# Application of Apriori Data Mining Method for Purchasing Pattern Analysis at UB Mart Minimarket

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| Sections Info | ABSTRACT |
|---|---|
| | *Objective:* The Apriori Algorithm method can be used to see the pattern of purchasing goods, such as what happens in the retail industry, including UB Mart minimarkets. UB Mart is one of the minimarkets that sells daily necessities and is often faced with challenges in increasing sales and revenue. Considering that there is quite a lot of competition in this minimarket, UB Mart is required to be able to think of a marketing strategy so that it is not inferior to competitors and one of them is by analyzing purchase patterns with a priori algorithm. It is hoped that by conducting this research it can find out the purchase pattern from UB Mart transaction data, so that transaction data that was initially just a pile of sales reports can turn into the right business strategy. *Method:* The Apriori Algorithm method can be used to see the pattern of purchasing goods by analyzing purchase patterns with a priori algorithm. *Results:* The results of this study resulted in 4 association rules from sales transaction data in 2024 in January and February. For example if someone buys a 600 ml retail Tras, they are likely to also buy Sakha with a confidence level of 23.89%. And the results of this research can provide business strategy advice to minimarket management for stock strategies, placement of goods to bundling promos. *Novelty:* Transaction data that was initially just a pile of sales reports can turn into the right business strategy through the application of the a priori algorithm to reveal purchase patterns in UB Mart. |

## INTRODUCTION

In competition business moment this, the perpetrators business sued For Keep going develop his business with innovation latest so as not to lost in competition, especially in competition sales, which demands entrepreneurs For think about strategy For increase sale And marketing, one of them with using sales data [1]. This is also reinforced by MI Sentosa's statement that system information very important For party management in the measure And determine decisions that can be made influence sustainability company, then from That important for owner business For analyze pattern purchase [2]. There are some techniques that can used For analyzing sales data, one of them is with data mining *A priori.*

Algorithm *A priori* according to Yanto And Kesuma is technique data collection using rule associative *rules* For identify connection associative between combination element [3]. Based on quote the so can concluded that algorithm *a priori* is the algorithm used For know How a number of object each other related in a dataset.

Has There is a number of study related use method algorithm *a priori.* The results of the research conducted by [4] on sale shop bakoel basic necessities use algorithm *a priori* get a number of results that can be utilized by owner shop start from determination stock, strategy placement goods until *bundling* promo strategy, more carry on results

study by [5] get pattern frequency large purchases in demand by consumer that is basic necessities, food And drink by Because That shop Swapen Jaya can more Lots provide the three items on the shop. Then use Algorithm *A priori* is the right choice For see pattern purchase at UB *Mart* so you can determine strategy more sales efficient. While on quoted research by Putri Mai Sarah on [6] do study about algorithm A priori For determine supply goods with algorithm This can used For predict results sale goods basic necessities in the shop Ray Harahap And determine goods What should saved. The study by [7]entitled "Implementation of Data Mining in Bed Sheet Sales Using the Apriori Algorithm" aims to support H. Manti in increasing bed sheet sales by analyzing transaction data to identify the most popular products. In addition, this study also aims to maintain stock availability and ensure that the products desired by customers remain available. The study entitled "Implementation of Data Mining in Coffee Sales Using the Apriori Algorithm" [8]aims to reveal consumer purchasing patterns and find relationships between products that are often purchased together. In addition, this study also provides discount recommendations to increase sales. By utilizing the Apriori algorithm, this study is expected to provide new insights for coffee business owners in designing more optimal sales and marketing strategies. Based on the research results, researchers identified a *research gap,* which is a problem that has not been answered or previously researched. According to Jumliadi, *a research gap* in a study has specific characteristics that distinguish it from other research.[9]

Method Algorithm *A priori* can used For see pattern purchase goods, as it happens on industry *retail,* including UB *Mart minimarket.* UB *Mart* is one of the *minimarket* that sells goods need daily And often faced on challenge For increase sale as well as income. Considering competition *minimarkets* nowadays are quite lots, UB *Mart* required capable think about strategy marketing so as not to lost competition with competitors and one of them with method do analysis pattern purchase with Algorithm *A priori,* it is expected with he did study This can know pattern purchase from UB *Mart* transaction data, so that the initial transaction data only become pile report sale just can changed become strategy the right business.

