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1 Market Basket Analysis to Identify Stock Handling Patterns and Item Arrangement Patterns Using Apriori Algorithms

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Abstract: The process of managing the pattern of handling stock of goods and the pattern of arranging goods on store shelves requires an identification process by utilizing data from sales transaction results. Market basket analysis of sales transaction data using Apriori Algorithm stages produces an information in the form of association rules with a minimum support value of 50% and a minimum confidence of 60%. It can be a reference in the arrangement of items on store shelves by referring to a combination of items that are often bought by consumers simultaneously. In addition, the stock inventory pattern can take advantage of the results of determining the high frequency value in the combination pattern 1 - itemset C1 with a minimum support value of 50% which is compared with the initial inventory.

Keywords: Apriori Algorithm, arrangement of goods, stock

1. Introduction

In the management of a minimarket, it is necessary to have a system management in the process of handling the patterns of stock handling and patterns of arrangement of goods, with the aim of structuring the goods¹ to make it easier for customers to shop and patterns of handling stock of goods to provide the availability of goods needed by customers. Of the two, if not handled by an analysis of sales transaction data, it can be a problem for the development of minimarkets. Many business sellers of goods that assume that the sales transaction data report is only to be a report on several things, such as how many items are sold, how many items⁵ are still available, and how much profit is obtained. Sales transaction data can be used to help decisions in predicting the layout of goods so that consumers easily find the items sought and determine the prediction of the amount of stock in the future. These problems can be solved by market basket analysis using the stages of Apriori² Algorithm, namely by identifying the value of support and confidence of goods sold at the minimarket. It can be a preference in the pattern of arrangement of goods based on customer habits in buying goods simultaneously and can¹¹ be a prediction of the stock of goods in the future [1].

Market basket analysis is the process of analyzing customer buying habits on each sales transaction data, by identifying associations between different items of the consumer shopping basket [2].

This research focuses² on the event identifying the process of managing stock patterns of handling goods and structuring patterns of goods using Apriori Algorithm. This algorithm is used to find rules or measure the relationship between two or more items. Associative rules are expressed in terms¹⁵ if they are antecedents, so they are consistent with the amount of support and confidence associated with the rules [3].

In a study entitled "Implementation of Apriori Algorithms with market basket analysis for product layout settings" explained that the association rules formed from the results of the discussion are used to regulate product placement in stores. Products that have high associations with other products will be placed close together, so as to facilitate consumers in buying products and store management in managing stock [4]. Maharani, et al. Also conduct research under the heading "Implementation of data mining for minimarket layout by applying association rule". The research aims to apply the association rule in the preparation of product layouts. From the rules generated, it can help companies in the preparation

of product layouts [5]. Meanwhile, according to research conducted by Adyawangkara, et al with the title "Analysis of the rules of association between items in purchase transactions using data mining with Apriori Algorithm (case study: Gunungan minimarket, Central Java)", in that study aims to find the rules of association in the purchase of items in minimarkets to solve the problem of procurement of goods stock, determining promotional strategies, and arranging goods in minimarkets [6]. Research on the rules of association between items in identifying products that are sold and the relationship between products based on the conditions of the sales transaction data. [7] [8] [9] [10] [11] [12] [13] [14] [15].

2. Research Methods

This study conducted an experimental process with the aim of understanding the steps in the market basket analysis process using Apriori Algorithms in identifying patterns of handling stock items and patterns of arrangement of goods on store shelves. The stages in this study can be shown by Figure 1:



Figure 1. Research Process Stage

a. Data Collection Stage

The data used in this study were taken from the sales transaction database that is available at the Surya Mart minimarket. The mini market is a campus cooperative located at STMIK Muhammadiyah Paguyangan Brebes which is located on Jl. Pangeran Diponegoro, Kec. Paguyangan, Kab. Brebes. Postal Code 52276.

b. Data Processing Stage

At this stage the database scan process is carried out from the sales transaction table in order to calculate the number of purchases that occur on each item of goods. After that, the process is implemented into tabular data in the form of binary data with the statement 0 if the item was not purchased and 1 if the item was purchased on each item sales transaction identity.

c. Market Basket Analysis Phase Using Apriori Algorithms.

