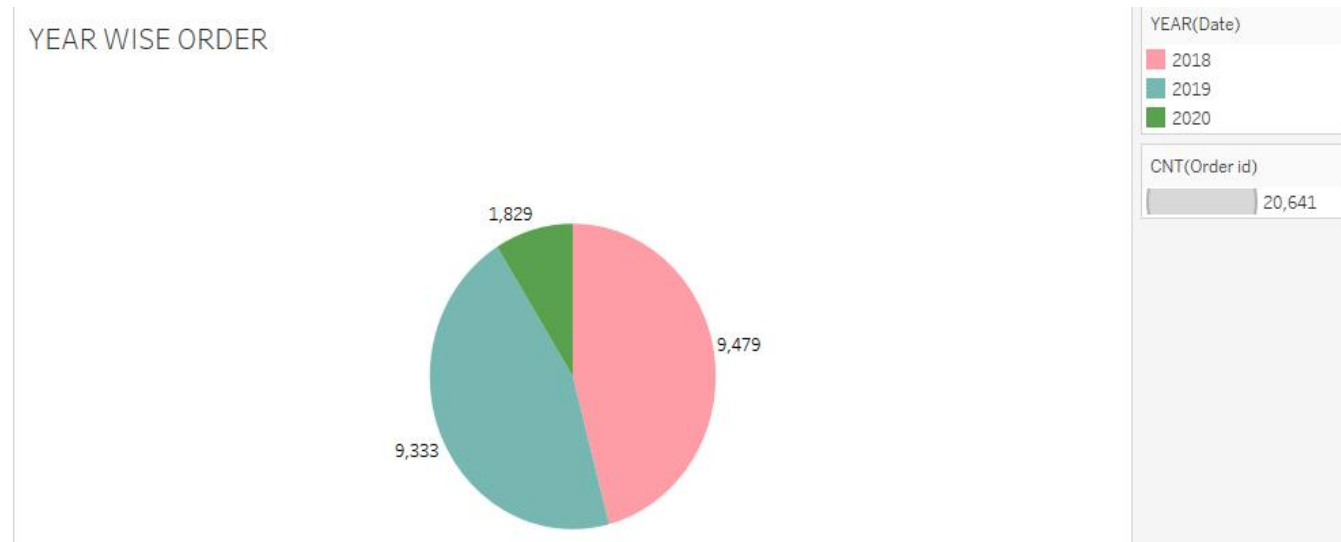- 2020

CNT(Order id)
20,641

1,829

9,479

9,333

FIGURE-6-YEAR WISE ORDERS

- ➢ The majority of product sales occurred in the year 2018.