The existence of e-commerce is one of the technological innovations that continues to grow. E-commerce is the act of making purchases and sales using electronic media only by using a smartphone and the internet. Many aspects of life are significantly impacted by this e-commerce system. According to Laudon and Laudon, e-commerce is a process in which people sell and buy goods electronically. E-commerce is a business-to-business transaction that involves a computer intermediary, especially a computer network. [3] In recent years, information system technology has developed very rapidly. In the business world, this helps various things to continue to progress, especially with web-based tools. Web-based applications are easy to use and have a user experience that can be used on both smartphones and PCs. Information systems are used by business people to monitor their inventory, sales, and transaction records. Because technology changes rapidly, every business must be able to keep up by creating a digital system that can obtain information quickly, correctly, and specifically. [4] Therefore, small business owners in the Muslim boutique industry do not want to miss this growth as a profitable opportunity to make money by selling various fashion models at affordable prices, high quality, and good models. The Jatikalang Village area, located at RT.02 RW.02, Prambon District, Sidoarjo, East Java, is the main location for this Muslim women's boutique business.

## RESEARCH METHOD

### A.    Method of collecting data

At this stage, data collection for the research was carried out. The researcher took data from transaction notes or sales transaction data from January 1, 2024, to February 20, 2024. The data collection was carried out at the UB *Mart minimarket* with a total of 4,542 transactions. Examples of sales transaction data can be seen in Table 1 of UB Mart Transaction Data.

**Table 1** UB Mart Transaction Data

| Date | Transaction | Item | Amount |
|------|-------------|------|--------|
| January 1, 2024 | 1 | Mama Lemon Orange Thin 230 ml | 1 |
| January 1, 2024 | 1 | Soy sauce Delicious 63ml | 1 |
| January 1, 2024 | 2 | Downy Floral Pink 10 ml | 8 |
| January 1, 2024 | 2 | Rinso Classic Fresh 40g | 6 |
| January 1, 2024 | 3 | Proclin Bleach 25ml | 12 |
| January 1, 2024 | 3 | Paseo Smart 500+ 40 ply | 1 |
| January 1, 2024 | 3 | Wheat Extract 108g | 1 |
| 1 January | 3 | Better for bites 100gr | 1 |
| 1 January | 3 | Too th Regular Condom Brush | 2 |
| 1 January | 3 | Too th Brush Ciptadent Extra Clean Medium | 2 |
| 1 January | 3 | Soklin Softergent Magnolia & Berries 41gr | 12 |
| 1 January | 3 | Tidy up Biang Luxury Pink 250ml | 1 |
| January 1, 2024 | 3 | Soklin Softergen Magnolia | 12 |
| ... | ... | ... | ... |

### B.    Design Study

Knowledge Discovery in Databases (KDD) is an approach to identifying and explaining significant patterns from large data sets. The essence of the KDD procedure lies in the ability to accurately apply data mining results to an easily understood format [10]. In this study, the researchers used *Knowledge Discovery in Databases* (KDD) through the procedure shown in Figure 1. The KDD flowchart:
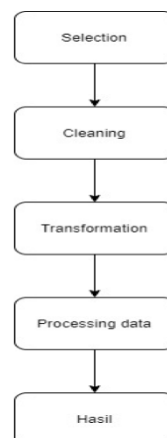


**Figure 1. KDD Flow**

### 1.    Selection

In the first step, namely the data selection process, the researcher selected data in the form of sales transaction data at the UB Mart *mini market.*

### 2.    Cleaning

In the second stage, researchers clean the data by removing unnecessary data or attributes. Data cleaning is a crucial step in Knowledge Discovery in Databases (KDD) [11].

3. **Transformation**

After data cleansing, the next step is data transformation. Data transformation involves converting the cleaned data from the previous stage, which is in *Microsoft Excel*, into *tabular format.* [12]This step plays a crucial role in ensuring the data can be adapted to analytical models that require the use of numeric formats.