From the tabular data generated at the data processing stage, a market basket analysis process is performed using Apriori Algorithm to find high frequency values of sales transaction data by identifying support values and determining a minimum support value of 50%. The next step is to establish a 2-item A 17 ciation containing B by finding a confidence value, and determining a minimum confidence value of 60%. Figure 2 shows the completion stage of the market basket analysis process using apriori algorithm:

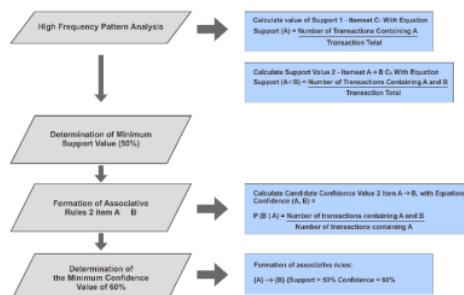


Figure 2. Market Basket Analysis Phase Using Apriori Algorithms.

d. Results Determination Stage

The final stage of this research is the process of determining the pattern of handling stock of goods and the arrangement of goods on store shelves from the results of the market basket analysis process using Apriori Algorithm in sales transaction data.

3. Results and Discussion

a. Data collection stage

At this stage the data collection process is carried out from the database, in the form of sales data at the solar mart minimarket during the 1 (one) month transaction period as shown in Figure 3:

ID_TRANSAKSI	ID_DETAIL_TRANSAKSI	NO_BAHAN	NAMA_BAHAN	QUANTITY	TANGGAL_TER	BISNUTU	CABANG_TRANSAKSI	PEGAWAI_KASIR
PTPEN00001	011001	Quli Jeju 1 Kg	0	2019-12-04	00:11:00	Sampel A	NI. Jefri Salman	
PTPEN00002	011111	Shiso Mentaiko 5 Kg	2	2019-12-04	00:11:00	Sampel A	NI. Jefri Salman	
PTPEN00003	011112	Shiso Mentaiko 10 Kg	1	2019-12-04	00:11:00	Sampel A	NI. Jefri Salman	
PTPEN00004	011101	Quli Jeju 12 Kg	0	2019-12-04	00:15:00	Sampel A	NI. Jefri Salman	
PTPEN00005	0000001	Kopi Hilo 12 Kg	2	2019-12-04	00:15:00	Sampel A	NI. Jefri Salman	
PTPEN00006	0000002	Quli Pari 1 Kg	2	2019-12-04	00:15:00	Sampel A	NI. Jefri Salman	
PTPEN00007	0000003	Quli Pari 1000	0	2019-12-04	00:15:00	Sampel A	NI. Jefri Salman	
PTPEN00008	0000000	Quli Pari 12 Kg	0	2019-12-04	00:30:00	Sampel A	NI. Jefri Salman	
PTPEN00009	011102	Al Marmur Delas	2	2019-12-04	00:30:00	Sampel A	NI. Jefri Salman	
PTPEN00010	011103	Al Marmur Delas	4	2019-12-04	00:30:00	Sampel A	NI. Jefri Salman	
PTPEN00011	011104	Shiso Mentaiko 5 Kg	2	2019-12-04	00:30:00	Sampel A	NI. Jefri Salman	
PTPEN00012	011105	Shiso Mentaiko 10 Kg	1	2019-12-04	00:30:00	Sampel A	NI. Jefri Salman	
PTPEN00013	011106	Al Marmur Kamisan	2	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00014	011107	Al Marmur Delas	4	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00015	011108	Quli Jeju 12 Kg	2	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00016	011110	Quli Jeju 12 Kg	1	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00017	011111	Shiso Mentaiko 5 Kg	2	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00018	011112	Shiso Mentaiko 10 Kg	1	2019-12-11	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00019	011113	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00020	011114	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00021	011115	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00022	011116	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00023	011117	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00024	011118	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00025	011119	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00026	011120	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00027	011121	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00028	011122	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00029	011123	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00030	011124	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00031	011125	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00032	011126	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00033	011127	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00034	011128	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00035	011129	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00036	011130	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00037	011131	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00038	011132	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00039	011133	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00040	011134	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00041	011135	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00042	011136	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00043	011137	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00044	011138	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00045	011139	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00046	011140	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00047	011141	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00048	011142	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00049	011143	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00050	011144	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00051	011145	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00052	011146	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00053	011147	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00054	011148	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00055	011149	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00056	011150	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00057	011151	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00058	011152	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00059	011153	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00060	011154	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00061	011155	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00062	011156	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00063	011157	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00064	011158	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00065	011159	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00066	011160	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00067	011161	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00068	011162	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00069	011163	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00070	011164	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00071	011165	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00072	011166	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00073	011167	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00074	011168	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00075	011169	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00076	011170	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00077	011171	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00078	011172	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00079	011173	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00080	011174	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00081	011175	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00082	011176	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00083	011177	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00084	011178	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00085	011179	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00086	011180	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00087	011181	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00088	011182	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00089	011183	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00090	011184	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00091	011185	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00092	011186	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00093	011187	Quli Jeju 12 Kg	0	2019-12-12	00:00:00	Sampel A	NI. Jefri Salman	
PTPEN00094	011188	Quli Jeju 12 Kg	0	2019-12-12	00			