PRODUCTS ORDERS
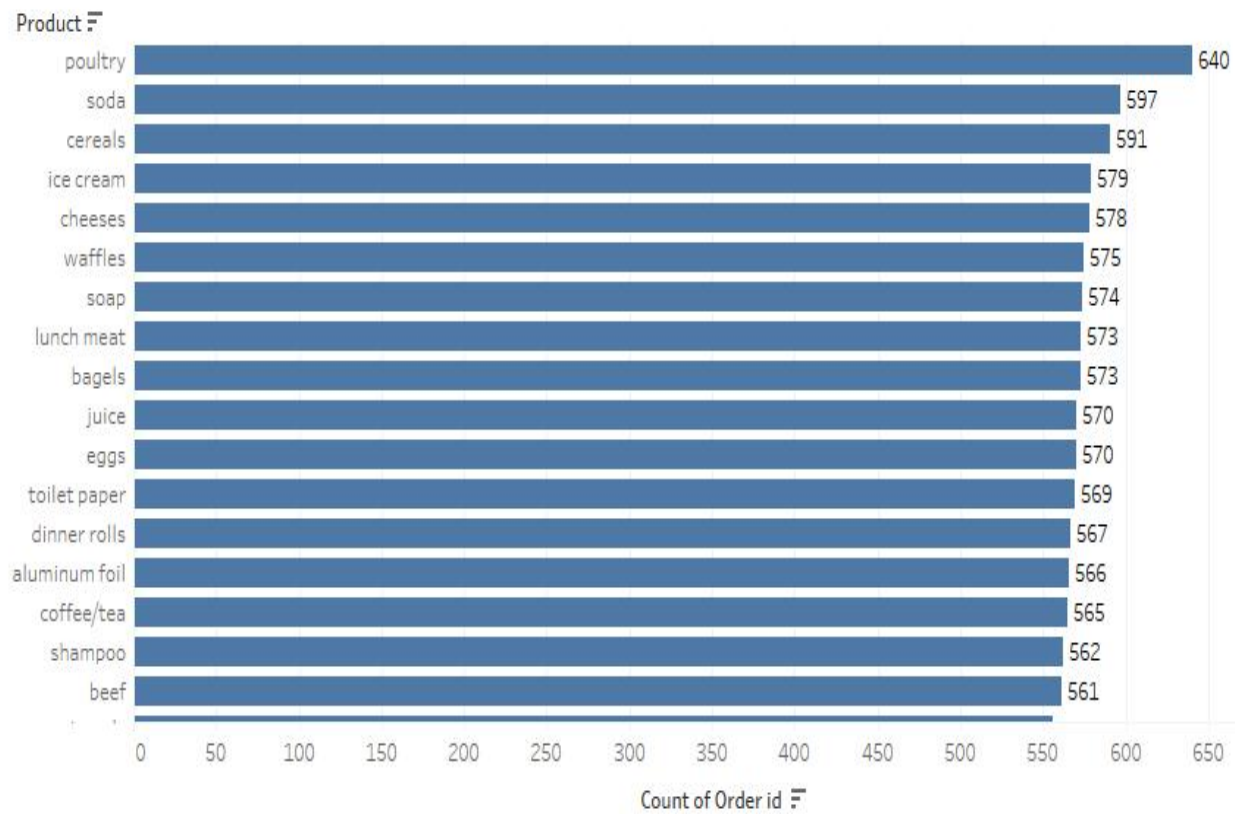
FIGURE-7-PRODUCT ORDERS

ALL PRODUCT

FIGURE-8-PRODUCT & NO.OF ORDERS

➢ Poultry, soda, and cereals are the highest-selling products.
➢ Hand soap ranks as the lowest-selling product.

EATABLE ORDERS

poultry 640	waffles 575	dinner rolls 567	milk 555	mixes 554	ketchup 548	yogurt 545
soda 597	bagels 573	coffee/tea 565				
cereals 591	lunch meat 573	beef 561	individual meals 544		spaghetti sauce 536	sugar 533
			tortillas 543			
ice cream 579	eggs 570	butter 555	pasta 542		pork 531	fruits 529
cheeses 578	juice 570	flour 555	sandwich bags 536		sandwich loaves 523	

FIGURE-9-EATABLE ORDERS& NO.OF ORDERS

➢ Poultry, soda, and cereals are the top sellers.
➢ Pork, fruits, and sandwich loaves have the lowest sales.
➢ Out of the 28 products in this category

FIGURE-10-NON EATABLE&NO.OF ORDERS

- ➢ In this category comprising 9 products:

- ➢ Soap and toilet paper are the best-sellers.
- ➢ Hand soap has the lowest sales.

