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Analysis of Food Menu Purchasing Patterns in Campus Canteens Using the Apriori Algorithm in Data Mining

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Abstract− This study aims to identify purchasing patterns of food menus in the campus cafeteria of STMIK Mulia Darma by applying the Apriori algorithm within the data mining framework. The background of this research is based on the increasing volume of transaction data that remains underutilized in supporting managerial decision-making. The Apriori algorithm is employed to uncover associations between items frequently purchased together by calculating their support and confidence values. A dataset of 20 daily digital transactions was used as the basis for analysis. The results revealed a single valid association rule that met the minimum threshold: Nasi Goreng → Teh Manis with a support value of 15% and a confidence value of 60%. This finding indicates a strong tendency in student consumption behavior, which can be leveraged for marketing strategies such as menu bundling and predictive inventory management. The study demonstrates that the Apriori algorithm can offer practical and strategic insights in the context of a campus cafeteria and holds potential for further development using larger datasets and more advanced analytical methods.

Keywords: Apriori; data mining; campus cafeteria; purchasing pattern; market basket analysis

1. INTRODUCTION

The development of information technology and digital-based transaction systems has resulted in a huge influx of data, particularly in the context of consumers and daily purchases. Transaction data containing food purchase records contain hidden patterns that can be used as a basis for strategic decision-making, such as menu planning, targeted promotions, and food stock adjustments in campus canteens.[1]
The STMIK Mulia Darma campus canteen is a vital place for students to meet their consumption needs while on campus. In this context, food menu purchase patterns at the canteen can provide valuable insights for canteen managers in designing sales and marketing strategies. By using the Apriori algorithm in data mining, purchase pattern analysis can be conducted to identify the relationships between various food items purchased by students. This not only helps in improving customer satisfaction but also in optimizing inventory and menu management.
A common problem faced by cafeteria managers is a lack of understanding of student preferences and purchasing behavior. Without accurate data, managers may find it difficult to determine what menu items to offer, how much stock to provide, and how to promote those items.
The Market Basket Analysis (MBA) method has long been the backbone of consumer behavior analysis in the retail sector. One of the most popular algorithms supporting MBA is Apriori, which works by exploring frequent itemsets and generalizing association rules based on support and confidence metrics [2], [3], [4].
Apriori identifies combinations of items frequently purchased together, such as coffee and fried snacks, providing insights for more effective marketing practices like product placement and bundling offers[5],[6]. Apriori was used to analyze 4,371 transaction data. The results identified 9 association rules recommended for product placement strategies and bundling offers [7]. The Apriori algorithm was applied to food transaction data in a campus environment and generated recommendations for bundled menu packages that increased sales by 15% compared to before the analysis was conducted [8]. Another study by Astuti et al. showed that patterns of interrelationship between beverages and snacks can be used to design more appealing budget-friendly packages for students [9]. Previous studies have demonstrated the success of the Apriori algorithm in analyzing purchasing behavior. Research by Setiawan and Mulyanti (2020) in a retail store showed that Apriori can uncover product combinations frequently purchased together, such as instant noodles and eggs, which were then utilized for bundling strategies[3]. Syahrul Bashiir and Witanti (2024) also applied the Apriori algorithm in a student e-warung system, generating association rules that helped improve stock effectiveness and product recommendations[4]. Meanwhile, Rahman and Indra (2024) successfully identified 9 association rules from 4,371 transactions analyzed in a university canteen, providing a basis for product placement and menu package strategies [8]. These studies demonstrate the significant potential of the Apriori algorithm in supporting data-driven decision-making; however, most research remains focused on the general retail sector and has not extensively examined the specific context of campus canteens in a comprehensive manner. Therefore, this study aims to address this gap by exploring the application of the Apriori algorithm to identify purchasing patterns of student meals at the STMIK Mulia Darma campus canteen.

2. RESEARCH METHODOLOGY

2.1 Research Stages

The following are the research stages applied as follows:

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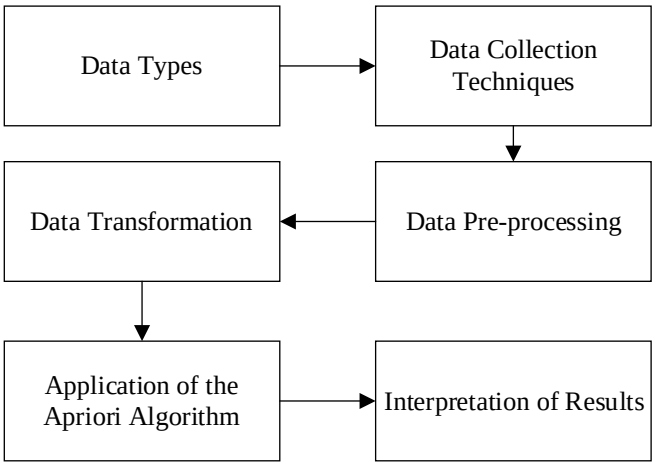

Figure 1. Research Stages

2.1 Type of Research

This research is quantitative research with an exploratory approach that utilizes data mining methods, specifically the Apriori algorithm in Market Basket Analysis (MBA). The main objective of this research is to identify food menu purchasing patterns among students at the STMIK Mulia Darma campus canteen so that it can be used as a basis for strategic decision making.

2.2 Data Sources and Types

1. Data Sources: Data is obtained from the digital transaction system used in the campus canteen.
2. Data Types: Data on food purchases made by students, including:
    a. Transaction ID
    b. Date and time of transaction
    c. List of items/menu items purchased in a single transaction

2.3 Data Collection Techniques

Data was collected through the documentation method, which involves taking historical data from the Point of Sale (POS) system or canteen transaction records. The transaction data was then stored in CSV/Excel format for further analysis.