Table 1. Number of items in each transaction id.

Transaction ID	Black Coffee 1/2 Kg	Granulated Sugar 1 Kg	Granulated Sugar 1/2 Kg	Gallon Bottled Water	600 ml Bottled Water	Glass drinking water	Cheap rice 5 kg	Premium Rice 5 Kg	Javanese Sugar 1 Kg	Java Sugar 1/2 Kg
PEMB01	Y	Y	Y	Y	N	N	Y	N	Y	N
PEMB02	N	Y	N	N	Y	N	N	Y	Y	Y
PEMB03	N	Y	N	N	N	Y	N	Y	Y	N
PEMB04	Y	Y	Y	N	N	N	Y	Y	N	N
PEMB10	Y	N	N	Y	N	N	N	N	Y	Y
PEMB11	Y	N	Y	N	N	N	Y	Y	Y	Y
PEMB15	Y	N	Y	Y	N	N	Y	Y	Y	Y
PEMB16	N	Y	Y	Y	Y	Y	Y	N	N	N
PEMB19	N	Y	N	Y	Y	N	N	N	N	N
PEMB20	Y	Y	Y	N	N	N	Y	Y	Y	N
PEMB23	N	Y	Y	Y	N	N	Y	N	Y	N
PEMB24	Y	N	N	Y	Y	N	Y	Y	N	Y
PEMB27	N	Y	Y	N	N	N	Y	N	Y	Y
PEMB28	Y	N	N	N	N	N	Y	Y	Y	N
PEMB31	N	N	N	Y	N	N	Y	Y	Y	N
PEMB32	Y	Y	Y	Y	N	N	Y	Y	N	Y
PEMB35	N	N	Y	Y	N	Y	Y	N	Y	Y
PEMB37	Y	Y	Y	Y	Y	N	Y	N	N	Y
PEMB38	N	N	Y	N	N	Y	Y	N	Y	N
PEMB41	Y	Y	Y	Y	N	Y	N	N	Y	N
PEMB43	Y	Y	Y	Y	Y	N	N	N	N	N
PEMB44	Y	Y	N	N	N	N	Y	Y	N	Y
PEMB47	Y	Y	N	N	N	Y	N	Y	N	N
PEMB49	N	N	N	N	N	N	Y	Y	N	N
PEMB50	N	N	Y	Y	N	N	Y	N	Y	N
PEMB53	Y	Y	N	N	Y	N	Y	N	Y	N
PEMB55	N	N	N	Y	N	N	N	Y	N	Y
PEMB56	Y	Y	Y	N	N	Y	N	N	N	N
PEMB59	N	N	N	N	N	N	Y	Y	N	N
PEMB61	Y	Y	N	N	N	Y	N	Y	N	N
PEMB62	N	N	Y	N	Y	N	Y	N	N	N
PEMB65	N	N	N	Y	N	N	N	Y	Y	N
PEMB67	N	Y	N	N	N	N	Y	N	N	N
PEMB68	N	N	Y	Y	N	N	N	N	Y	N
PEMB71	N	Y	N	N	N	Y	Y	N	N	N
PEMB73	N	N	N	Y	N	N	Y	Y	Y	N
PEMB74	Y	Y	N	N	N	N	N	N	Y	N
PEMB77	N	N	Y	Y	N	N	N	Y	Y	N
PEMB79	Y	N	Y	Y	N	N	Y	N	N	Y
PEMB80	N	Y	N	N	N	Y	N	N	N	N
PEMB81	Y	Y	Y	Y	N	N	N	Y	Y	N
PEMB82	N	N	N	N	N	Y	Y	Y	N	N
PEMB88	Y	N	Y	13	N	N	Y	N	Y	N
PEMB89	N	N	N	Y	N	Y	N	Y	N	N
PEMB91	Y	Y	Y	Y	N	N	N	Y	N	N
PEMB92	Y	Y	Y	Y	Y	N	N	Y	Y	N
PEMB95	N	N	Y	Y	N	N	N	N	Y	N
PEMB97	Y	Y	Y	Y	N	N	N	Y	Y	N
PEMB98	Y	Y	Y	Y	N	N	N	Y	Y	N
PEMB99	Y	N	Y	N	N	N	N	Y	N	N

