

PURCHASE PATTERN ANALYSIS

CDACL005

PROBLEM STATEMENT

In the context of a retail environment, the challenge is to leverage Market Basket Analysis (MBA) on a Transaction dataset to unveil relationships between products. By conducting exploratory data analysis, addressing data quality issues, employing data visualization techniques, and implementing the Apriori algorithm, the objective is to extract valuable insights. This includes understanding customer purchasing behaviour, identifying frequently co-occurring products, and deriving actionable recommendations to enhance sales strategies and customer satisfaction.

OBJECTIVE

The objective of this analysis is to identify customer purchasing patterns and uncover frequent co-occurring products using the Apriori algorithm. By understanding these patterns, we aim to provide actionable insights to optimize product bundling, improve sales strategies, increase revenue, and enhance overall customer satisfaction

METHODOLOGY USED

Exploratory Data Analysis

Descriptive Statistics

Data Visualization

Technology Used

Python Programming

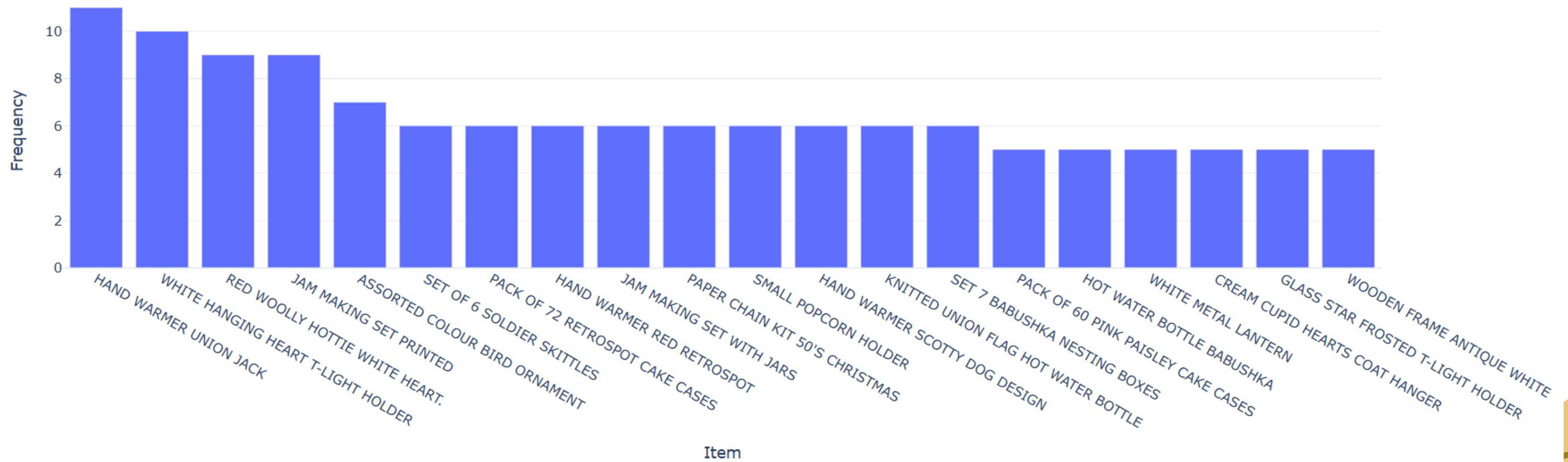
Python Libraries: Pandas, Numpy (Data Manipulation)

