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Andrew Marshall

Minitab Project - 2

INFS 608 Applied Statistics

Overview: We are currently planning to introduce the ZFactor 5000 in time for the holiday season in an effort to maximize its sale potential. Our management team has suggested the following order quantities for our planned launch window:

* 920,000
* 950,000
* 1,040,000
* 1,100,000

As you can see, the range of order quantities shows that a consensus has yet been reached on which order quantity would best serve our needs. This is where our senior sales forecaster comes in. They were able to provide use with additional information after some further research into our previous sales history for comparable products. The following analysis will go into further detail.

# Initial findings

We begin our analysis with the initial findings provided by the senior sales forecaster. They predicted we could anticipate a 0.90 probability that demand would fall in a range between 840,000 and 1,160,000 units, with an expected (mean) demand of 1,000,000 ( ) units. While they were unable to provide the standard deviation as well, they were able to provide us with the related Z score of 1.645. With the addition of the Z score we should be able to now calculate the standard deviation () using the following equation:

= \* 1,000,000 ≈ 97,264

Once we were able we determine the standard deviation we were able to determine the normal probability distribution as will be shown the next section.

# Normal probability distribution

Using the initial findings provided in the previous section we can now calculate the Normal probability distribution for unit demand for the provided data as shown in Figure 1.



Figure 1

# Out of Stock and Surplus Potential

While the graph in Figure 1 is informative, it is just one piece in our continued analysis. We can now also calculate the probability of running out of stock based on the management group’s suggested order quantities. As Figure 2 shows, the probability of running out of stock based projected demand decreases as the order quantity increases. While this may seem like an obvious conclusion, it does not resolve the potential result of having a surplus, which could result in lost profits due to unsold product. This will be discussed further in the next section.



Figure 2

# Profit and Surplus

In the previous section, we concluded that increasing the order quantity would reduce the probability of running out of stock due based on demand. However, this information does not address how each suggested order quantity would affect Predicted Profit. In this section we will address that by calculating the Predicted Profit and Expected Profit, based on the following 3 unit sales scenarios provided by the management team:

* 850,000 (Worst Case)
* 1,000,000 (Likely Case)
* 1,150,000 (Best Case)

We were able to calculate the Predicted Profit by subtracting the suggested sale quantities from the provided scenarios. We then calculated the sales revenue for each scenario, considering any lost revenue due to surplus product. The result was the Predicted Profit. We were also provided with a 5% chance of either the worst- and best-case scenarios. Given that the likely case also falls in the predicted range of 840,000 and 1,160,000 units, that leaves its probability to be 0.90. We now have all the information we need to calculate the Predicted and Expected Profit as is shown in Figures 3-6:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Order Quantity 1:  920,000 | |  |  |  |  |  |  |
| Demand | Sales | Surplus | Sales Revenue | Surplus Loss | Predicted Profit | Prob (Demand) | **Expected Profit** |
| 850,000 | 850,000 | 70,000 | $ 110,500,000 | $ (2,100,000) | $ 108,400,000 | 0.05 | **$ 119,040,000** |
| 1,000,000 | 920,000 | 0 | $ 119,600,000 | $ - | $ 119,600,000 | 0.9 | **$ 119,040,000** |
| 1,150,000 | 920,000 | 0 | $ 119,600,000 | $ - | $ 119,600,000 | 0.05 | **$ 119,040,000** |

Figure 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Order Quantity 2: 950,000 | |  |  |  |  |  |  |
| Demand | Sales | Surplus | Sales Revenue | Surplus Loss | Predicted Profit | Prob (Demand) | **Expected Profit** |
| 850,000 | 850,000 | 100,000 | $ 110,500,000 | $ (3,000,000) | $ 107,500,000 | 0.05 | **$ 122,700,000** |
| 1,000,000 | 950,000 | 0 | $ 123,500,000 | $ - | $ 123,500,000 | 0.9 | **$ 122,700,000** |
| 1,150,000 | 950,000 | 0 | $ 123,500,000 | $ - | $ 123,500,000 | 0.05 | **$ 122,700,000** |

Figure 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Order Quantity 3:  1,040,000 | |  |  |  |  |  |  |
| Demand | Sales | Surplus | Sales Revenue | Surplus Loss | Predicted Profit | Prob (Demand) | **Expected Profit** |
| 850,000 | 850,000 | 190,000 | $ 110,500,000 | $ (5,700,000) | $ 104,800,000 | 0.05 | **$ 133,680,000** |
| 1,000,000 | 1,040,000 | 0 | $ 135,200,000 | $ - | $ 135,200,000 | 0.9 | **$ 133,680,000** |
| 1,150,000 | 1,040,000 | 0 | $ 135,200,000 | $ - | $ 135,200,000 | 0.05 | **$ 133,680,000** |

Figure 5

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Order Quantity 4:  1,100,000 | |  |  |  |  |  |  |
| Demand | Sales | Surplus | Sales Revenue | Surplus Loss | Predicted Profit | Prob (Demand) | **Expected Profit** |
| 850,000 | 850,000 | 250,000 | $ 110,500,000 | $ (7,500,000) | $ 103,000,000 | 0.05 | **$ 141,000,000** |
| 1,000,000 | 1,100,000 | 0 | $ 143,000,000 | $ - | $ 143,000,000 | 0.9 | **$ 141,000,000** |
| 1,150,000 | 1,100,000 | 0 | $ 143,000,000 | $ - | $ 143,000,000 | 0.05 | **$ 141,000,000** |

Figure 6

# Bonus suggestion

One of the managers strongly feels that there is a significant profit potential, so much so that they stated that there is an order quantity that has a 75% chance of meeting demand and only a 25% chance of resulting in a stock-out. After additional research, we were able to determine this projected order quantity as shown in Figure 7.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Order Quantity 5:  1,065,550 | |  |  |  |  |  |  |
| Demand | Sales | Surplus | Sales Revenue | Surplus Loss | Predicted Profit | Prob (Demand) | **Expected Profit** |
| 850,000 | 850,000 | 215,550 | $ 110,500,000 | $ (6,466,500) | $ 104,033,500 | 0.05 | **$ 136,797,100** |
| 1,000,000 | 1,065,550 | 0 | $ 138,521,500 | $ - | $ 138,521,500 | 0.9 | **$ 136,797,100** |
| 1,150,000 | 1,065,550 | 0 | $ 138,521,500 | $ - | $ 138,521,500 | 0.05 | **$ 136,797,100** |

Figure 7

# Final Recommendation

We now have enough information now to make a recommendation on what order quantity to use. Based on the provided data, we believe that an order quantity of 1,100,000 is the best choice. This option provides the ideal balance between surplus loss and Expected Profit.