From the data in Table 1 which contains the items column with information Y and N, it is changed in binary form to Y = 1 and N = 0 with the intention that it is easy to count each item on each transaction, as shown in Table 2:

Table 2. The number of transaction items is changed in binary form.

Transaction ID	Black Coffee 1/2 Kg	Granulated Sugar 1 Kg	Granulated Sugar 1/2 Kg	Gallon Bottled Water	600 ml Bottled Water	Glass drinking water	Cheap rice 5 kg	Premium Rice 5 Kg	Javanese Sugar 1 Kg	Java Sugar 1/2 Kg
PEMB01	1	1	1	1	0	0	1	0	1	0
PEMB02	0	1	0	0	1	0	0	1	1	1
PEMB03	0	1	0	0	0	1	0	1	1	0
PEMB04	1	1	1	0	0	0	1	1	0	0
PEMB10	1	0	0	1	0	0	0	0	1	1
PEMB11	1	0	1	0	0	0	1	1	1	1
PEMB15	1	0	1	1	0	0	1	1	1	1
PEMB16	0	1	1	1	1	1	1	0	0	0
PEMB19	0	1	0	1	1	0	0	0	0	0
PEMB20	1	1	1	0	0	0	1	1	1	0
PEMB23	0	1	1	1	0	0	1	0	1	0
PEMB24	1	0	0	1	1	0	1	1	0	1
PEMB27	0	1	1	0	0	0	1	0	1	1
PEMB28	1	0	0	0	0	0	1	1	1	0
PEMB31	0	0	0	1	0	0	1	1	1	0
PEMB32	1	1	1	1	0	0	1	1	0	1
PEMB35	0	0	1	1	0	1	1	0	1	1
PEMB37	1	1	1	1	1	0	1	0	0	1
PEMB38	0	0	1	0	0	1	1	0	1	0
PEMB41	1	1	1	1	0	1	0	0	1	0
PEMB43	1	1	1	1	1	0	0	0	0	0
PEMB44	1	1	0	0	0	0	1	1	0	1
PEMB47	1	1	0	0	0	1	0	1	0	0
PEMB49	0	0	0	0	0	0	1	1	0	0
PEMB50	0	0	1	1	0	0	1	0	1	0
PEMB53	1	1	0	0	1	0	1	0	1	0
PEMB55	0	0	0	1	0	0	0	1	0	1
PEMB56	1	1	1	0	0	1	0	0	0	0
PEMB59	0	0	0	0	0	0	1	1	0	0
PEMB61	1	1	0	0	0	1	0	1	0	0
PEMB62	0	0	1	0	1	0	1	0	0	0
PEMB65	0	0	0	1	0	0	0	1	1	0
PEMB67	0	1	0	0	0	0	1	0	0	0
PEMB68	0	0	1	1	0	0	0	0	1	0
PEMB71	0	1	0	0	0	1	1	0	0	0
PEMB73	0	0	0	1	0	0	1	1	1	0
PEMB74	1	1	0	0	0	0	0	0	1	0
PEMB77	0	0	1	1	0	0	0	1	1	0
PEMB79	1	0	1	1	0	0	1	0	0	1
PEMB80	0	1	0	0	0	1	0	0	0	0
PEMB81	1	1	1	1	0	0	0	1	1	0
PEMB82	0	0	0	0	0	1	1	1	0	0
PEMB88	1	0	1	1	0	0	1	0	1	0
PEMB89	0	0	0	1	0	1	0	1	0	0
PEMB91	1	1	1	1	0	0	0	1	0	0
PEMB92	1	1	1	1	1	0	0	1	1	0
PEMB95	0	0	1	1	0	0	0	0	1	0
PEMB97	1	1	1	1	0	0	0	1	1	0
PEMB98	1	1	1	1	0	0	0	1	1	0
PEMB99	1	0	1	0	0	0	0	1	0	0