2.4 Apriori Algorithm

Association analysis is defined as a process of finding association rules that meet the minimum support and minimum confidence criteria. When searching for association rules, one problem is that many possible rules may be found, but they may not necessarily be the best and most reliable rules [10].

2.4.1 Association Rules

Association rules are a method that aims to find patterns that frequently appear among many transactions, where each transaction consists of several items so that this method will support recommendation systems through the discovery of patterns between items in transactions.[11][12][13].
The basic methodology of association analysis is divided into two stages:
a. High frequency pattern analysis
b. This stage looks for combinations of items that meet the minimum support value in the database. The support value of an item is obtained using the following formula:

$$\text{Support A} = \frac{\text{number of transactions containing A}}{\text{total transactions}} \quad (1)$$

Meanwhile, the support value from the two items is obtained from the following formula

$$support(A,B) = \frac{\text{number of transactions containing A and B}}{\sum Transaction} \quad (2)$$

Formulation of associative rules After all high-frequency patterns have been found, associative rules that meet the minimum confidence requirements are sought by calculating the confidence of associative rule A U B.

3. RESULT AND DISCUSSION

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3.1 Transaction Data Analysis

The transaction data used in this study was obtained from the Point of Sale (POS) system at the STMIK Mulia Darma canteen, with a total of 24 transactions during the observation period. Each transaction contains information about the list of menu items purchased by students at one time.

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3.1.1 Dataset dan Preprocessing

Here is a sample of transaction data in table format:

Table 1. Campus Canteen Transaction Data for June 2025

Transaction ID	Purchase Item
TRX001	Fried Rice, Sweet Tea
TRX002	Chicken Noodles, Orange Juice
TRX003	Toasted Bread, Black Coffee
TRX004	Coconut Rice, Fried Chicken, Mineral Water
TRX005	Chicken Noodles, Iced Tea
TRX006	Fried Rice, Crispy Fried Chicken, Mineral Water
TRX007	Toasted Bread, Sweet Tea
TRX008	Chicken Noodles, Meatballs, Orange Juice
TRX009	Steamed Rice with Coconut Milk, Tofu and Tempeh, Mineral Water
…	…
TRX024	Chicken Noodles, Toasted Bread, Chocolate Ice Cream

3.2 Application of the Apriori Algorithm

The Apriori method is used to identify frequent itemsets and association rules between items based on minimum support and minimum confidence values. In this study, the following threshold values were used:

Minimum Support = 0.10 (10%)

Minimum Confidence = 0.60 (60%)

Most Frequent Items

Table 2. 10 Most Frequently Appearing Items

Item	Frequency	Support
Chicken Noodles	8	0.40
Fried Rice	5	0.25
Sweet Tea	5	0.25
Toast	5	0.25
Mineral Water	4	0.20
Black Coffee	3	0.15
Orange Juice	3	0.15
Fried Chicken	2	0.10
Chocolate Ice Cream	2	0.10
Fried Chicken	2	0.10

3.3 Association Rule Results

After the mining process is done, here are the association rule results that meet the support and confidence criteria:

Table 3. Valid association rules

Association Rules	Support	Confidence
Fried rice, sweet tea	0.15	0.60

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The above rules show that of all purchases of Nasi Goreng, 60% also included purchases of Teh Manis. This illustrates a habit or preference among customers to buy these two products together.

3.4 Association Visualization

Figure 1 shows the visualization results of one of the association rules obtained using the Apriori algorithm based on campus canteen transaction data. In this association network, two nodes are displayed representing food and beverage items that are often purchased together.

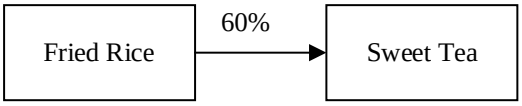

Figure 1. Visualization of the Association Network

3.5 Discussion

The results of this study indicate that the Apriori algorithm is effective in identifying student purchasing patterns based on digital transaction data in campus canteens. The main pattern found is that students tend to buy Sweet Tea every time they buy Fried Rice. The practical implication is that canteen managers can create a bundled package of Fried Rice + Sweet Tea, and place these two items in a strategic location close to each other. The dominance of the "Chicken Noodles" item indicates high popularity, but due to the excessive variety of item pairs, not all result in strong association rules. The benefits of applying this method include more accurate inventory planning, reduced food waste, and menu design that is more appealing to student consumers.

4. CONCLUSION

This study aims to analyze food menu purchasing patterns at the STMIK Mulia Darma campus canteen using the Apriori algorithm in a data mining approach. Based on the processing and analysis of 20 transaction data entries, it was found that the Apriori method is effective in revealing hidden relationships between food and beverage items that are frequently purchased together by students. From the mining process, one valid association rule was obtained: Fried Rice and Sweet Tea, with a support value of 15% and a confidence value of 60%. This finding indicates that the majority of students who purchase Fried Rice also tend to purchase Sweet Tea in the same transaction. This indicates the presence of strong consumption habits or preferences, which can be leveraged by canteen managers to develop promotional strategies, such as bundling packages or reorganizing menus and efficiently managing food inventory. The use of the Apriori algorithm in the context of a campus canteen has proven relevant and can assist in making more accurate and data-driven decisions. Although the amount of data used is still limited, the results have shown significant potential for the application of data mining methods in optimizing canteen services. Moving forward, this method can be further developed with larger datasets, longer observation periods, and more complex algorithms to support automated recommendation systems and smarter, more efficient canteen operational management.

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