4. **Data processing**

At this stage, the transformed data is processed using the *Apriori algorithm.* The *Apriori algorithm* is used to find *association rules* between item combinations. According to [13]the Apriori algorithm, it is a data mining technique classified as an association *rule.* Its goal is to find all association rules that meet the *minimum support* and *confidence values* for the previously processed data. Figure 2 shows the Apriori Algorithm Flowchart, which explains how the Apriori algorithm will be used to create the system.
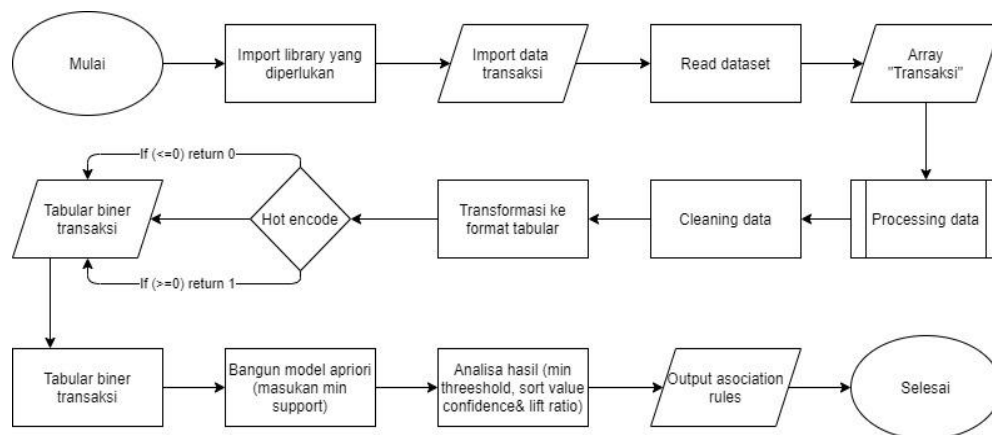


**Figure 1.** Algorithm Flowchart A priori

step involves inputting transaction data. After processing, the data is cleaned. The data is selected as needed, converted to a binary tabular format, and the results are analyzed. At this stage, the author is also required to calculate the minimum *support* and *confidence values* using the following formula:

- Calculating the minimum *support value*

Before calculating the minimum support, the author is required to determine the minimum support value, after which calculate the *support value* per product using the following formula:

$$Support \text{ (A)} = \frac{\sum Transaksi \; mengandung \; A}{\sum Transaksi} \text{x } 100\%$$

- Determine which meets the *support value*

The next step is to determine the value that meets the minimum *support* set from the previous calculation. For products that don't meet the minimum value requirement, support is removed, and for products that do, *the support value* is recalculated as in the previous step [14]. However, the method is slightly different from the previous step. This time, we need to combine two different products, and the combinations cannot be identical. To determine this, we use the formula below:

$$Support \text{ (A\&B)} = \frac{\sum Transaksi \; mengandung \; A \; dan \; B}{\sum Transaksi} \text{x } 100\%$$

- Calculating the *confidence value*

*minimum support* threshold, the next step is to calculate *the confidence level.* To obtain the *minimum confidence level,* divide the number of transactions containing A and B by the number of transactions containing only A. [14]Here's an example of the formula:

$$Confidence \ P(B\,|\,A) = \frac{\sum Transaksi \ mengandung \ A \ dan \ B}{\sum Transaksi \ mengandung \ A} x \ 100\%$$

**5.    Results**

The final stage is the data processing stage. Applying the *Apriori algorithm* to UB *Mart's sales data* yields sales patterns for each item, yielding highly useful information for *minimarket owners.*

**RESULTS AND DISCUSSION**

After obtaining the data set, then enter the implementation stage of the Apriori algorithm using *Visual Studio Code software*. The process flow of the Apriori algorithm implementation stages as mentioned in Figure 2 of the Apriori algorithm flowchart, the initial stage is importing the required library, then reading the data set, after that entering the read data set stage, then processing the data after that implementing the Apriori algorithm.