Total Items Sold	26	27	28	28	9	12	27	27	27	12

1) Market Basket Analysis Phase Using Apriori Algorithms.

16 a) Analysis of high frequency patterns

High frequency pattern analysis is done by finding a combination of items that meet the minimum requirements of support value in the transaction data. The data in Table 3 shows the results of the number of transactions in each itemset:

Table 3. List of itemset.

Numb	Code BR	Name BR	Total Transactions	Initial Inventory	Stock Available
1	0000001	Black Coffee 1/2 Kg	26	45	19
2	0000002	Granulated Sugar 1 Kg	27	30	3
3	0000003	Granulated Sugar 1/2 Kg	28	40	12
4	ASL101	Gallon Bottled Water 600 ml	28	80	52
5	ASL102	Bottled Water	9	240	231
6	ASL103	Glass drinking water	12	40	28
7	BR1111	Cheap rice 5 kg	27	40	13
8	BR1112	Premium Rice 5 Kg	27	40	13
9	GL1001	Javanese Sugar 1 Kg	27	40	13
10	GL1002	Java Sugar 1/2 Kg	12	60	48

The next step is to calculate the value of support in combination with 1 - itemset or C_1 using equation (1):

$$\text{Support}(A) = \frac{\text{Number of Transactions Containing } A}{\text{Transaction Total}} \quad (1)$$

The results of determining the support value of each item can be seen in table 4:

Table 4. Results for 1- itemset support values

NUMB	Code BR	Name BR	Total Transactions	Support (%)
1	0000001	Black Coffee 1/2 Kg	26	52
2	0000002	Granulated Sugar 1 Kg	27	54
3	0000003	Granulated Sugar 1/2 Kg	28	56

NUMB	Code BR	Name BR	Total Transactions	Support (%)
4	ASL101	Gallon Bottled Water 600 ml	28	56
5	ASL102	Bottled Water	9	18
6	ASL103	Glass drinking water	12	24
7	BR1111	Cheap rice 5 kg	27	54
8	BR1112	Premium Rice 5 Kg	27	54
9	GL1001	Javanese Sugar 1 Kg	27	54
10	GL1002	Java Sugar 1/2 Kg	12	24

The next step is to identify a combination pattern with a minimum support of 50%, then the process of forming 2 - itemset or C_2 with a minimum support of 50% as shown in table 5.

