# ANALYSIS OF SHOE ORDERING PATTERN AT PT. PRATAMA ABADI INDUSTRI USING THE APRIORI ALGORITHM

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**Abstract** - Inventory is one of the most important factors in ensuring the continuity of the production process. PT. Pratama Abadi Industri is an industrial company in the field of shoe sales. In its activities, PT. Pratama Abadi Industri was unable to provide production materials appropriately, causing a shortage of shoe material stock for the production of the type of shoe that the customer is most interested in. The method used in this research is to use the a priori Algorithm and to get accurate results, this research uses the Tanagra 1.4.50 software. The purpose of this study was to analyze the ordering of NIKE shoes that are often ordered by customers by looking at their previous order patterns. This a priori algorithm can produce 7 final association rules between items with a minimum value of 30% of support and a minimum of 70% of confidence and from May 2020 to October 2020 it is known that the most popular order pattern for NIKE shoes is NIKE shoes with the Tailwind (100%), Revolution 5 (100%), Air Max Plus (100%) and Classic Cortez Leather (100%) which can be used as reference materials in determining the next production material inventory.

**Keywords:** Apriori algorithm, Data mining, Ordering

**Abstrak** - *Persediaan merupakan salah satu faktor terpenting dalam menjamin kelancaran proses produksi. PT. Pratama Abadi Industri merupakan perusahaan industri dalam bidang penjualan sepatu. Dalam kegiatannya, PT. Pratama Abadi Industri tidak dapat menyediakan bahan material produksi secara tepat sehingga menyebabkan terjadinya kekurangan stok persediaan material sepatu untuk dilakukannya produksi dari jenis sepatu yang paling diminati oleh customer. Metode yang digunakan dalam penelitian ini adalah dengan menggunakan Algoritma apriori dan untuk mendapatkan hasil yang akurat, penelitian ini menggunakan software Tanagra 1.4.50. Tujuan dari penelitian ini adalah untuk menganalisis pemesanan sepatu NIKE yang sering dipesan oleh customer dengan melihat pola pemesanan sebelumnya. Algoritma apriori ini dapat menghasilkan 7 aturan asosiasi final antar item dengan nilai minimum support 30% dan minimum confidence 70% serta pada bulan Mei 2020 sampai dengan Oktober 2020 diketahui pola pemesanan sepatu NIKE yang paling diminati adalah sepatu NIKE dengan jenis Tailwind (100%), Revolution 5 (100%), Air Max Plus (100%) dan Classic Cortez Leather (100%) yang dapat dijadikan bahan acuan dalam menentukan persediaan material produksi selanjutnya.*

**Kata Kunci:** *Algoritma Apriori, Data Mining, Pemesanan*

## INTRODUCTION

Economic growth in Indonesia is currently entering a turning point due to the deterioration of the COVID-19 pandemic. The economic growth has begun to show an increasing trend and has even passed its critical phase. The Indonesian economy in the first quarter of 2020 against the first quarter of 2019 grew by 2.97 percent [1]. The current development of the shoe industry tends to increase. The increase in the shoe industry is a great opportunity for shoe producers considering that Indonesia is a country with one of the largest populations in the world [2].

Shoes are one of the most important fashions in supporting appearance. The percentage of

expenditure on clothing, footwear, headgear per capita of the Indonesian people is 5.80% in a month [3]. PT. Pratama Abadi Industri is a company engaged in the fashion footwear industry in producing athletic shoes for the NIKE brand. In its business activities, the company carries out production based on customer orders or make to order. Types of orders or orders from customers have variations and types and fluctuating amounts.

The inventory system applied in the company is that orders are made at the beginning of each month with a lead time of four days and [4] Order quantity is based on estimates only. Companies sometimes experience an excess or lack of production material when a customer changes an order request for certain types [5]. To solve this problem, a data mining technique is needed in analyzing the habits of ordering customers in knowing the relationship between an item and another item in order to find out what types of NIKE shoes are the most often ordered simultaneously by customers. [6] Data mining is the process of analyzing data to find a pattern from the hidden data sets. The application of the apriori algorithm to data mining techniques is very efficient and can speed up the process of forming item combination patterns [7] then the test is carried out to whether the combination meets the minimum support and confidence parameters, which are the threshold values given by the user [8].