Data Visualization: Matplotlib, Seaborn, Plotly

Algorithm: FP-Growth

TOP 20 ITEMS BY FREQUENCY

Top 20 Items by Frequency



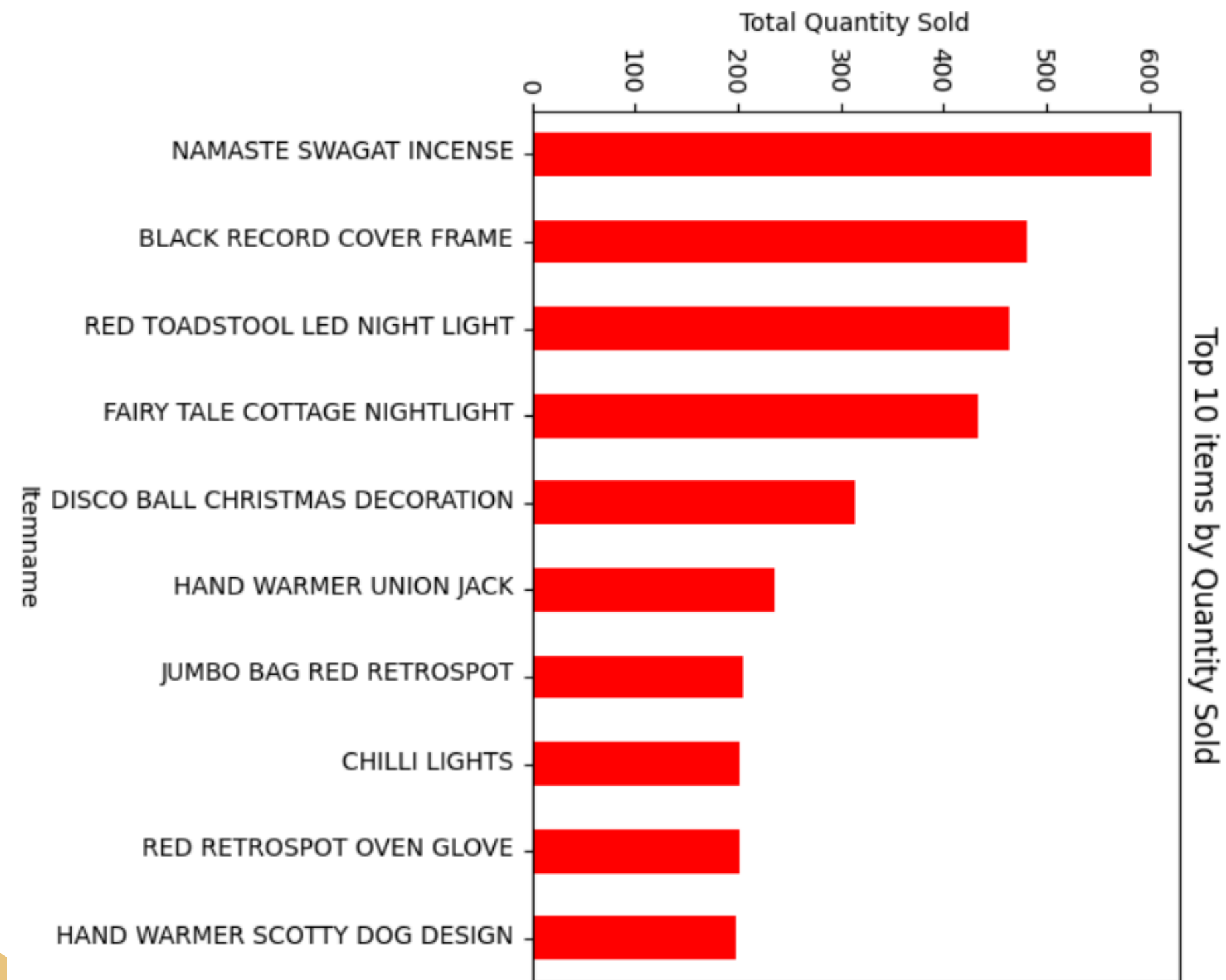
Key Insights:

1. The most frequently purchased item is **"HAND WARMER UNION JACK"**, appearing in transactions 10 times.
2. Other top items include:
 - a. **"WHITE HANGING HEART T-LIGHT HOLDER"**
 - b. **"RED WOOLLY HOTTIE WHITE HEART"**
 - c. These items show consistent demand across customers.
3. The chart suggests that seasonal or decorative items are among the most popular, indicating a potential seasonal purchasing trend.