Table 5. Combination patterns of C_1 with a minimum support of 50%.

Numb	Code BR	Name BR	Total Transactions	Support (%)
1	0000001	Black Coffee 1/2 Kg	26	52
2	0000002	Granulated Sugar 1 Kg	27	54
3	0000003	Granulated Sugar 1/2 Kg	28	56
4	ASL101	Gallon Bottled Water	28	56
5	BR1111	Cheap rice 5 kg	27	54
6	BR1112	Premium Rice 5 Kg	27	54
7	GL1001	Javanese Sugar 1 Kg	27	54

2 Calculation of support values using a 2-itemset combination using equation (2):

$$\text{Support}(A, B) = P(A \cap B)$$

$$\text{Support}(A, B) = \frac{\Sigma \text{transaction contains } A \text{ and } B}{\Sigma \text{Total Transactions}} \quad (2)$$

Table 6. Minimum support values of 50% of the 2-itemset combination

Numb	Item Name	Amount	Support (%)
1	Black Coffee 1/2 Kg → Granulated Sugar 1 Kg	19	38
2	Black Coffee 1/2 Kg → Granulated Sugar 1/2 Kg	18	36
3	Black Coffee 1/2 Kg → Gallon Bottled Drinking Water	5	10
4	Black Coffee 1/2 Kg → Cheap Rice 5 Kg	12	24
5	Black Coffee 1/2 Kg → Premium Rice 5 Kg	16	32
6	Black Coffee 1/2 Kg → Java Sugar 1 Kg	14	28
7	Granulated Sugar 1 Kg → Granulated Sugar 1/2 Kg	16	32
8	Granulated Sugar 1 Kg → Gallon Bottled Drinking Water	13	26
9	Granulated Sugar 1 Kg → Cheap Rice 5 Kg	12	24
10	Granulated Sugar 1 kg → Premium Rice 5 kg	13	26
11	Granulated Sugar 1 kg → Javanese Sugar 1 kg	13	26
12	Gallon Bottled Drinking Water → Cheap Rice 5 Kg	13	26
13	Gallon Bottled Drinking Water → Premium Rice 5 Kg	14	28
14	Gallon Bottled Drinking Water → Java Sugar 1 Kg	18	36
15	Cheap Rice 5 Kg → Premium Rice 5 Kg	13	26
16	Cheap Rice 5 Kg → Java Sugar 1 Kg	15	30
17	Premium Rice 5 Kg → Java Sugar 1 Kg	12	24

In the process of forming a 2-itemset combination pattern no one meets the minimum support value of 50%, then a 1-itemset combination can be met for the formation of associative rules.

rule is sought that meets the minimum confidence requirement of candidate 2 item A containing B in each itemset. The confidence value of the associative rule 2 - item A → B is obtained using equation (3):

2 Establishment of associative rules

After a minimum support value of 50% of the C_1 combination is determined, an associative

$$\text{Confidence (A,B)} =$$

$$P(B|A) = \frac{\text{Number of transactions containing } A \text{ and } B}{\text{Number of transactions containing } A} \quad (3)$$

Table 7. Confidence values from forming 2-item associative rules A → B.