**A.    Import Required Libraries**

The initial stage for the apriori algorithm process in Python is to import the required libraries starting from importing numpy which functions to read Excel files, then mlxtend.frequent_patterns which functions to implement the apriori algorithm and its association rules for association patterns as in Figure 3 of the Library Program Section.

```python
# import library
import pandas as pd
import numpy as np
from mlxtend.frequent_patterns import association_rules, apriori
```

**Figure 2.** Library Program Cuts

**B.    Read Dataset**

Next, there is the process of reading Excel data on Google Drive, therefore the initial stage is to request access permission on Google Drive, which is shown in Figure 4 of the Google Drive Access Program Section.

```python
#izin akses gdrive
from google.colab import drive
drive.mount('/content/drive')
```

**Figure 3.** Google Drive Access Program Discounts

After requesting access permission on Google Drive, the next step is to call the Excel file on Google Drive according to its address, as shown in Figure 5, a fragment of the Read Data Set program.

```
#membaca data penjualan ub januari.xlsx
df = pd.read_excel('drive/MyDrive/Skripsi/Skripsi/Data nota penjualan UB/data penjualan ub januari.xlsx')
df.head()
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async`
  and should_run_async(code)
```

|   | Tanggal | Transaksi | item | Jumlah |
|---|---------|-----------|------|--------|
| 0 | 2024-02-01 00:00:00 | 1 | Mama Lemon Jeruk Nipis 230 ml | 1.0 |
| 1 | 2024-02-01 00:00:00 | 1 | Kecap Sedap 63ml | 1.0 |
| 2 | 2024-02-01 00:00:00 | 2 | Downy Floral pink 10 ml | 8.0 |
| 3 | 2024-02-01 00:00:00 | 2 | Rinso Classic Fresh 40gr | 6.0 |
| 4 | 2024-02-01 00:00:00 | 3 | Proclin Pemutih 25ml | 12.0 |

**Figure 4**. Program snippet read data set

**C.    Data Preprocessing**

The data processing stage is the stage carried out before implementing the apriori algorithm. This stage includes data cleaning, which removes unused variables and leaves only the required variables [15]. Figure 6 shows a fragment of the data processing program.

```
# processing data
data = df[["Transaksi","item"]].copy()
data.head()
```

```
/usr/local/lib/python3.10/dist-packages/ipyk
  and should_run_async(code)
```

|   | Transaksi | item |
|---|-----------|------|
| 0 | 1 | Mama Lemon Jeruk Nipis 230 ml |
| 1 | 1 | Kecap Sedap 63ml |
| 2 | 2 | Downy Floral pink 10 ml |
| 3 | 2 | Rinso Classic Fresh 40gr |
| 4 | 3 | Proclin Pemutih 25ml |

**Figure 5**. Data processing program snippet

Then there is a transformation to a tabular format or pivot table, namely grouping and presenting data in a structured table format and changing it into binary data as in Figure 7, a fragment of the transformation program in tabular form, because the apriori algorithm can only manage binary data.
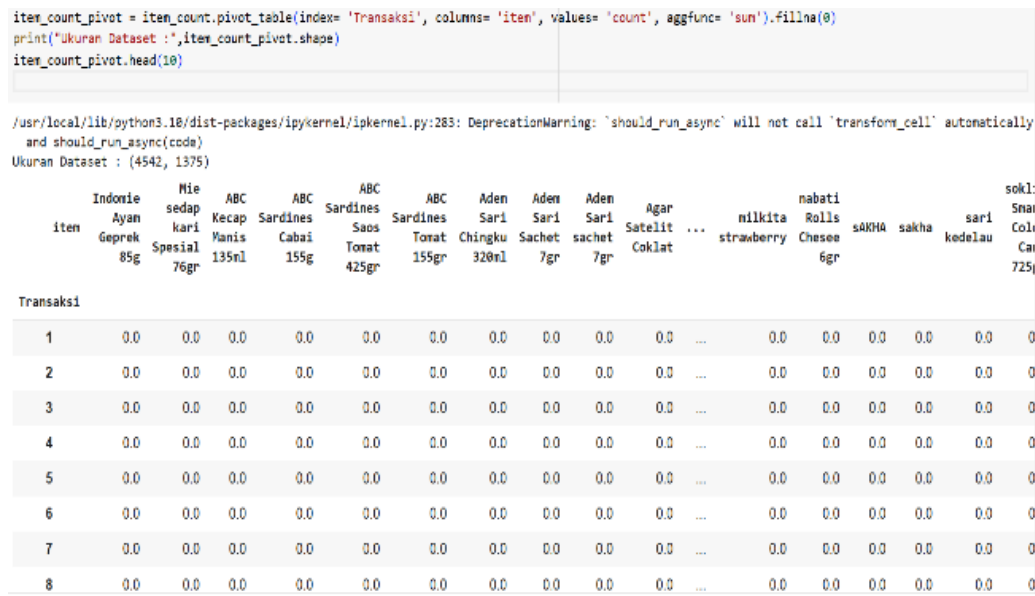
**Figure 6**. Transformation program pieces in tabular form