HIGH ORDER ITEMS Vs YEARS_
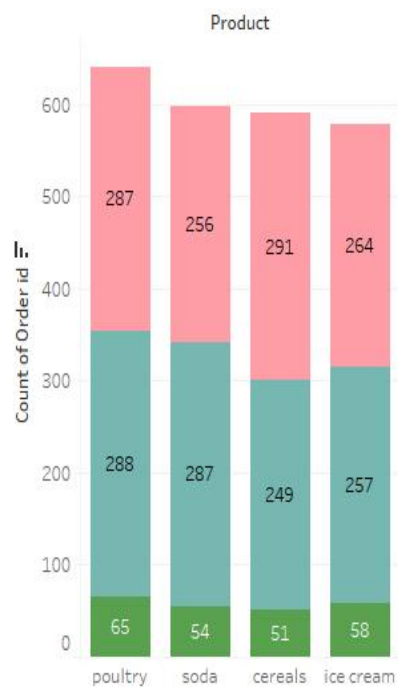
FIGURE-11-YEARS& HIGH ORDER ITEMS

Poultry, cereals, soda, and ice cream consistently demonstrate high sales figures over the years.

2020 Vs PRODUCT
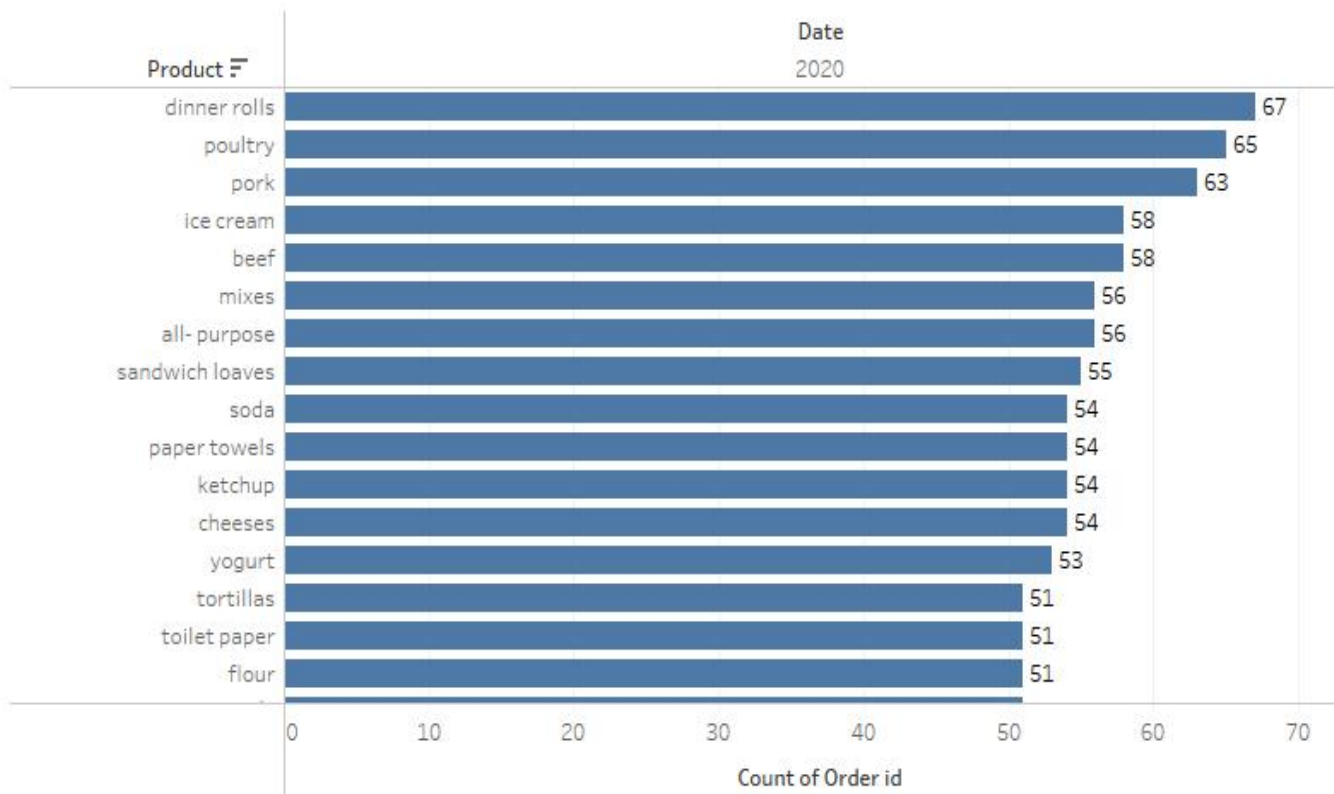
FIGURE-12-PRODUCT ORDERS &2020

➢ The top three products sold in January and February 2020 are dinner rolls, poultry, and pork.

