Optimal Smartphone Sales Inventory

Dhun Sheth

Question: Which product and quantity to buy {iPhone 13, Samsung S24, iPhone 13 case, Samsung charger…} each month.

Decision Variable: type and # of product(s) to purchase for each month

Objective: max revenue, min unsold inventory

Context: Monthly budget, store capacity to hold total # of products, min # of each product to show diversity in products (this is to ensure the store doesn’t just hold products from a particular brand like Apple – we are a multi-branded seller).

**Introduction**

Operating a brick-and-mortar retail store is more competitive than ever, not only does the business compete with other local shops, but also countless remote sellers. As such, it is crucial to understand the target customer base, and their preferences. Being a new retail chain in the Indian market, this becomes more necessary because the Asian market preferences may be substantially different from North America. The goal of this project is to analyze the referenced data to determine the optimal inventory and products a store should purchase every-month, given a budget of $25,000.

**Background**

The results of this analysis would help in the inventory ordering process. Inventory must be ordered ahead of time – maybe by several months even, therefore, it isn’t possible to analyze current month sales and order inventory for the next month based on this because it is likely the inventory wouldn’t be available in time. In addition, this method does not capture seasonal trends because you assume future trend would follow current performance. A positive impact would be optimizing inventory based on historical performance/patterns and automating the task of determining how much to buy and of what.

**Plan**

The initial task is to analyze the data to understand the relationship of product sales and brand popularity. The “Smartphone Retail Outlet Sales Data” [1] will be used to analyze month-over-month and yearly trends to understand which products (phone/phone accessories) are popular. Then the “Smartphone Sales Dataset” [2] will be used to analyze the specific devices to determine which configurations (device model, color, and storage option) are the most desirable. Once this has been completed, a wight structure can be created by which to weight the objective function and the establish the proper constraint values. After, an optimization using machine learning can be performed to output the optimal product quantities to determine how much of which product should be ordered.

**Cost-Benefit**

As mentioned previously, the current approach involves a lot of guess work and is not backed by data, even though an experienced business owner may have a keen sense of which products sells and which do not, but that is not enough to determine optimal inventory quantities, and more importantly, that will not help in the face of changing market trends. Although the initial analysis and potentially a few months of trials and tweaking my be needed, the long-run benefits of having this model out weight the short-term effort.

**Conclusion**

Having the ability to optimize inventory to perfectly meet the needs of a shop’s customer base maximizes revenue and minimizes storage space taken by unsold products. In an increasingly competitive market, this optimization not only helps brick-and-mortar shops compete with their limited storage but also reduces recurring guess work of purchasing inventory.

**Dataset References:**

[1] Shubham. "Smartphone Retail Outlet Sales Data." *Kaggle*, 2023, <https://www.kaggle.com/datasets/shubham2703/smartphone-retail-outlet-sales-data/data>

[2] Yaminh. "Smartphone Sale Dataset." *Kaggle*, <https://www.kaggle.com/datasets/yaminh/smartphone-sale-dataset>