This study aims to analyze shoe orders for 6 months using the apriori algorithm and association rules. So that the results can be seen what type of shoes are often purchased simultaneously by customers during the 6 months.

### Literature Research

There are several previous studies related to the Apriori Algorithm. Research conducted by Anggraini, Putri, and Utami [9] Regarding the Implementation of the Apriori Algorithm in Determining the Most Interested Car Sales at Honda Permata Serpong, said that Data Mining is very useful to determine the relationship between the frequency pattern of Honda car sales that consumers are most interested in. The results of sales data for the Honda Permata Serpong 2018, with the highest support and confidence values are the Mobilio-Brio Satya (50% -100%), Jazz-HRV (33.33% -100%), and HRV-Mobilio-Brio Satya (33.33% -100%). With the results of the sales analysis at Honda Permata Serpong, it is hoped that it can regulate the stock of goods for marketing so that there is no accumulation of less desirable goods, which results in losses in the future. [10], suggested that the Apriori algorithm with minimum support of 30% and a minimum of 60% confidence

can produce 6 final association rules which are very useful for making decisions in preparing stocks of what types of shoes are needed in the future. Subsequent research conducted by Lestari and Hafiz on the Application of the Apriori Algorithm to the Barbar Warehouse Sales Data [11], argues that Barbar Warehouse owners can find out which product categories are most sold each week in sales for 3 months by using apriori algorithm, namely the Bedding (bed sheet) and Watches (glasses) category with 100% confidence and support values. The a priori algorithm has a positive influence on the sales report of Barbar Warehouse because the owner can find out which products need to be reproduced or reduced in stock to increase sales turnover.

Based on the GAP analysis of the above research with this research using apriori algorithm is to determine the pattern of shoe orders by the customer which can be used as knowledge or a reference in determining efficient production material inventory so that the production process can run smoothly and can reduce additional costs such as costs of stock.

## MATERIALS AND METHODS

### Research Stages

Research is looking through a methodical process of adding to knowledge itself and with others, by the discovery of facts and unusual insights [12]. The following are the steps taken by the author in this research can be seen in figure 1 below:
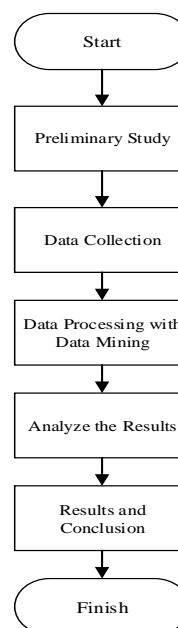


Source: [13]

Figure 1. Stages of Research

Explanation of the stages of the research:
a. Preliminary study
   The first step of this research is to find and study the problems that exist at PT. Pratama Abadi Industri then determines the scope of the problem, the background of the problem, and studies some literature related to the problem and how to find solutions to these problems.
b. Data Collection
   In this context, it is intended to find out important things related to this research. Data collection is done by making observations at PT. Pratama Abadi Industri. Also, researchers conducted interviews with parties related to this research. Then the authors took a sample of the order transaction database in May 2020 - October 2020 at PT. Pratama Abadi Industri to supporting this research.
c. Data Processing with Data Mining
   The data processing process is carried out to identify the problems and are often at PT. Pratama Abadi Industri, then an analysis of these problems is carried out for the author to get a solution, and then the algorithm can be used to obtain a solution. In the next stage, the authors use data mining techniques with a priori algorithms to get results as goals to be achieved.
d. Analyze the Results
   At this stage, the authors analyzed the results with the tools used as system testing, namely is Tanagra 1.4.50.
e. Results and Conclusion
   After being tested, the results of the analysis are between manual ways and testing using the software of data processing. The next step is to provide conclusions that can be made into new knowledge that has been obtained from the test results of a priori algorithm model.

**Data collection technique**

a. Observation
   The author made observations at PT. Pratama Abadi Industri. The author observes the business process and procedures that run in the company and collecting the data and information required in this research.
b. Interview
   The author collects the data by interacting and communicating directly with Mr. Jaelani as the Warehouse Staff at PT. Pratama Abadi Industri to provide the necessary information in writing this research.
c. Library Study
   This method is carried out by the author are reading and quoting books, journals, and other sources related to modeling using the data mining and a priori algorithms.