2019 Vs PRODUCT

Product

Product	Count of Order id
poultry	288
soda	287
dishwashing liquid/deterg..	271
waffles	270
milk	270
paper towels	267
juice	266
bagels	266
yogurt	265
soap	265
eggs	265
cheeses	265
laundry detergent	260
toilet paper	258
aluminum foil	258
ice cream	257
lunch meat	256

Count of Order id
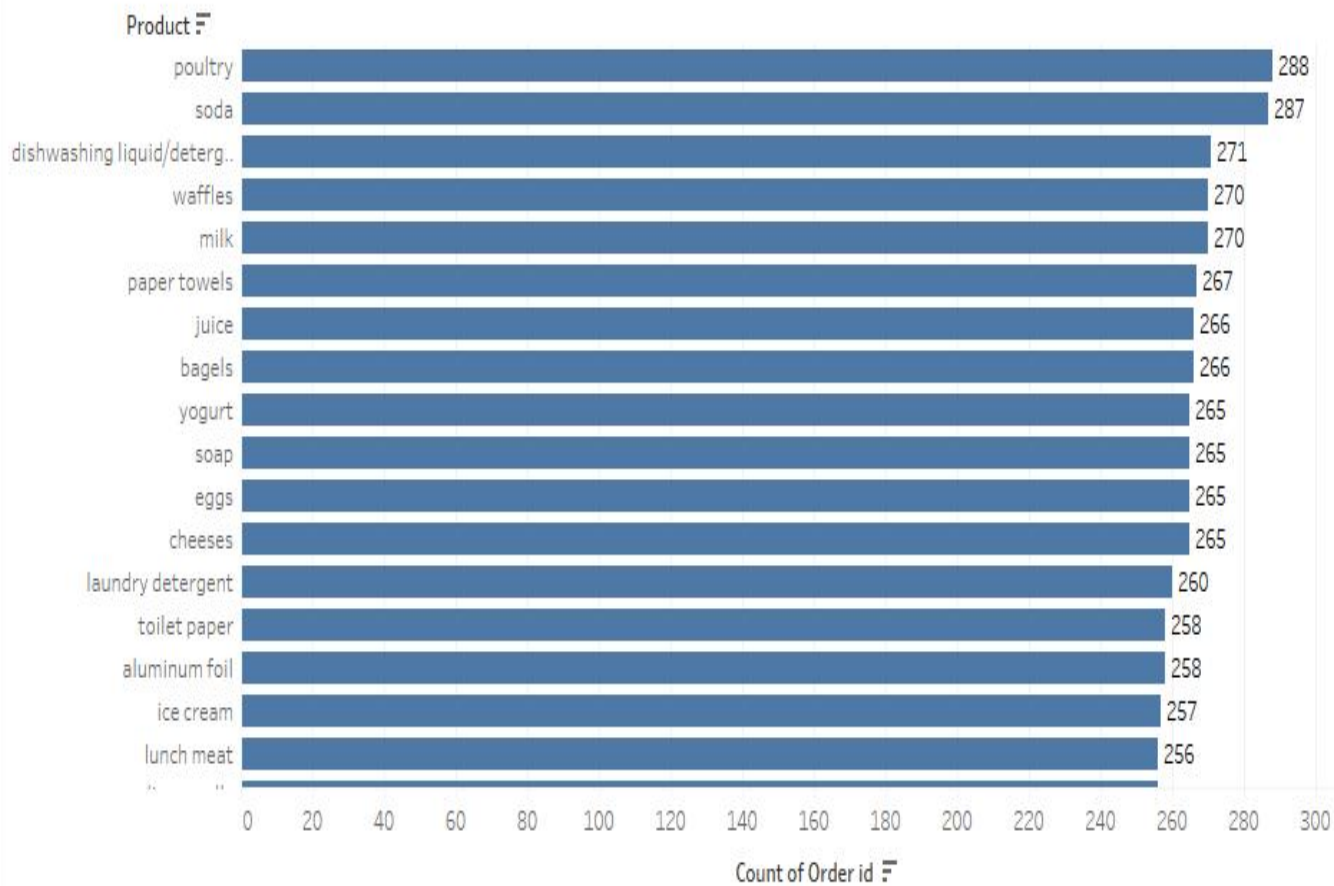
FIGURE-13-PRODUCT ORDERS &2019