Numb	Itemset	Amount	Confident (%)
1	(0000001, Black Coffee 1/2 Kg), (0000002, 1 Kg Granulated Sugar)	18	69,23
2	(0000001, Black Coffee 1/2 Kg), (0000003, Granulated Sugar 1/2 Kg)	18	69,23
3	(0000001, Black Coffee 1/2 Kg), (ASL101, Gallon Bottled Drinking Water)	15	57,69
4	(0000001, Black Coffee 1/2 Kg), (BR1111, Cheap Rice 5 Kg)	13	50,00
5	(0000001, Black Coffee 1/2 Kg), (BR1112, Premium Rice 5 Kg)	16	61,53
6	(0000001, Black Coffee 1/2 Kg), (GL1001, Javanese Sugar 1 Kg)	14	53,84
7	(0000002, 1 Kg Granulated Sugar), (0000003, 1/2 Kg Granulated Sugar)	16	59,25
8	(0000002, 1 Kg Granulated Sugar), (ASL101, Gallon Bottled Drinking Water)	13	48,14
9	(0000002, 1 Kg Granulated Sugar), (BR1111, Cheap Rice 5 Kg)	12	44,44
10	(0000002, 1 Kg Granulated Sugar), (BR1112, Premium Rice 5 Kg)	13	48,18
11	(0000002, 1 Kg Granulated Sugar), (GL1001, 1 Kg Java Sugar)	13	48,14
12	(0000003, Granulated Sugar 1/2 Kg), (ASL101, Gallon Bottled Drinking Water)	20	71,42

Numb	Itemset	Amount	Confident (%)
13	(0000003, Granulated Sugar 1/2 Kg), (BR1111, Cheap Rice 5 Kg)	16	57,14
14	(0000003, Granulated Sugar 1/2 Kg), (BR1112, Premium Rice 5 Kg)	12	42,85
15	(0000003, Granulated Sugar 1/2 Kg), (GL1001, Java Sugar 1 Kg)	18	64,28
16	(ASL101, Gallon Bottled Water), (ASL102, 600ml Bottled Water)	6	21,42
17	(ASL101, Gallon Bottled Drinking Water), (BR1111, Cheap Rice 5 Kg)	13	46,42
18	(ASL101, Gallon Bottled Drinking Water), (BR1112, Premium Rice 5 Kg)	14	50,00
19	(ASL101, Gallon Bottled Drinking Water), (GL1001, Java Sugar 1 Kg)	18	64,28
20	(BR1111, Cheap Rice 5 Kg), (BR1112, Premium Rice 5 Kg)	13	48,14
21	(BR1111, Cheap Rice 5 Kg), (GL1001, Java Sugar 1 Kg)	14	51,85
22	(BR1112, Premium Rice 5 Kg), (GL1001, Java Sugar 1 Kg)	14	51,85

8
Next is determining the minimum confidence value of 60%, the confidence value of 2 - items A → B

that will qualify for the determination of association rules has a confidence value above 60%.

1
Table 8. Value of Association rules with a minimum value of 60% confidence.

Numb	Itemset	Amount	Confident (%)
1	(0000001, Black Coffee 1/2 Kg) → (0000002, 1 Kg Granulated Sugar)	18	69,23
2	(0000001, Black Coffee 1/2 Kg) → (0000003, Granulated Sugar 1/2 Kg)	18	69,23
3	(0000001, Black Coffee 1/2 Kg) → (BR1112, Premium Rice 5 Kg)	16	61,53
4	(0000003, Granulated Sugar 1/2 Kg) → (ASL101, Gallon Bottled Drinking Water)	20	71,42
5	(0000003, Granulated Sugar 1/2 Kg) → (GL1001, Java Sugar 1 Kg)	18	64,28
6	(ASL101, Gallon Bottled Drinking Water) → (GL1001, Java Sugar 1 Kg)	18	64,28

Table 9. Results of determining the pattern of handling stock of goods.

