	Bansilal Ramnath Agarwal Charitable Trust's Vishwakarma Institute of Information Technology Department of Artificial Intelligence and Data Science

Name: Aaryan Nanasaheb Aher		
Class: TY	Division: A	Roll No: 371003
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Subject Name & Code: Machine Learning		
Title of Assignment: Assignment E2 : Perform Market Basket Analysis using Apriori Algorithm		
Date of Performance:26/03/2025	Date of Submission: 2/04/2025	

Aim:

ımplement Market Basket Analysis using Apriori Algorithm.

Software Requirements:

VS Code.
Jyupter Notebook

Background Theory:

Introduction

Market Basket Analysis (MBA) is a data mining technique used to uncover associations between products frequently bought together. It is widely used in the retail and e-commerce industries for cross-selling, recommendation systems, and store layout optimization.

Concept of Market Basket Analysis

Market Basket Analysis helps identify patterns in customer purchases by analyzing transaction data. The key idea is to discover **association rules**, which indicate the likelihood of items being purchased together. For example, if customers who buy bread are also likely to buy butter, retailers can place these items together to boost sales.

Apriori Algorithm

The **Apriori Algorithm** is one of the most commonly used techniques for Market Basket Analysis. It identifies frequent itemsets and generates association rules based on the concept of "support" and "confidence."

Working of Apriori Algorithm:

1. **Step 1: Identify Frequent Itemsets**
    - The algorithm scans the dataset to find items that meet a minimum support threshold. These are called **frequent itemsets**.
2. **Step 2: Generate Association Rules**
    - Using frequent itemsets, rules are generated in the form:
      {Antecedent} → {Consequent}
      Example: **{Bread} → {Butter}** (If a customer buys Bread, they are likely to buy Butter.)
3. **Step 3: Evaluate Rule Strength**
    - The generated rules are evaluated using:
        - **Support**: How frequently an itemset appears in transactions.
        - **Confidence**: The probability that the consequent appears given the antecedent.
        - **Lift**: Measures the strength of a rule compared to random chance.

Importance of Lift vs Confidence Analysis

- **High Confidence & High Lift:** Strong, useful rules
- **High Confidence & Low Lift:** Common but less useful rules
- **Low Confidence & High Lift:** Rare but significant rules.

Applications of Market Basket Analysis

- **Retail & E-commerce:** Product recommendations (e.g., Amazon's "Frequently Bought Together")
- **Supermarkets:** Optimizing product placement and bundle promotions.
- **Healthcare:** Finding correlations between medications.
- **Banking & Finance:** Fraud detection by identifying unusual transaction patterns.

Conclusion

Market Basket Analysis using the Apriori Algorithm provides valuable insights into customer purchasing behavior. By identifying strong association rules, businesses can improve their sales strategies, enhance customer experience, and optimize inventory management.