Suggestions for Business implication:

- A retailer can bundle a hand warmer with a hot water bottle during winter and offer the combo at a discounted price.
- Instead of buying items separately, customers see more value in the bundle and are likely to purchase both items.
- If a customer is buying a jam-making set, the retailer can suggest jam jars or labels for jars as additional purchases.
- Similarly, if a customer is buying a knitted scarf, the retailer can suggest matching gloves or a hat.

TOP SELLING ITEMS BY QUANTITY



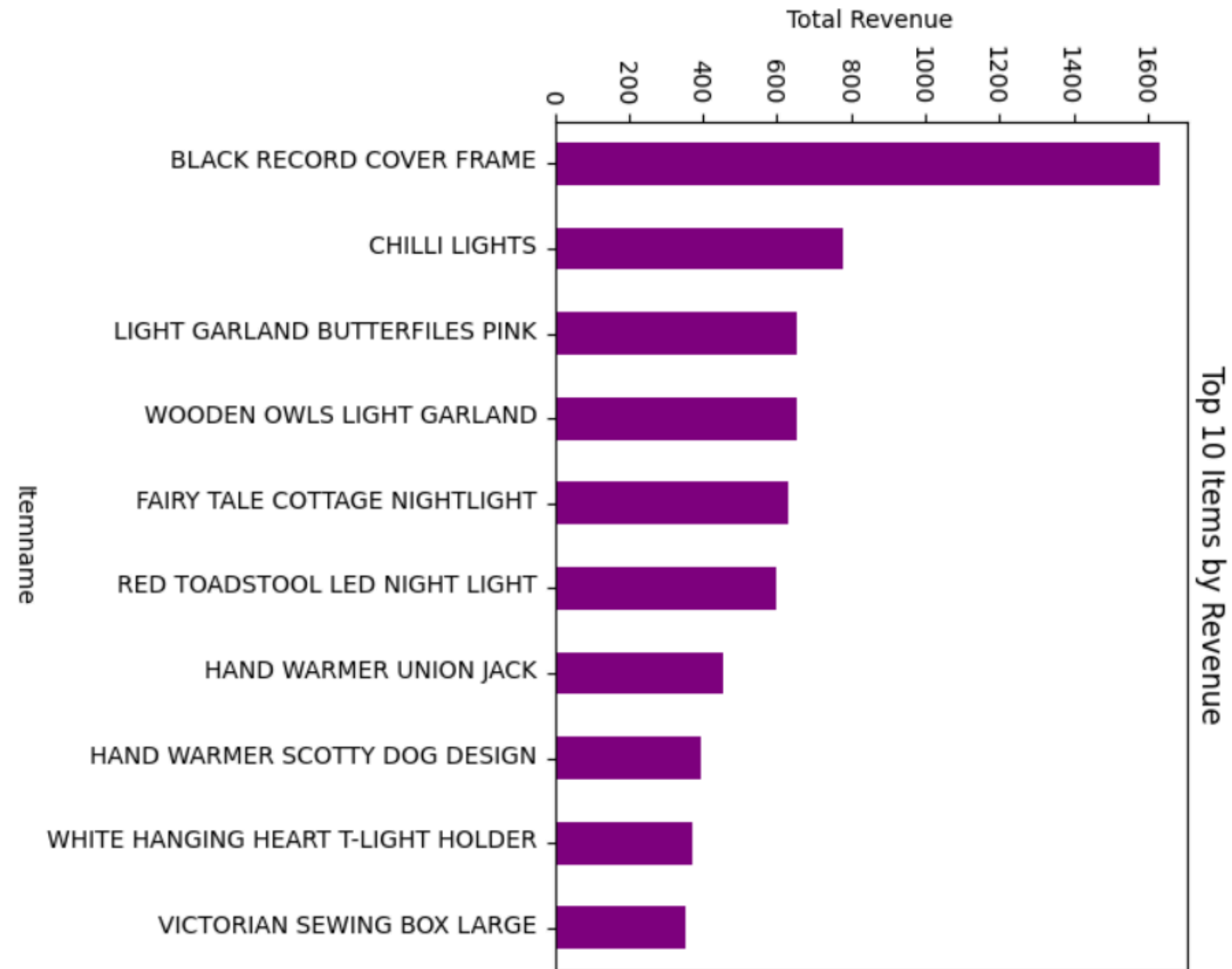
Key Insights:

1. The most sold item is "**NAMASTE SWAGAT INCENSE**" with a total quantity of around 600 units sold.
2. The next most popular items are:
 - "**BLACK RECORD COVER FRAME**"
 - "**RED TOADSTOOL LED NIGHT LIGHT**"
 - Both items have over 450 units sold, indicating strong customer demand for decorative and lighting products.
3. Items like **hand warmers** and **Christmas decorations** are also among the top-selling products, showing seasonal trends in customer purchases.

Suggestions for Business Implication:

- Retailers can focus on stocking high-demand items and applying targeted promotions on these products. Additionally, bundling complementary products like nightlights with decorative frames or incense with gift sets can increase overall sales and revenue.

REVENUE TRENDS BY ITEMS



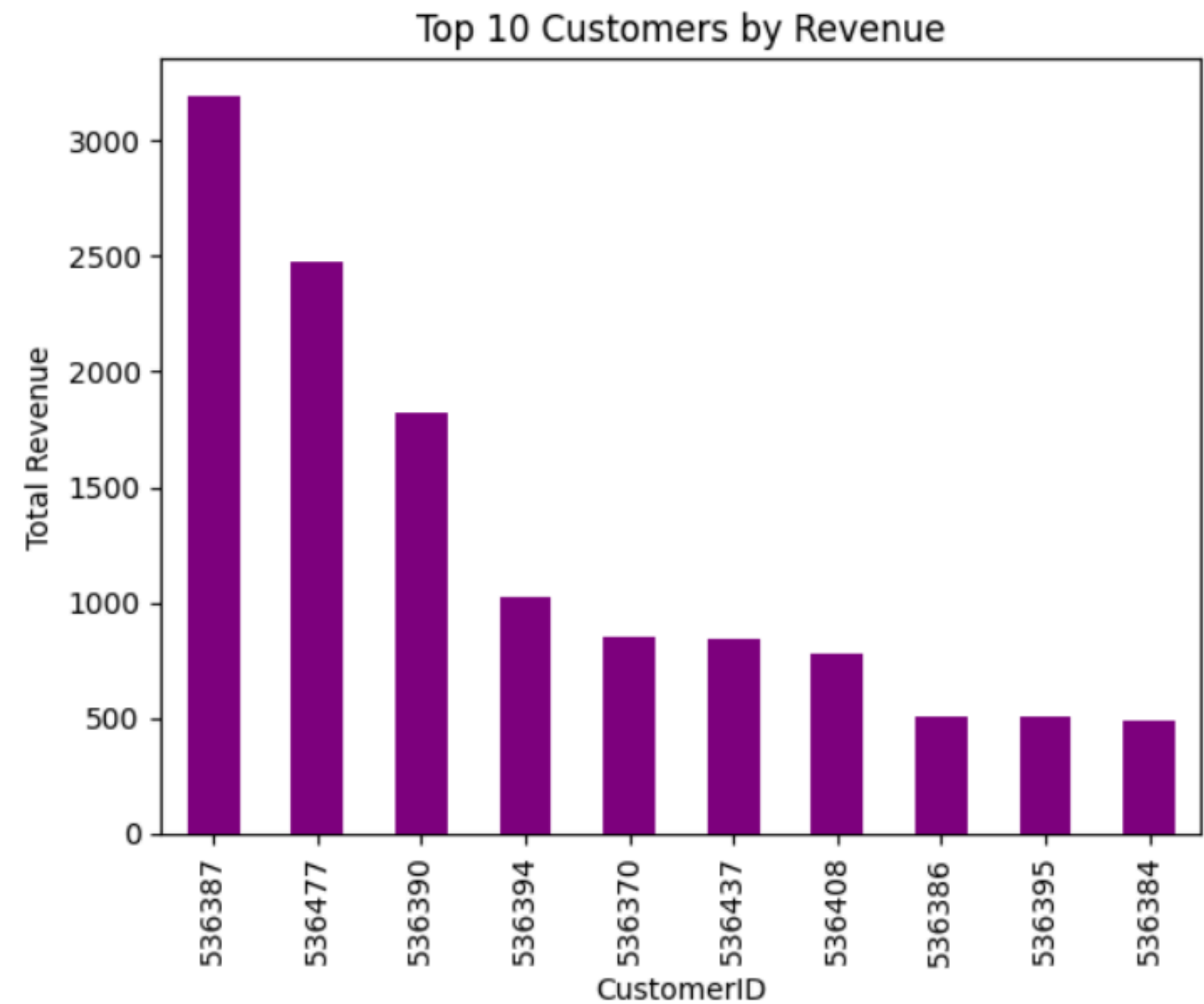
Key Insights

- The most sold item is "**Black Record Cover Frame**", generating the highest revenue at nearly 1600 units sold. This highlights a strong customer demand for trendy and decorative items.
- The next most popular items are "**Chilli Lights**" and "**Light Garland Butterflies Pink**," both of which also contribute significantly to revenue. These items showcase the popularity of aesthetically pleasing home lighting.
- Seasonal items, such as "**Hand Warmers**" (Union Jack and Scotty Dog Design) and "**Christmas-themed decorations**" (e.g., Fairy Tale Cottage Nightlight), show clear seasonal **purchasing patterns**, offering retailers an opportunity to capitalize during peak periods.
- Items like "**Victorian Sewing Box Large**" and "**White Hanging Heart T-Light Holder**" also feature in the top 10, signaling a demand for unique and niche decorative products.

Suggestions for Business Implication:

- **Stock Optimization:** Retailers should ensure consistent availability of high-demand items like decorative frames, nightlights, and garlands to maintain steady revenue.
- **Promotional Opportunities:** Seasonal items, such as hand warmers and festive lights, can benefit from targeted promotions during winter and holiday periods.
- **Product Bundling:** Combining complementary products like nightlights with decorative frames or incense with themed gift sets could boost overall sales and improve customer satisfaction.
- **Trend Monitoring:** The popularity of decorative and lighting products suggests a growing trend toward aesthetic home decor. Retailers can explore expanding their range to include similar high-demand products.