After that, it enters the hot encoding stage. This process is used to apply the Bolean function which represents the true value 1 and false value 0, as shown in Figure 8.
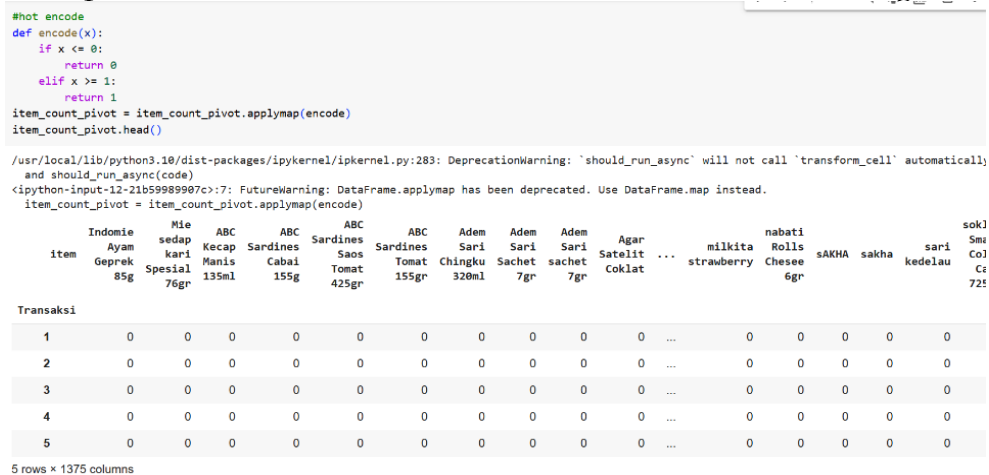


**Figure 7**. Hot Encoding Program Snippet

## D. Implementation Algorithm A priori

The final stage is the implementation of the apriori algorithm with python by determining the support value and determining the minimum confidence threshold. In this study, the researchers used several types of trials, the first being 0.005 support value and 0.05 minimum confidence limit as shown in Figures 9 and 10.
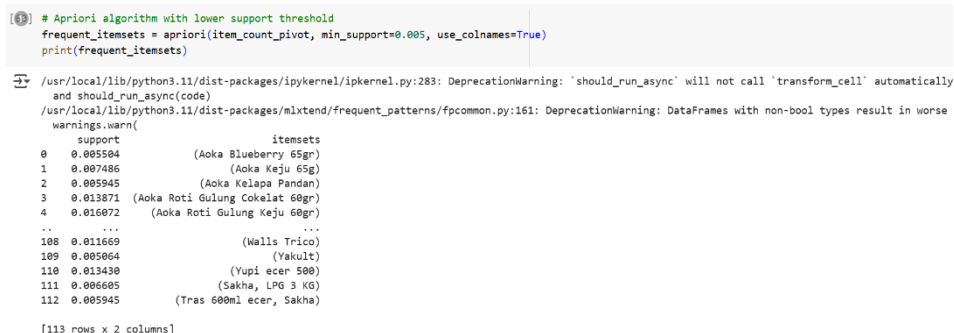


**Figure 8**. Program Piece Building Apriori Model

```
# Output results
rules = association_rules(frequent_itemsets, metric="lift", min_threshold=0.5, num_itemsets=len(frequent_itemsets))
rules_selected = rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']]
if not rules_selected.empty:
    print("\nAturan asosiasi yang ditemukan:")
    print(rules_selected)
else:
    print("\nTidak ada aturan asosiasi yang ditemukan. Coba kurangi nilai `min_support` atau `min_threshold`.")


Aturan asosiasi yang ditemukan:
         antecedents        consequents    support  confidence      lift
0           (Sakha)        (LPG 3 KG)   0.006605    0.049180  0.926876
1        (LPG 3 KG)           (Sakha)   0.006605    0.124481  0.926876
2   (Tras 600ml ecer)          (Sakha)   0.005945    0.238938  1.779109
3           (Sakha)  (Tras 600ml ecer)   0.005945    0.044262  1.779109
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not c
  and should_run_async(code)
```