In 2019, poultry, soda, and cereal were the three best-selling products

2018 VS PRODUCT

FIGURE-14-PRODUCT ORDERS &2018

➢ Cereals, Poultry and Soda are the top 3 Products sold in 2018

INSIGHTS

1. Cereals, poultry, and soda consistently rank among the top three best-selling products in both 2018 and 2019.

2. The top three products sold in January and February 2020 are dinner rolls, poultry, and pork.

3. Poultry, cereals, and soda emerge as consistently high-selling products across multiple years.

4. Soap and toilet paper are the highest-selling non-edible products, while hand soap records the lowest sales.

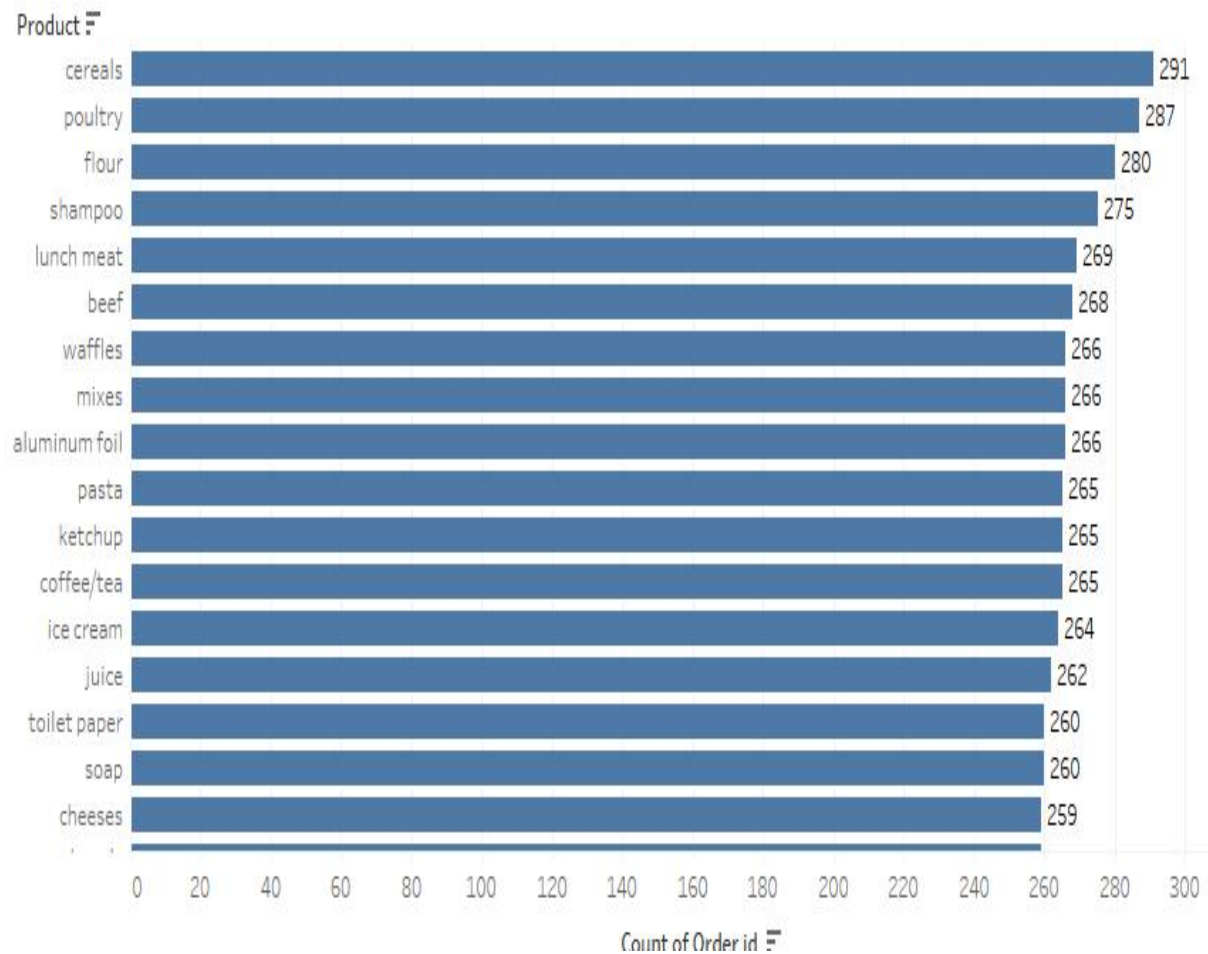5. Poultry, soda, and cereals lead the sales in the edible products category, with pork, fruits, and sandwich loaves having the lowest sales.