NUMB	KODE BR	NAME BR	TOTAL TRANSACTIONS	SUPPORT (%)	INITIAL INVENT-ORY	ADDITI-ON STOCK
1	0000001	Black Coffee 1/2 Kg	26	52	45	23
2	0000002	Granulated Sugar 1 Kg	27	54	30	16
3	0000003	Granulated Sugar 1/2 Kg	28	56	40	22
4	ASL101	Gallon Bottled Water	28	56	52	29
5	BR1111	Cheap rice 5 kg	27	54	40	22
6	BR1112	Premium Rice 5 Kg	27	54	40	22
7	GL1001	Javanese Sugar 1 Kg	27	54	40	22

Table 10. Association Rules

Numb	Rules	Confidence %
1	If you buy ½ Kg Black Coffee then buy 1 Kg Granulated Sugar	69,23
2	If you buy ½ Kg Black Coffee then buy ½ Kg Sugar	69,23
3	If you buy ½ Kg Black Coffee then buy 5 Kg Premium Rice	61,53
4	If you buy ½ Kg Granulated Sugar then buy Gallon Bottled Drinking Water	71,42
5	If you buy ½ Kg Granulated Sugar then buy 1 kg of Java Sugar	64,28
6	If you buy Gallon Bottled Drinking Water then buy Java Sugar 1 Kg	64,28

c. Results Determination Stage

From [5] the results of the analysis of determining the value of support and confidence, it can be concluded the results of the pattern of handling stock of goods and arrangement of goods on the store shelf, as follows:

1. Pattern of handling stock of goods

From the results of determining the minimum support value of 50% in the 1-itemset combination pattern, it can be identified the addition of stock items with a percentage:

$$\text{Stock Addition} = \frac{\text{Initial inventory}}{\text{Value of Support} (\%)} \times 100\% \quad (4)$$

From Table 9 results can be drawn from the stage of identifying [14] the pattern of handling stock of goods utilizing a minimum value of support of 50% of the combination of 1-itemset, by calculating the initial inventory is compared with the value of support so that it can be identified in the item stock increase column in Table 9.

2. Pattern of Arrangement of Goods

From the results of the analysis in identifying the handling of the layout of the goods [4] using Apriori Algorithm, it can be determined from the minimum value of 50% support and the minimum value of Confidence 60% which produces the following association rules:

From Table 10. it can be identified the tendency of customer purchases, it is known that the tendency of customers if buying Black Coffee items ½ Kg is most likely with a Confidence value of 69.23% customers will also buy 1 Kg Granulated Sugar. from this tendency can be a strategy to arrange the layout of the item with the pattern of Black Coffee ½ Kg brought closer to 1 Kg Granulated Sugar, Black Coffee ½ Kg closer to Granulated Sugar ½ Kg and so on, so that customers can easily find the items they need.

4. Conclusion

[2] Based on the analysis phase of the results and discussion above, it can be concluded that identification of patterns of handling stock of goods and arrangement of goods can utilize data on the results of sales transactions. And then, analysis of high frequency patterns with a minimum support [2] value of 50% from a combination of 1 - itemset C1 can determine the pattern of handling stock of goods, namely by balancing the initial inventory with a support value so that the prediction results of adding stock will be obtained. Beside that, the results of the formation of association rules that are determined from a minimum value of 50% support and a minimum value of 60% confidence can produce a tendency of customers to buy items, so that these tendencies can be a reference in the process of item layout by arranging items close together.

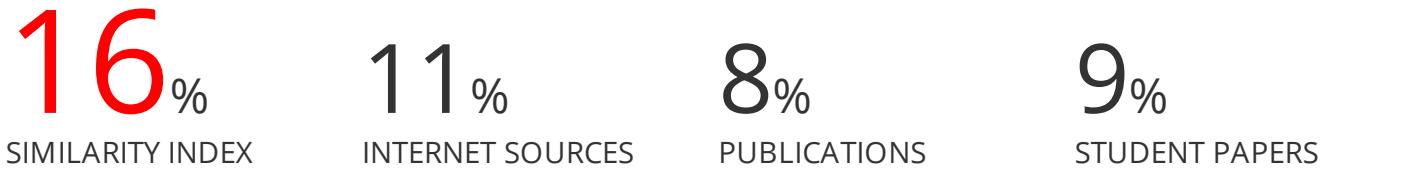
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