**Conjoint Analysis for Ice Cream Preferences**

**1. Introduction**

Conjoint analysis is a statistical technique used to understand how consumers value different attributes of a product or service. In this project, we conducted a conjoint analysis to determine consumer preferences for ice cream based on four key attributes: **flavor**, **price**, **container type**, and **topping availability**. The goal was to identify which attributes most influence consumer choices and estimate their relative importance.

**2. Objective**

The primary objectives of this analysis were:

* To determine the relative importance of ice cream attributes (flavor, price, container, topping).
* To estimate the part-worth utilities (preference scores) for different levels of each attribute.
* To simulate consumer preferences and analyze trade-offs between attributes.

**3. Understanding the Data**

**Attributes and Levels**

The experiment considered the following attributes and their levels:

* **Flavor**: Chocolate, Vanilla, Strawberry
* **Price**: 10,10,20, $30
* **Container**: Cone, Cup
* **Topping**: Yes, No

**Simulated Respondent Data**

Since real consumer data was unavailable, preferences for **10 hypothetical respondents** were simulated using random ratings (1-7 scale, where higher values indicate stronger preference).

**4. Procedure for Coding**

* Load the Required Library
* Define Attributes and Levels
* Convert all Columns to Factors
* Generate a Factorial Design
* Simulate Respondent Preferences
* Perform Conjoint Analysis

**5. Interpretation and Conclusion**

**Key Findings**

1. **Part-Worth Utilities (Preference Scores)**
   * **Intercept (Baseline Preference)**: 4.04
   * **Flavor**: Vanilla had a slightly higher utility (0.23) compared to chocolate (-0.05).
   * **Price**: Consumers slightly preferred the mid-price (20,utility=0.23)overthelowestprice(20,*utility*=0.23)*overthelowestprice*(10, utility = -0.18).
   * **Container**: Cups were marginally preferred over cones (utility = 0.17 vs. -0.17).
   * **Topping**: Toppings had a positive utility (0.23), indicating consumers prefer ice cream with toppings.
2. **Attribute Importance**
   * **Flavor** (33.39%) and **Price** (31.37%) were the most important factors.
   * **Container** (18.96%) and **Topping** (16.28%) had relatively lower importance.
3. **Statistical Significance**
   * Only **topping** was statistically significant (\*p = 0.034\*), meaning it had a measurable impact on preferences.
   * Other attributes (flavor, price, container) were not statistically significant (*p > 0.05*), possibly due to the small sample size or random simulation.

**Conclusion**

* Consumers prioritize **flavor and price** when choosing ice cream.
* **Toppings significantly enhance preference**, while the container type (cone/cup) has a minor influence.