6. Sundays witness the highest product sales, whereas Mondays observe the lowest sales.

7. In 2018, January saw the highest sales, contrasting with February having the lowest. In 2019, March experienced the highest sales, while January had the lowest.

8. The first quarter of 2019 and the third quarter of 2018 reported the highest sales.

9. The sales count in Q2 remains approximately consistent between 2019 and 2018.

10. The low count of products sold in 2020 could be attributed to the data only being available until February 26th.

Recommendation:

1. **Promote Top Selling Products:
   - Focus marketing efforts and promotional campaigns on the top-selling products such as poultry, cereals, soda, dinner rolls, and pork to capitalize on their popularity and drive further sales.

2. **Diversify Product Offerings:
   - While certain products consistently perform well, explore opportunities to introduce new products or variants to attract a wider customer base and mitigate reliance on a few key products.

3. **Optimize Inventory Management:

- Use sales trends and historical data to optimize inventory levels, ensuring adequate stock of high-demand products while minimizing excess inventory of slower-moving items.

4. **Targeted Promotions:
   - Tailor promotional offers and discounts to specific days of the week based on sales patterns. Consider offering special promotions on Mondays to boost sales on traditionally slower days.

5. **Seasonal Campaigns:
   - Develop seasonal marketing campaigns and promotions aligned with sales trends observed in different months and quarters. For instance, focus on promoting high-selling products during peak sales months like March and January.

6. **Bundle Offers:
   - Leverage insights from market basket analysis to create attractive bundle offers or combo deals featuring frequently purchased product combinations. This can incentivize customers to buy more while increasing overall revenue.

7. **Enhance Product Visibility:
   - Optimize product placement within the store to ensure that top-selling items are prominently displayed and easily accessible to customers, further driving sales.

8. **Customer Engagement:
   - Implement loyalty programs or rewards schemes targeted towards encouraging repeat purchases, particularly for high-selling products. Engage with customers through personalized offers and recommendations based on their purchasing history.

9. **Monitor Competitor Trends:
   - Keep track of competitor activities and market trends to stay competitive. Analyze their product offerings, pricing strategies, and promotional tactics to identify potential areas for improvement or differentiation.

10. **Continuous Analysis and Adaptation:

- Regularly monitor sales data, customer feedback, and market trends to identify evolving preferences and opportunities. Continuously refine strategies and adapt to changing consumer behavior to maintain competitiveness in the market.

