Clustering Results Report

Clustering Methodology & Results:

1. **Optimal Number of Clusters:**
   After assessing various cluster configurations using the Davies-Bouldin (DB) Index, the best number of clusters was determined to be 5.

2. **DB Index Value:**
   The DB Index for the selected cluster configuration is 0.7040. Since a lower DB Index indicates better separation between clusters, this suggests that the customer segments are well-defined and distinct.

3. **Cluster Visualization:**
   The clustering graph shows how the 5 customer segments are distributed.

   - **Clustering Algorithm:** K-Means

   - **Feature Scaling:** Features were scaled prior to clustering to ensure consistency and equal importance of all variables.

   - **Evaluation Metric:** The Davies-Bouldin Index was used to assess the clustering quality, and the value of 0.7040 reflects well-separated, compact clusters.

   - **Axes:** PCA1 and PCA2 (Principal Component Analysis was used for dimensionality reduction).

   - **Color Coding:** Each cluster is represented by a distinct color (from 0 to 4).

Key Insights:

- **Clear Cluster Differentiation:**
  The clusters are clearly separated, demonstrating a significant distinction between customer groups. The density and spread of points in each cluster indicate that customers within the same group share similar traits.

- **Customer Segments:**
  The segmentation identifies 5 distinct customer groups, each with unique characteristics. These groups can be leveraged for targeted marketing and customized strategies.

- **Cluster Cohesion & Separation:**
  With a DB Index of 0.7040, the clustering method strikes a good balance between compactness and separation. This means customers within each cluster are closely related, while those in different clusters are clearly different from each other.

Practical Applications:

1. **Tailored Promotions:**
   Create marketing campaigns that specifically target each cluster, enhancing relevance and engagement.

2. **Personalized Product Recommendations:**
   Offer product suggestions based on the preferences and needs of customers within each cluster.

3. **Optimized Inventory Management:**
   Align inventory levels with the dominant customer segments to ensure stock availability matches demand.

Business Applications:

- **Cluster-Focused Marketing:**
  Develop marketing strategies that cater to the specific traits of each customer segment for improved results.

- **Prioritize High-Value Clusters:**
  Identify and focus efforts on high-value clusters for loyalty programs, exclusive offers, and customer retention.