**Data analysis method**

To achieve the goals of this research, the author uses quantitative data analysis methods. [14] Quantitative data analysis is a data analysis that is used if the conclusions obtained can be proven by numbers and a formula that is related to the analysis is also used in the calculations. In analyzing the data, the author uses a priori algorithm calculation.

**RESULTS AND DISCUSSION**

**Data analysis**

In this research, the stages began with data analysis to apply the apriori algorithm in analyzing orders at PT. Pratama Abadi Industri. Data on this research are using secondary data on shoe orders obtained from PT. Pratama Abadi Industri as shown in table 1 below:

Table 1. List of Types NIKE Shoes

| No. | Types of NIKE Shoes |
|---|---|
| 1 | Air Max Plus |
| 2 | Air Zoom |
| 3 | Classic Cortez Leather |
| 4 | Flyease |
| 5 | Revolution 5 |
| 6 | SB Air Trainer I ISO |
| 7 | Speedrep |
| 8 | Tailwind |
| 9 | TN Supreme |
| 10 | Waffle Trainer |
| 11 | Zoom 2K |

Source: [15]

The next stage is grouping the 3 types of NIKE shoes that are most ordered by customers based on the historical data of PT. Pratama Abadi Industri from May 2020 to October 2020, resulting in a transaction pattern as shown in table 2 below:

Table 2. Transaction Patterns of Ordering NIKE Shoes

| Month | Itemset |
|---|---|
| 5 | Tailwind, Revolution 5, Air Max Plus |
| 6 | Waffle Trainer, Zoom 2K, Air Max Plus |
| 7 | Classic Cortez Leather, Air Max Plus, Revolution 5 |
| 8 | Tailwind, Revolution 5, Air Max Plus |
| 9 | Zoom 2K, Classic Cortez Leather, Revolution 5 |
| 10 | Speedrep, Zoom 2K, Revolution 5 |

Source: [15]

Then, the tabulation format of each month, if created will be like are in table 3 below:

Table 3. Tabulation Format of Data Transaction

| Month | Tailwind | Revolution 5 | Air Max Plus | Waffle Trainer | Zoom 2K | Classic Cortez | Spedrep |
|---|---|---|---|---|---|---|---|
| 5 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 8 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 9 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 10 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |

Source: [15]

### Frequency Pattern Analysis

### Itemset Formation

This stage looks for a combination of items that qualify the minimum requirements of the support value in the database. The process of forming $C_1$ or called is 1 itemset with a minimum value of support = 30% which produces the itemset as in table 4 below:

Table 4. Itemset with a Minimum Support of 30%

| Itemset | Total | Support |
|---|---|---|
| Tailwind | 2 | 33.33% |
| Revolution 5 | 5 | 83.33% |
| Air Max Plus | 4 | 66.67% |
| Zoom 2K | 3 | 50.00% |
| Classic Cortez Leather | 2 | 33.33% |

Source: [16]

After the calculation results from $C_1$ are obtained, it is followed by the process of forming $C_2$ or called is 2 itemset with a minimum support value = 30% which produces the itemset as in table 5 below:

Table 5. Itemset with a Minimum Support of 30%

| Itemset | Total | Support |
|---|---|---|
| Tailwind, Revolution 5 | 2 | 33.33% |
| Tailwind, Air Max Plus | 2 | 33.33% |
| Revolution 5, Air Max Plus | 3 | 50.00% |
| Revolution 5, Zoom 2K | 2 | 33.33% |
| Revolution 5, Classic Cortez Leather | 2 | 33.33% |

Source: [16]

The last stage is to continue the process of forming C3 or called is 3 itemset with a minimum support value = 30% which produces an itemset as in table 6 below:

Table 6. Itemset with a Minimum Support of 30%

| Itemset | Total | Support |
|---|---|---|
| Tailwind, Revolution 5, Air Max Plus | 2 | 33.33% |

Source: [16]

### Final Association Rules

After all high-frequency patterns are found ($C_1$, $C_2$, and $C_3$), then the association rules are looked for with the results of the frequency patterns shown in table 7 below:

Table 7. Results of Qualifying High-Frequency Patterns

| Itemset | Support |
|---|---|
| Tailwind, Revolution 5 | 33.33% |
| Tailwind, Air Max Plus | 33.33% |
| Revolution 5, Air Max Plus | 50.00% |
| Revolution 5, Zoom 2K | 33.33% |
| Revolution 5, Classic Cortez Leather | 33.33% |
| Tailwind, Revolution 5, Air Max Plus | 33.33% |

Source: [16]

The next step is to look for association rules that qualify the minimum requirements for confidence, by calculating confidence or associative $A \rightarrow B$, with a minimum value of confidence = 70% which results in the itemset as in table 8 below:

Table 8. Results of Confidence or Association

| Rules | | Confidence |
|---|---|---|
| If you order Tailwind, it will order Revolution 5 | 2/2 | 100% |
| If you order Revolution 5, you order Tailwind | 2/5 | 40% |
| If you order Tailwind, you will order Air Max Plus | 2/2 | 100% |
| If you order Air Max Plus, you will order Tailwind | 2/4 | 50% |
| If you order Revolution 5, you will order Air Max Plus | 3/5 | 60% |
| If you order Air Max Plus, you will order Revolution 5 | 3/4 | 75% |
| If you order Revolution 5, it will order the Zoom 2K | 2/5 | 40% |
| If you order Zoom 2K, it will order Revolution 5 | 2/3 | 66.67% |
| If you order Revolution 5, you will order Classic Cortez Leather | 2/5 | 40% |
| If you order Classic Cortez Leather, you will order Revolution 5 | 2/2 | 100% |

| Rules | Confidence | |
|---|---|---|
| If you order Tailwind, you will order Revolution 5 and Air Max Plus | 2/2 | 100% |
| If you order Revolution 5, you will order Tailwind and Air Max Plus | 2/5 | 40% |
| If you order Air Max Plus, you will order Revolution 5 and Tailwind | 2/4 | 50% |
| If you order Tailwind and Revolution 5, you will order Air Max Plus | 2/2 | 100% |
| If you order Tailwind and Air Max Plus, you will order Revolution 5 | 2/2 | 100% |
| If you order Air Max Plus and Revolution 5, you will order Tailwind | 2/3 | 66.67% |

Source: [16]

The final step is the formation of a final association rule that is obtained based on predetermined minimum support and minimum confidence, so can be seen in table 9 and the diagram below:

Table 9. Final Association Rules

| Rules | *Support* | *Confidence* |
|---|---|---|
| If you order Tailwind, it will order Revolution 5 | 33.33% | 100% |
| If you order Tailwind, you will order Air Max Plus | 33.33% | 100% |
| If you order Air Max Plus, you will order Revolution 5 | 50.00% | 75% |
| If you order Classic Cortez Leather, you will order Revolution 5 | 33.33% | 100% |
| If you order Tailwind, you will order Revolution 5 and Air Max Plus | 33.33% | 100% |
| If you order Tailwind and Revolution 5, you will order Air Max Plus | 33.33% | 100% |
| If you order Tailwind and Air Max Plus, you will order Revolution 5 | 33.33% | 100% |