7-Market Basket Analysis

Definition

- ➤ - **Market Basket Analysis:** A statistical technique that analyzes customer purchase patterns to identify associations between different products. It helps businesses understand which products are frequently purchased together and how customers' buying habits affect sales.

Association Rules

- ➤ - **Support:** Probability of observing items together in a transaction (frequency of itemset occurrence).
- ➤ - **Confidence:** Conditional probability that a transaction containing one item also contains another (strength of association).
- ➤ - **Lift:** Measure of how much more often two items occur together than expected if independent (degree of correlation).

Applications

- ➤ - **Retail:** Optimize product placement and promotions.
- ➤ - **E-commerce:** Personalize product recommendations.
- ➤ - **Marketing:** Develop targeted advertising campaigns.

Benefits

- ➤ - **Revenue Increase:** Identify cross-selling opportunities and develop targeted promotions.
- ➤ - **Customer Satisfaction:** Provide personalized recommendations and improve the shopping experience.

Association Metrics

- ➤ - **Support:** Number of transactions with both items / total transactions. High support indicates popular itemsets.
- ➤ - **Confidence:** Number of transactions with both items / transactions with the first item. High confidence indicates likely co-purchase.
- ➤ - **Lift:** Support of itemset / (support of item 1 * support of item 2. Lift > 1 indicates strong positive association.
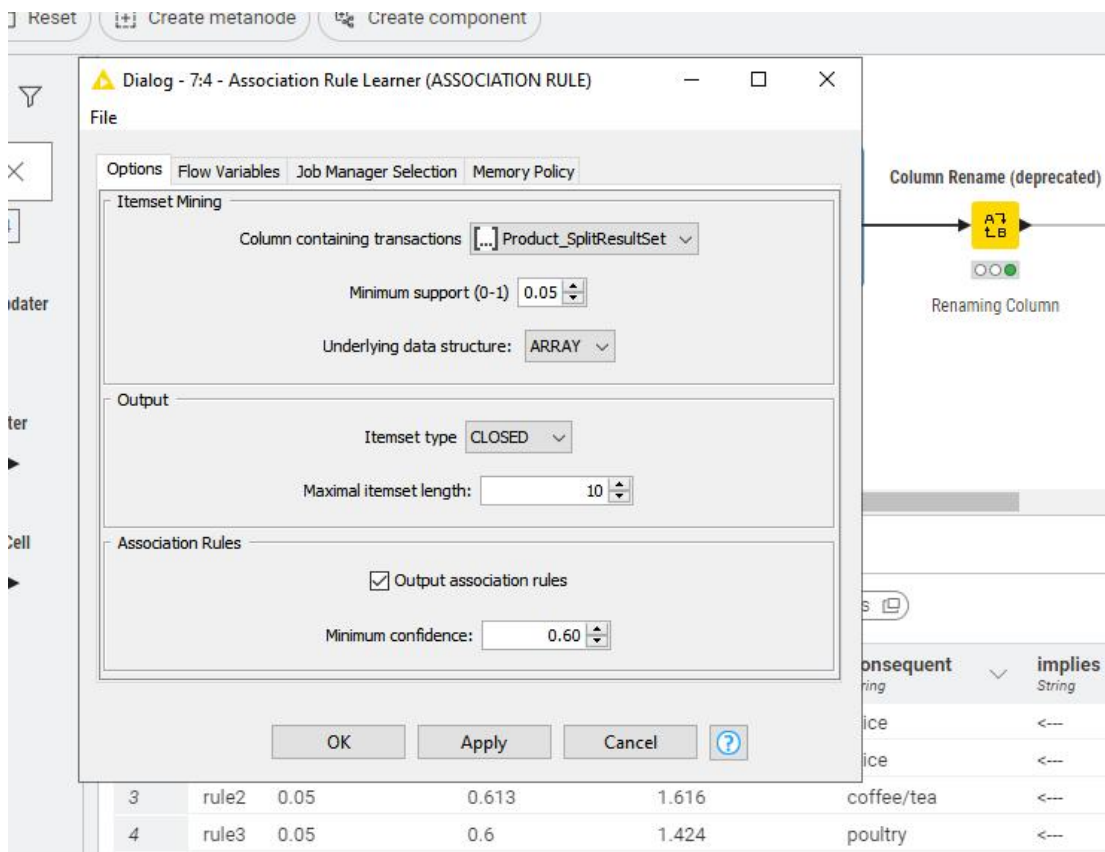