REVENUE TRENDS BY CUSTOMERS



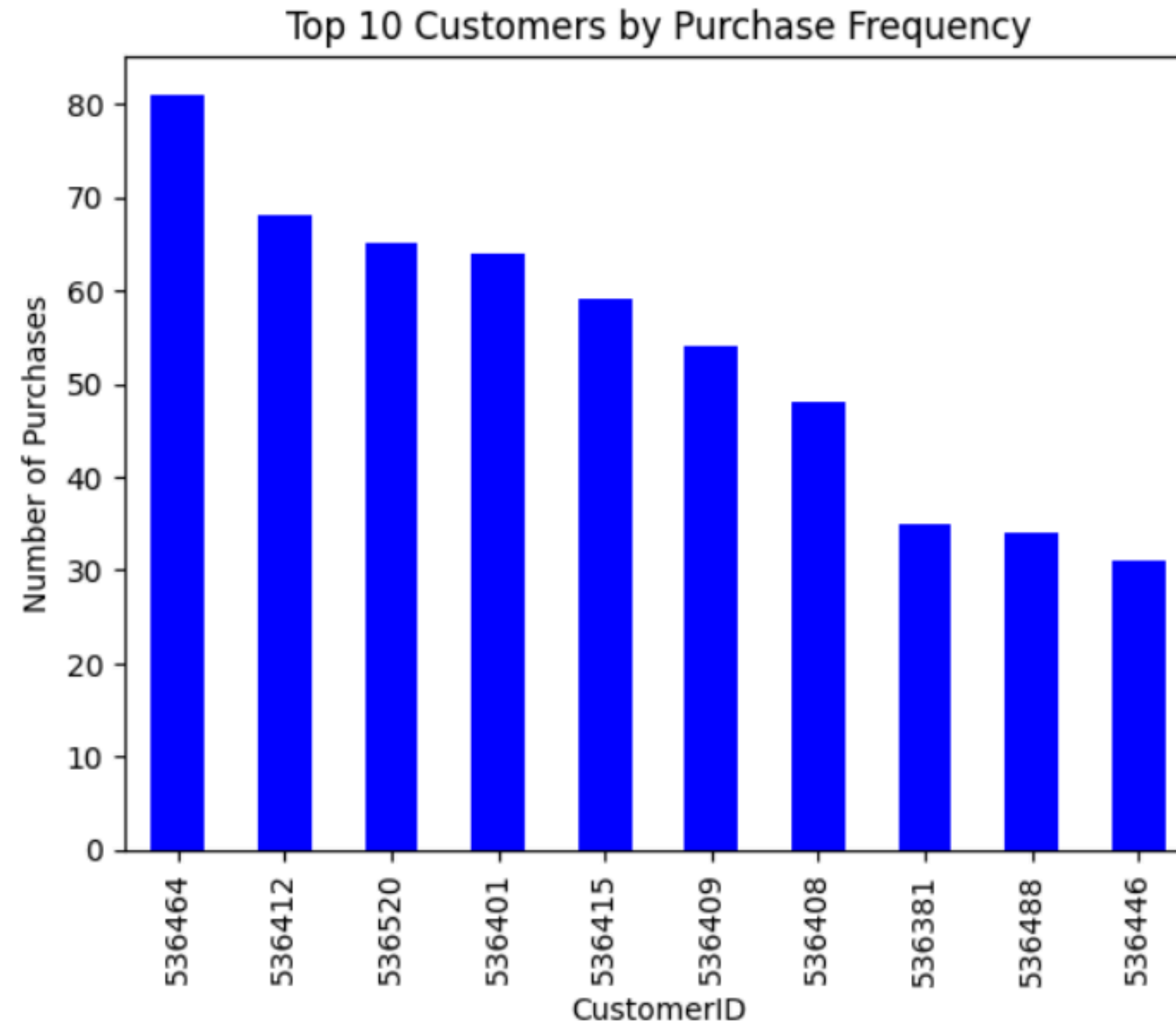
Key Insights

- The top customer by revenue is **CustomerID 536387**, contributing over **3,000 units** in total revenue. This customer is a **highly valuable asset for the business**.
- **CustomerIDs 536477 and 536390 follow closely, generating significant revenue of approximately 2,500 and 2,000 units, respectively.**
- The remaining top customers, such as 536594, 536370, and 536437, each contribute moderately, with revenues ranging from 1,000 to 1,800 units.
- The bottom three in the top 10 list—536408, 536386, and 536384—generate less than 1,000 units but still represent important contributors to overall revenue.

Suggestions for Business Implications

- **Customer Retention:** High-revenue customers like 536387 and others in the top tier should be prioritized for loyalty programs, personalized offers, and premium services to ensure retention and satisfaction.
- **Upselling and Cross-Selling:** Moderate contributors like 536594 and 536370 could be targeted with customized campaigns to encourage higher spending through upselling or cross-selling complementary products.
- **Customer Segmentation:** By identifying purchasing behaviors and patterns among these top customers, retailers can refine marketing strategies to target similar high-value customer segments.
- **Reward Programs:** Introducing tiered reward systems for top customers can increase engagement and incentivize repeat purchases.