Source: [16]
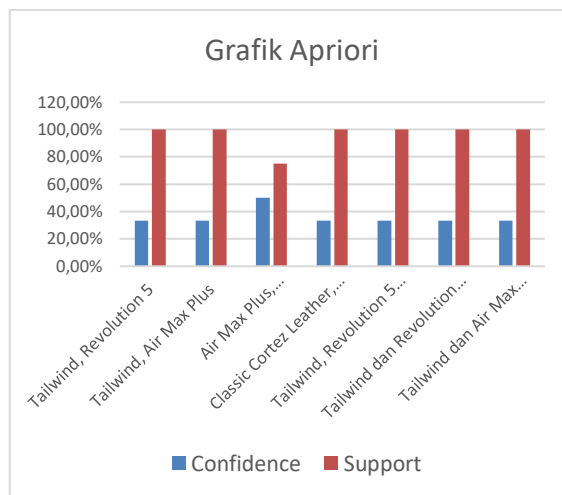


Figure 2. Final Association Rules Diagram for the Most Ordered Type of Shoes

**Algorithm Calculation with Tanagra 1.4.50**

1. Algorithm Support
In determining support which consists of input, process, and output. Following are the results of support based on the results of the analysis carried out and can be seen in figure 3 and 4 below:
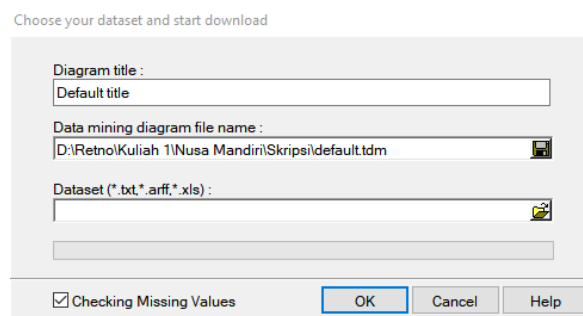


Figure 3. Data Retrieval Process

Figure 3 above is the process of retrieving data from Microsoft Excel to Tanagra 1.4.50 for the data processing.
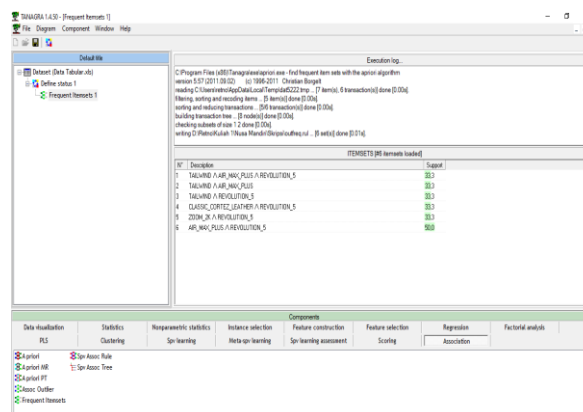


Figure 4. Display Support

Figure 4 above is the result of the support that has been previously determined by the author.

2. Algorithm Confidence

In determining confidence which consists of input, process, and output. Following are the results of the implementation using Tanagra 1.4.50 and can be seen in figure 5 and 6 below:
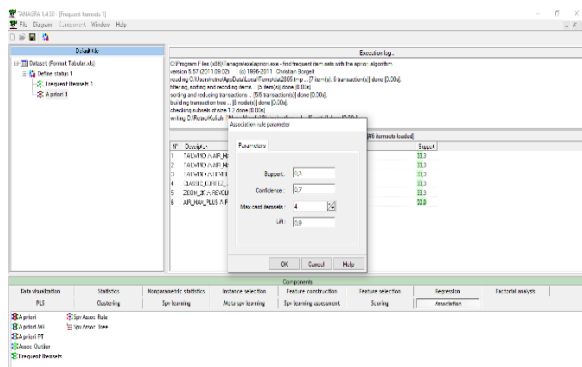


Figure 5. Determining the Value of Confidence



Figure 6. Results of the Final Association Rule

Figure 6 above is the result of the final association of shoe ordering patterns at PT. Pratama Abadi Industri. So, based on the picture above, the application of the a priori algorithm can result in 7 strong rules associated with the most popular products by the customer are Tailwind, Revolution 5, Air Max Plus, and Classic Cortez Leather.

## CONCLUSION

In this research, the a priori algorithm was successfully applied for the search of shoe ordering patterns at PT. Pratama Abadi Industri. This can be seen from the results of the research which shows that the most ordered types of shoes are ordered by customers at PT. Pratama Abadi Industri, by looking at products that qualify for minimum support and minimum confidence. From the highest final association rules, it is known that if you order Tailwind you will order Revolution 5 with 33.33% support and 100% confidence. If you order Tailwind, you will order Air Max Plus with 33.33%

support and 100% confidence. If you order Classic Cortez leather, you will order Revolution 5 with 33.33% support and 100% confidence. If you order Tailwind, you will order Revolution 5 and Air Max Plus with 33.33% support and 100% confidence. If you order Tailwind and Revolution 5, you will order Air Max Plus with 33.33% support and 100% confidence. So based on the results of this research, knowing the type of NIKE shoes that customers are most interested in can be used as knowledge or reference for PT. Pratama Abadi Industri to determining the supply of production materials optimally and efficiently which can ensure the continuity of the production process on increasing the company's turnover in the future.

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