**Executive Summary: Market-Basket Analysis Using Synthetic Transaction Data**

**1. How the Synthetic Data Were Generated**

To simulate real-world shopping behavior and enable market-basket analysis, we generated synthetic transaction data based on real product listings from two supermarkets. The data generation followed a structured, probability-weighted methodology:

* **Product Source**: Actual supermarket product and pricing data were used.
* **Item Popularity Model**: Product selection probabilities were **inversely proportional to their prices** — a realistic assumption that lower-cost staple items are more commonly bought than premium or niche products.
* **Customer Simulation**:
  + **10,000 synthetic customers** were generated.
  + Each customer’s basket contained **1 to 25 products**, with an average of 5.
  + Items in each basket were **randomly drawn**, but **weighted by popularity**.
  + Only the **top 50 most frequent items** were retained to improve analytical focus and reduce memory overload.
* **Data Format**:
  + The final dataset was exported in **wide** format:
    - **Wide Format**: Each row = Customer, each column = Product (1 if purchased)

**2. Most Actionable Association Rules**

Using the Apriori algorithm, we identified many **statistically significant buying patterns**. The following are the most **actionable and interpretable rules** for business stakeholders:

| **Antecedent Products** | **⇒** | **Consequent Product** | **Confidence** | **Lift** |
| --- | --- | --- | --- | --- |
| Eti Gofret + İçim Kakaolu Süt | ⇒ | Ülker Badem Kraker | 34% | 4.50 |
| Ülker Badem Kraker + İçim Süt | ⇒ | Eti Gofret | 29% | 4.55 |
| Halley Bisküvi + Kekstra Muffin | ⇒ | Indomie Noodle | 22% | 3.16 |
| Eti Gofret + Indomie Gurme | ⇒ | Ülker Badem Kraker | 22% | 2.85 |
| Dankek 8 Kek + Yupo Çokojelo | ⇒ | Dankek Pöti Kek | 22% | 3.05 |

These rules reveal **consistent co-purchase behavior**, especially among:

* **On-the-go snacks**
* **Sweet-salty combos**
* **Quick meal pairings**

**3. Business Interpretation and Strategic Recommendations**

This analysis offers valuable **insights into customer shopping behavior** and suggests several actionable strategies for supermarkets:

**Cross-Promotion Opportunities**

* **Bundle snack bars, flavored milk, and crackers** into "office snack packs" or "school lunch kits".
* Promote combinations like **noodles + sweet bars** for after-school or late-night meals.

**Shelf Placement**

* Co-locate high-lift itemsets (e.g., "Eti Gofret", "Ülker Badem Kraker", and "İçim Süt") near checkout lines or convenience aisles to trigger impulse buys.
* Use **"Often Bought Together" signage** in aisles or online stores.

**Dynamic Pricing & Combo Offers**

* Apply targeted discounts to **frequently paired items**, increasing basket size.
* Implement **loyalty rewards** when customers buy multi-item bundles derived from high-confidence rules.

**Flavor/Variety Optimization**

* Multiple rules show flavor variation is common (e.g., multiple types of Dankek).  
  → Use this insight to promote **multi-flavor bundles** or sampler packs.

**Conclusion**

Through realistic simulation and rigorous association analysis, this project reveals **tangible opportunities** for product placement, pricing, bundling, and targeted marketing. These insights are not only statistically significant but also directly translatable into **sales-boosting retail strategies**.