CUSTOMER PURCHASE BEHAVIOUR



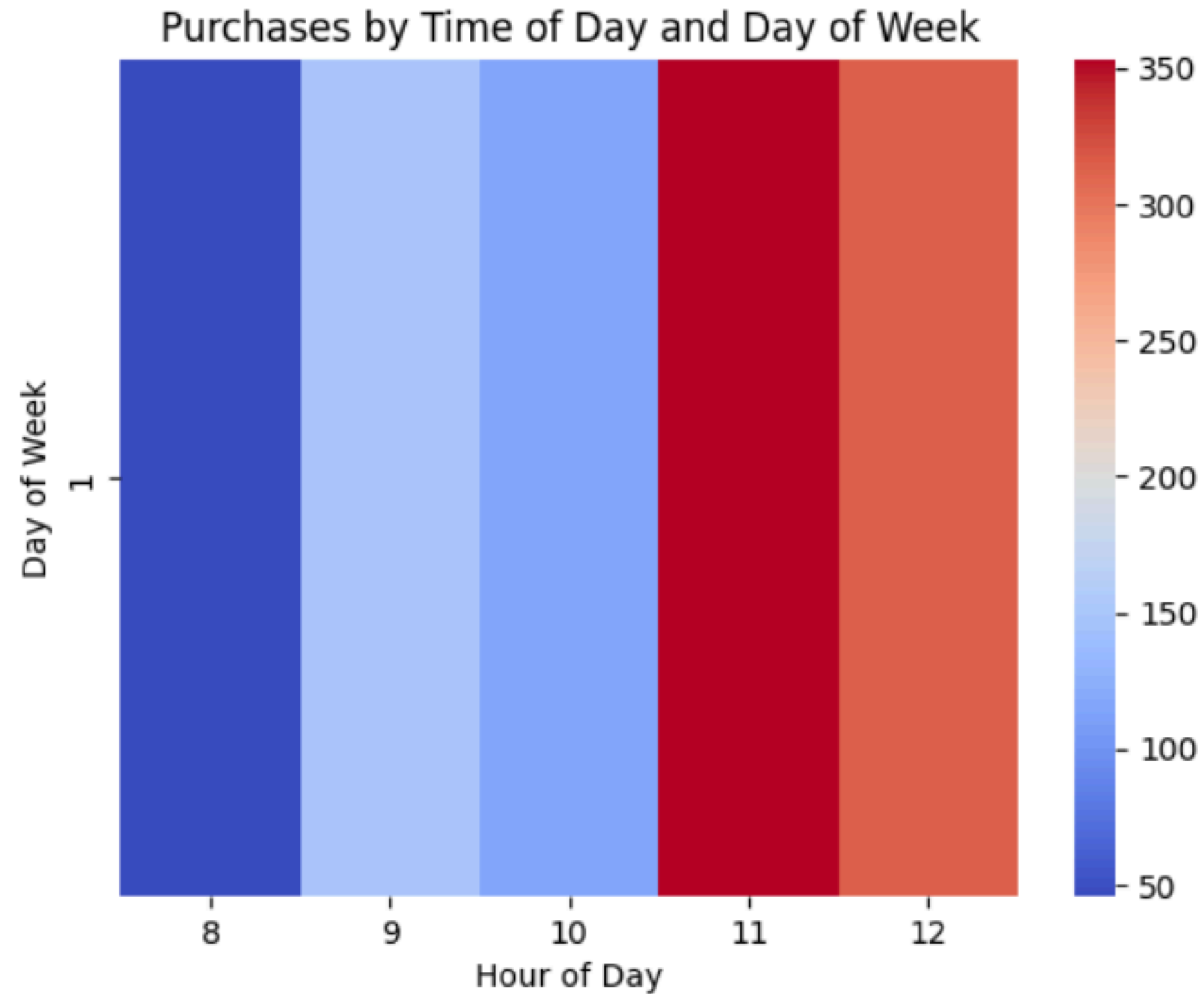
Key Insights

- The most frequent purchaser is **CustomerID 536464**, with approximately **80 purchases, indicating high engagement and loyalty.**
- **CustomerIDs 536412 and 536520** rank next, each completing over 60 purchases, **highlighting consistent purchasing behavior.**
- Mid-level customers like 536401, 536415, and 536409 contribute with 50–60 purchases, showing strong engagement.
- Customers at the lower end of the top 10, such as 536408, 536381, and 536446, have purchase frequencies in the 40–50 range, still making them valuable repeat customers.

Suggestions for Business Implications

- **Customer Loyalty:** Customers with high purchase frequency, such as **536464** and **536412**, should be **included in loyalty and rewards programs to further strengthen their engagement.**
- **Upsell Opportunities:** Frequent purchasers represent a prime opportunity for introducing new or premium products, as their consistent buying behavior suggests a strong brand connection.
- **Segment Analysis:** The behavior of these customers can be analyzed to create profiles for identifying and targeting similar high-frequency buyers.
- **Retention Strategies:** Customers with mid-range purchase frequencies (e.g., 536401 and 536409) may benefit from personalized marketing or special promotions to encourage more frequent transactions.

CUSTOMER PURCHASE BEHAVIOUR BY TIME OF THE DAY AND DAY OF WEEK



Key Insights:

High Activity Periods:

- The data indicates that purchases are concentrated during late morning hours, specifically from **11:00 AM to 12:00 PM**.
- **There is a significant increase in purchase activity starting around 11:00 AM, peaking at noon.**

Purchase Volume:

- The intensity of red hues shows a sharp rise in purchase volume during specific times. **The range from 300 to 350 purchases during these hours could indicate promotional campaigns, customer habits, or special deals driving this behaviour**

Suggestions for Business Implications:

Target High-Traffic Hours:

- **Retailers should focus marketing efforts, such as email campaigns, social media ads, or flash sales, during peak hours (11:00 AM - 12:00 PM) to maximize engagement and conversions.**

Optimize Staff and Inventory:

- **Ensure adequate staffing and inventory availability during peak times to provide a seamless customer experience and capitalize on high purchase rates.**