**Figure 9**. Apriori Rules Program Cut

Then the researcher also tested with support values of 0.005 and 0.4 for the confidence limit with the results in Figures 11 and 12.

```
# Apriori algorithm with lower support threshold
frequent_itemsets = apriori(item_count_pivot, min_support=0.005, use_colnames=True)
print(frequent_itemsets)

/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not call `transform_cell` automatically
  and should_run_async(code)
/usr/local/lib/python3.11/dist-packages/mlxtend/frequent_patterns/fpcommon.py:161: DeprecationWarning: DataFrames with non-bool types result in worse
  warnings.warn(
       support                       itemsets
0     0.005504          (Aoka Blueberry 65gr)
1     0.007486             (Aoka Keju 65g)
2     0.005945          (Aoka Kelapa Pandan)
3     0.013871  (Aoka Roti Gulung Cokelat 60gr)
4     0.016072    (Aoka Roti Gulung Keju 60gr)
..         ...                            ...
108   0.011669                  (Walls Trico)
109   0.005064                       (Yakult)
110   0.013430               (Yupi ecer 500)
111   0.006605             (Sakha, LPG 3 KG)
112   0.005945         (Tras 600ml ecer, Sakha)

[113 rows x 2 columns]
```

**Figure 10**. Program Piece Building Apriori Model

```
# Output results
rules = association_rules(frequent_itemsets, metric="lift", min_threshold=0.4, num_itemsets=len(frequent_itemsets))
rules_selected = rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']]
if not rules_selected.empty:
    print("\nAturan asosiasi yang ditemukan:")
    print(rules_selected)
else:
    print("\nTidak ada aturan asosiasi yang ditemukan. Coba kurangi nilai `min_support` atau `min_threshold`.")


Aturan asosiasi yang ditemukan:
         antecedents        consequents    support  confidence      lift
0           (Sakha)        (LPG 3 KG)   0.006605    0.049180  0.926876
1        (LPG 3 KG)           (Sakha)   0.006605    0.124481  0.926876
2   (Tras 600ml ecer)          (Sakha)   0.005945    0.238938  1.779109
3           (Sakha)  (Tras 600ml ecer)   0.005945    0.044262  1.779109
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
  and should_run_async(code)
```

**Figure 11**. Apriori Rules Program Cut

And in the third trial, the researcher used a value of 0.005 for the support value and 0.3 for the confidence value and obtained results as shown in Figures 13 and 14.

```
[13] # Apriori algorithm with lower support threshold
     frequent_itemsets = apriori(item_count_pivot, min_support=0.005, use_colnames=True)
     print(frequent_itemsets)
```

```
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not call `transform_cell` automatically
  and should_run_async(code)
/usr/local/lib/python3.11/dist-packages/mlxtend/frequent_patterns/fpcommon.py:161: DeprecationWarning: DataFrames with non-bool types result in worse
  warnings.warn(
        support                     itemsets
0      0.005504           (Aoka Blueberry 65gr)
1      0.007486                 (Aoka Keju 65g)
2      0.005945             (Aoka Kelapa Pandan)
3      0.013871   (Aoka Roti Gulung Cokelat 60gr)
4      0.016072      (Aoka Roti Gulung Keju 60gr)
..          ...                           ...
108    0.011669                    (Walls Trico)
109    0.005064                        (Yakult)
110    0.013430                  (Yupi ecer 500)
111    0.006605                (Sakha, LPG 3 KG)
112    0.005945           (Tras 600ml ecer, Sakha)

[113 rows x 2 columns]
```