FIGURE-15-PARAMETERS

Parameters

- **Minimum Support: 0.05
- **Maximum Item Set Length: 10
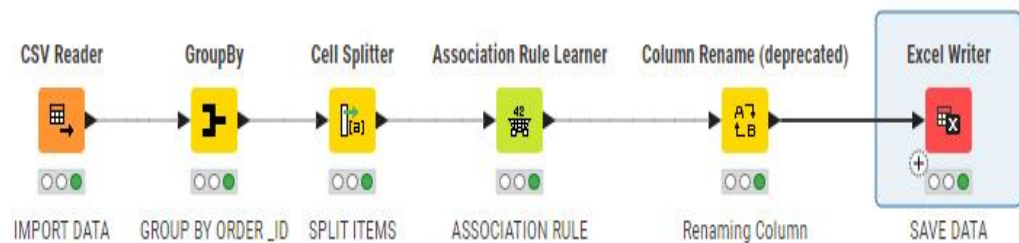- **Minimum Confidence Level: 0.6

FIGURE-16-KNIME WORK FLOW

OUTPUT   TABLE

	Support	Confidence	Lift	SUGGESTED ITEMS	implies	BASKET ITEMS
0	0.050044	0.640449	1.700401	juice	<---	[yogurt, toilet paper, aluminum foil]
1	0.050044	0.619565	1.644953	juice	<---	[yogurt, poultry, aluminum foil]
2	0.050044	0.612903	1.615965	coffee/tea	<---	[yogurt, cheeses, cereals]
3	0.050044	0.600000	1.423750	poultry	<---	[dishwashing liquid/detergent, laundry deterge...]
4	0.050922	0.630435	1.677722	mixes	<---	[yogurt, poultry, aluminum foil]

Table-4-output table

8-Recommendations

Suggested Promotions

1. **Discounted Combo Deal:**
   - Create a special offer where customers can buy cereals, bagels, and sandwich bags together at a reduced price.

2. **"Buy Two, Get One Free" Offer:**
   - Motivate customers to increase their purchases of yogurt, poultry, and aluminum foil by implementing a "Buy Two, Get One Free" promotion on these products.

3. **Mix Bundle Discount:**
   - Offer a price reduction on mixes when purchased alongside yogurt, poultry, or aluminum foil.

4. **Dinner Roll Savings:**
   - Provide a discount on dinner rolls when they are bought in conjunction with spaghetti sauce or poultry.

5. **Paper Products Bundle:**
   - Develop a bundled deal for paper towels, toilet paper, and tissues, offering them at a discounted rate when purchased together.

Promotion Strategy

- ➢ - Ensure visibility and awareness of these offers through effective in-store signage, advertising, and social media campaigns.
- ➢ - These promotional strategies are designed to enhance customer value and boost sales by encouraging the purchase of additional items.

Summary

The analysis has revealed which products customers frequently buy together, aiding the store in optimizing product placement and promotions. Key products that are often purchased include yogurt, poultry, aluminum foil, cheeses, cereals, and dinner rolls. Some surprising associations were found, such as the pairing of poultry with dishwashing liquid/detergent, laundry detergent, and mixes.

Based on these insights, offering promotions like "buy two, get one free" can encourage customers to buy more. Additionally, placing complementary products near each other can increase the chances of additional purchases. Overall, this market basket analysis provides valuable insights into customer behavior and preferences, helping the store make better decisions about product placement and promotions.