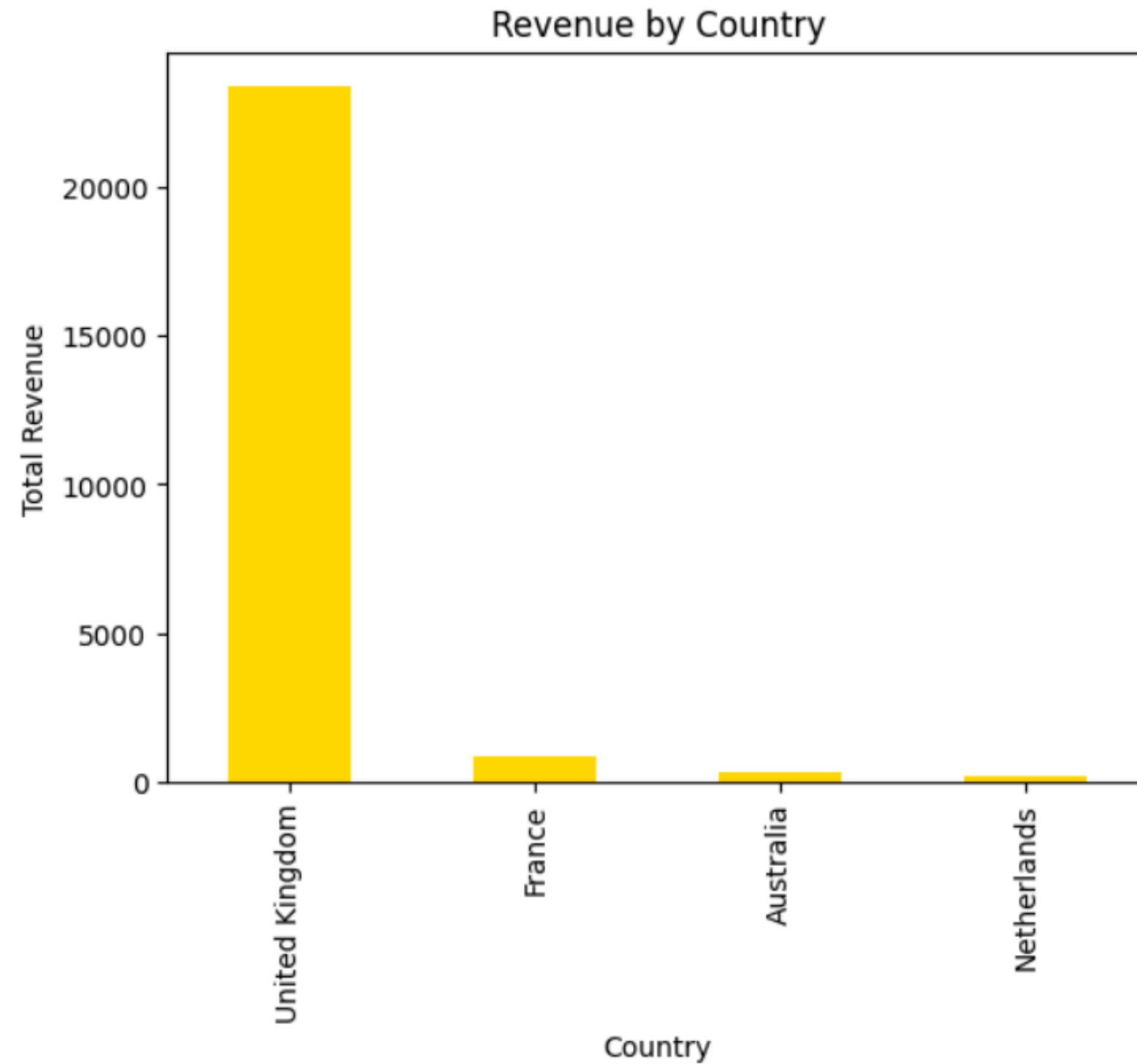
Weekday Analysis:

- If this pattern holds true across other weekdays, businesses can use this data to plan daily operations and tailor promotions to maximize sales throughout the week.

Seasonal or Product Trends:

- Consider analyzing specific products or customer preferences driving these spikes. Insights into popular items, like the top sellers mentioned earlier, can inform bundling strategies or targeted discounts.

REVENUE PRODUCED BY EACH COUNTRY



Key Insights:

Dominance of the UK Market:

- **The United Kingdom generates significantly higher revenue compared to other countries, with total revenue surpassing 20,000 units.** This suggests that the majority of the customer base or sales activity is concentrated in this region.

Minimal Contributions from Other Countries:

- France, Australia, and the Netherlands contribute relatively small amounts of revenue, each trailing far behind the UK. These markets show potential for growth but currently represent a minor share.

Potential Market Imbalance:

- The stark difference in revenue across countries highlights a heavy dependency on the UK market, which could pose risks if trends shift or competition increases.

Suggestions for Business Implications:

Focus on the UK Market:

- Since the UK is the largest revenue contributor, retailers should prioritize maintaining and expanding their customer base in this region through loyalty programs, local promotions, and optimized supply chain management.

Explore Growth in International Markets:

- France, Australia, and the Netherlands have untapped potential. Businesses could conduct market research to identify barriers to entry or preferences unique to these regions. Targeted campaigns, partnerships, or region-specific product lines could help boost sales.

Diversification Strategy:

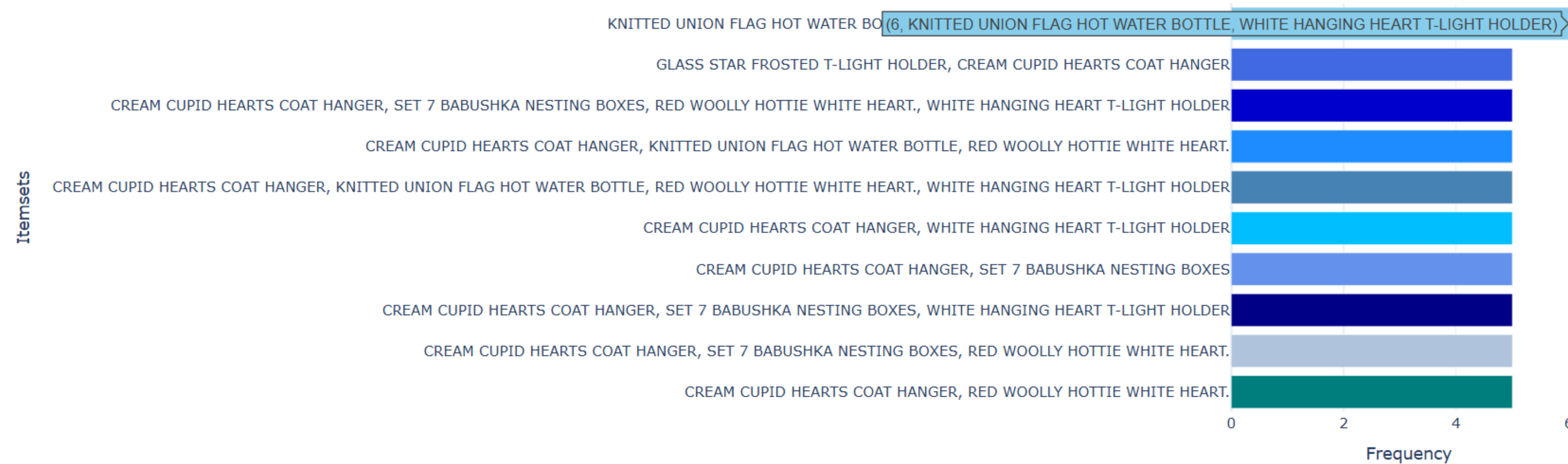
- Reliance on a single market (the UK) could make the business vulnerable to local economic fluctuations or regulatory changes. Diversifying revenue streams by enhancing operations and marketing in other countries could reduce this risk.