**Figure 12**. Program Piece Building Apriori Model

```
# Output results
rules = association_rules(frequent_itemsets, metric="lift", min_threshold=0.3, num_itemsets=len(frequent_itemsets))
rules_selected = rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']]
if not rules_selected.empty:
    print("\nAturan asosiasi yang ditemukan:")
    print(rules_selected)
else:
    print("\nTidak ada aturan asosiasi yang ditemukan. Coba kurangi nilai `min_support` atau `min_threshold`.")
```

```
Aturan asosiasi yang ditemukan:
        antecedents        consequents   support   confidence      lift
0           (Sakha)        (LPG 3 KG)   0.006605     0.049180  0.926876
1        (LPG 3 KG)           (Sakha)   0.006605     0.124481  0.926876
2  (Tras 600ml ecer)          (Sakha)   0.005945     0.238938  1.779109
3           (Sakha)  (Tras 600ml ecer)   0.005945     0.044262  1.779109
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not call
  and should_run_async(code)
```

**Figure 13**. Apriori Rules Program Cut

And in the final trial, the researcher used a support value of 0.005 and a confidence value of 0.2 and obtained results as shown in Figures 15 and 16.

```
[13] # Apriori algorithm with lower support threshold
     frequent_itemsets = apriori(item_count_pivot, min_support=0.005, use_colnames=True)
     print(frequent_itemsets)
```

```
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not call `transform_cell` automatically
  and should_run_async(code)
/usr/local/lib/python3.11/dist-packages/mlxtend/frequent_patterns/fpcommon.py:161: DeprecationWarning: DataFrames with non-bool types result in worse
  warnings.warn(
        support                     itemsets
0      0.005504           (Aoka Blueberry 65gr)
1      0.007486                 (Aoka Keju 65g)
2      0.005945             (Aoka Kelapa Pandan)
3      0.013871   (Aoka Roti Gulung Cokelat 60gr)
4      0.016072      (Aoka Roti Gulung Keju 60gr)
..          ...                           ...
108    0.011669                    (Walls Trico)
109    0.005064                        (Yakult)
110    0.013430                  (Yupi ecer 500)
111    0.006605                (Sakha, LPG 3 KG)
112    0.005945           (Tras 600ml ecer, Sakha)

[113 rows x 2 columns]
```

**Figure 14**. Program Piece Building Apriori Model

```
# Output results
rules = association_rules(frequent_itemsets, metric="lift", min_threshold=0.2, num_itemsets=len(frequent_itemsets))
rules_selected = rules[['antecedents', 'consequents', 'support', 'confidence', 'lift']]
if not rules_selected.empty:
    print("\nAturan asosiasi yang ditemukan:")
    print(rules_selected)
else:
    print("\nTidak ada aturan asosiasi yang ditemukan. Coba kurangi nilai `min_support` atau `min_threshold`.")


Aturan asosiasi yang ditemukan:
        antecedents        consequents  support  confidence      lift
0           (Sakha)        (LPG 3 KG)  0.006605    0.049180  0.926876
1        (LPG 3 KG)           (Sakha)  0.006605    0.124481  0.926876
2  (Tras 600ml ecer)        (Sakha)  0.005945    0.238938  1.779109
3           (Sakha)  (Tras 600ml ecer)  0.005945    0.044262  1.779109
/usr/local/lib/python3.11/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not
  and should_run_async(code)
```

**Figure 15**. Apriori Rules Program Cut

Based on the research results above which have been tested with several support and confidence values, the results obtained were the same and include:

1      If you buy Sakha then buy 3 KG LPG with *support* : 0.006605 and *confidence* : 0.049180
2      If you buy 3 KG LPG you will buy Sakha with *support* : 0.006605 and *confidence* : 0.124481
3      If you buy Tras 600ml retail, you will buy Sakha with *support* : 0.005945 and *confidence* : 0.238938
4      If you buy Sakha, you will buy Tras 600ml retail with *support* : 0.005945 and *confidence* : 0.044262

## CONCLUSION

**Fundamental Finding :** The study demonstrates that applying the apriori algorithm to purchasing data from UB Mart (January 1, 2024 to February 20, 2024) generates four key associations, revealing consistent co-occurrence patterns between Sakha, 3 KG LPG, and Tras 600 ml retail products. **Implication :** These identified associations provide a practical basis for optimizing product placement, improving stock management, and designing effective bundling promotions within UB Mart's minimarket operations. **Limitation :** The analysis is limited by the use of a single algorithm and a restricted data period, which may constrain the variability and robustness of the resulting association rules. **Future Research :** Future work may employ alternative algorithms or incorporate more recent and extensive datasets to enhance the accuracy, relevance, and adaptability of the association rules generated.

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