Clustering Results Report

1. Number of Clusters Formed

- **5 Clusters** were formed using the **KMeans clustering algorithm**.

- The number of clusters was determined using the **Elbow Method**, which evaluates the trade-off between the number of clusters and the Sum of Squared Errors (SSE). The optimal k=5 was chosen based on the point where adding more clusters provided diminishing returns in reducing the SSE.

2. DB Index Value

- **Davies-Bouldin Index (DB Index): 0.68**

  - The DB Index evaluates the compactness and separation of clusters. A lower DB Index indicates better clustering.

  - A value of **0.68** suggests that the clusters are reasonably well-separated and compact, making the segmentation meaningful and actionable.

Characteristics of Each Cluster

1. **Cluster 0: Moderate Spenders with Average Diversity**

   - **AvgSpend:** $3,287

   - **AvgFrequency:** 4.69 transactions

   - **AvgTransactionValue:** $711

   - **UniqueProducts:** 4.62

   - **UniqueCategories:** 2.93

   - **AvgDaysSinceSignup:** 551 days (~1.5 years since signup)

   - **Insights:**

     - These customers are moderate spenders with medium frequency and purchase diversity.

     - They have been active customers for a considerable period (~1.5 years).

- o **Actionable Recommendations:**

  - Offer targeted promotions focusing on under-purchased categories to increase their diversity of purchases.

  - Introduce seasonal discounts to drive more frequent purchases.

2. **Cluster 1: Low Spenders with Low Engagement**

   - o **AvgSpend:** $1,646

   - o **AvgFrequency:** 2.69 transactions

   - o **AvgTransactionValue:** $600

   - o **UniqueProducts:** 2.64

   - o **UniqueCategories:** 1.83

   - o **AvgDaysSinceSignup:** 535 days (~1.5 years since signup)

   - o **Insights:**

     - This group represents customers with the lowest spending and engagement levels.

     - They purchase a narrow range of products and categories.

   - o **Actionable Recommendations:**

     - Launch re-engagement campaigns, such as welcome-back discounts or reminders about their past purchases.

     - Encourage trial of new products or categories through targeted promotions and sample giveaways.

3. **Cluster 2: Moderate Spenders with High Engagement**

   - o **AvgSpend:** $3,125

   - o **AvgFrequency:** 5.03 transactions

   - o **AvgTransactionValue:** $650

   - o **UniqueProducts:** 5.03

   - o **UniqueCategories:** 3.00

   - o **AvgDaysSinceSignup:** 438 days (~1.2 years since signup)

- o **Insights:**
  - ▪ Customers in this group are highly engaged with frequent purchases and above-average diversity.
  - ▪ They are relatively newer customers (~1.2 years since signup).
- o **Actionable Recommendations:**
  - ▪ Focus on building loyalty through exclusive bundles or category-specific discounts.
  - ▪ Use personalized product recommendations to encourage repeat purchases.

4. **Cluster 3: High Spenders with High Engagement**

- o **AvgSpend:** $4,259
- o **AvgFrequency:** 5.73 transactions
- o **AvgTransactionValue:** $747
- o **UniqueProducts:** 5.51
- o **UniqueCategories:** 3.08
- o **AvgDaysSinceSignup:** 594 days (~1.6 years since signup)
- o **Insights:**
  - ▪ This cluster represents **high-value customers** who spend frequently and explore a diverse range of products.
  - ▪ They are loyal customers who have been active for ~1.6 years.
- o **Actionable Recommendations:**
  - ▪ Offer loyalty rewards, exclusive memberships, or early access to new products to retain these premium customers.
  - ▪ Use cross-category promotions to further increase spending.

5. **Cluster 4: Super Spenders with the Highest Engagement**

- o **AvgSpend:** $5,819
- o **AvgFrequency:** 8.16 transactions

- o **AvgTransactionValue:** $730

- o **UniqueProducts:** 7.76

- o **UniqueCategories:** 3.72

- o **AvgDaysSinceSignup:** 512 days (~1.4 years since signup)

- o **Insights:**

  - These are the **most valuable customers** with the highest spending and engagement levels.

  - They frequently purchase a wide variety of products and categories.

- o **Actionable Recommendations:**

  - Develop an **exclusive VIP program** for this group, offering premium perks, early access to products, or personalized services.

  - Use retention strategies to ensure these customers remain loyal.

5. Clustering Methodology

- **Algorithm:** KMeans

- **Number of Clusters:** 5

- **Evaluation Metric:** Davies-Bouldin Index = **0.68**

- **Feature Set:**

  - o **AvgSpend**: Total customer spending.

  - o **AvgFrequency**: Number of transactions per customer.

  - o **AvgTransactionValue**: Average value of transactions.

  - o **UniqueProducts**: Number of unique products purchased.

  - o **UniqueCategories**: Number of unique categories purchased.

  - o **AvgDaysSinceSignup**: Recency of the customer's signup.