Localized Marketing Efforts:

- Tailor marketing strategies to cultural and regional preferences in underperforming markets. For instance, leveraging seasonal trends or focusing on popular products in each country could help drive engagement and sales.

TOP FREQUENT ITEMSETS BY FP- GROWTH ALGORITHM

Top Frequent Itemsets



Key Insights:

Popular Item Combinations:

- The **"Knitted Union Flag Hot Water Bottle"** and **"White Hanging Heart T-Light Holder"** are the most frequently purchased together (6 occurrences), indicating strong customer demand for these items as a pair.

Complementary Products:

- Other combinations, such as the **"Cream Cupid Hearts Coat Hanger"** and **"Red Woolly Hottie White Heart,"** show moderate frequency, highlighting trends in bundled or related purchases.

Gift-Oriented Products Dominate:

- Items like coat hangers, hot water bottles, and decorative T-light holders suggest customer preferences for giftable, home-related items.

Suggestions for Business Implications:

Bundle High-Frequency Items:

- **Promote bundles or discounts for top-paired items** (e.g., hot water bottles with T-light holders) to increase sales.

Focus on Decorative Items:

- **Prioritize stocking decorative and gift-oriented products that align with customer purchasing habits.**

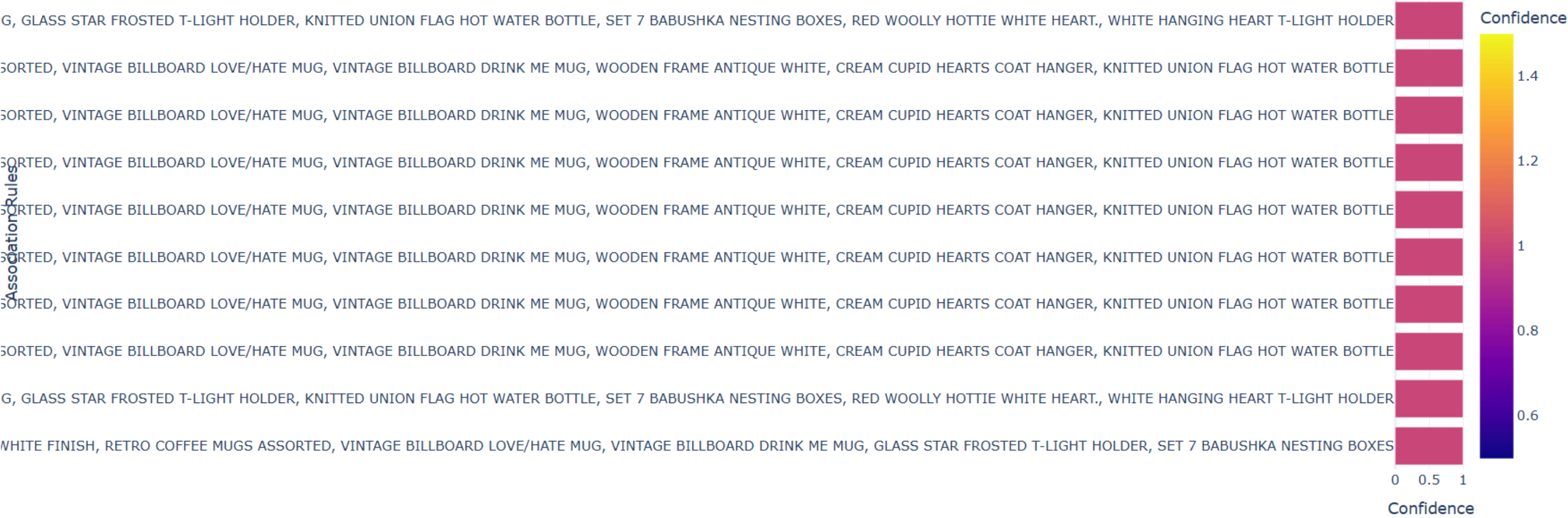
Leverage Seasonality:

- **Items like "Woolly Hotties" indicate seasonal demand; plan promotions around colder months or holidays.**

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TOP ASSOCIATION RULES BY CONFIDENCE

Top Association Rules by Confidence



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THANK YOU