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Sers profit analysis

# Executive Summary

Sers has inquired that BC Consulting maximize profit associated with weekly sales of TVs. The provided Q\R policy at 12\7 yielded a weekly profit of $4,470.00. With the analysis provided, Sers can yield a weekly profit as high as $7,928.37. This shows approximately a 56.4% margin of profit gain possible from the change in suggested Q\R policy.

The profit above is subject to constraints including TVs being the sole source of revenue and demand. By examining the smallest, middle, and most Q\R policies tolerable, we can see which policy has the most attractive returns. *Table 1* provides a look at each Q\R policy and the corresponding expected weekly profit. Applying analytic methods ensured that within the grid-space defined in *Table 1*, the local optimum was acquired.

*Table 1: The heat map associated with each Q/R combination. Green indicates more money.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Q\R** | **Min: 1** | **Mid: 3** | **Max: 7** |
| **Min: 1** | INF | INF | INF |
| **Mid: 6** | $3,542.57 | $3,248.48 | INF |
| **Max: 12** | **$7,302.43** | $6,798.04 | $4,470.00 |

# Recommendation and Future Work

BC Consulting suggests that Sers prepare and employ a new Q\R policy to enforce the maximum quantity of TVs per week at 12, and only resupply when inventory reaches below 1. This would enable Sers to obtain a profit margin as high as 56.4% based on current profit. The amount of profit made on a TV outweighs the loss from backordering to needy customers. The mentioned recommendation is subject to demand correctness, employee standards, suppliers, and economic uncertainty involving the commodities involving TV production. In order to account for these uncertainties, various statistical techniques, stochastic simulation, and predictive modeling techniques can scale this optimization model to forecast demands more accurately, account for uncertainty, and put throttles on inevitable risk that Sers will see in the future. BC Consulting has encountered such problems before and is able to do solve them in future as well.

# Technical Report

## Methods Used, Recommendation, and Benefits

BC Consulting was inquired by Sers to construct an optimal Q\R policy that maximizes profit on weekly TV sales. The methods used to acquire this solution involved *Discrete Markov Chains*. *Table 2* provides information initial to the study.

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## Assumptions

Factors involved in the ability to obtain a consistent profit for fiscal year 2018 include: supplier, cost, political, and economic variance. Supplier variance may occur when costs by week, cost of shipping, maintenance, labor costs, or the ability to obtain new suppliers fluctuate by any degree. Cost variance may be any cost involving the costs themselves, these charges may occur in the event costs or the processes that induce costs change. Examples of cost variability could include uncertainty or risk in the ability for a cost to actually contain the quality the supplier issued or additional costs available for creation and purchase to the general public. Political and economic variance can cause more ripple effects than any, minimum wage standards changes, cost of living, inflation, or any other legal changes that influence the way people can or choose to do commerce with the corresponding industry. Any and all of these ripple effects will either directly or indirectly influence the costs, revenues, and profits. All of these varying degrees of risk, change, and influence have been scoped out of the analysis to enable a robust and quantifiable solution on the current problem statement.

## State Space, Sets, Parameters, Constraints, and Objective

After decomposing this problem, we were able to acquire more information about costs, pounds per employee, and employee maxims for each division and shift; pre-requisite information on all data provided in the *Memorandum of Understanding* is listed in *Table 3.* Tools included Microsoft Excel. The state-space and period for the problem has been defined as:

*Table 2*: Provided data elements

|  |  |
| --- | --- |
| Probability of Demand | |
| Number of TVs | Probability |
| 0 | 10% |
| 1 | 20% |
| 2 | 40% |
| 3 | 25% |
| 4 | 5% |

*Table 3*: Constructed probability matrix. Q\R: 12\7

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *P* | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **-1** | **-2** | **-3** | **-4** | **-5** |
| **12** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11** | 0 | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **10** | 0 | 0 | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9** | 0 | 0 | 0 | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8** | 0 | 0 | 0 | 0 | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7** | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **0** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **-1** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **-2** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **-3** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **-4** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **-5** | 0.1 | 0.2 | 0.4 | 0.25 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Additional constraints include the memoryless property that being in state t-1 has no effect on being in state t next. Following steps from *Table 3* included the appending of a single column of 1s to the state -5. This disannulled one equation in favor of the equation to ensure the sum of each steady state probability must sum to one. This is reflected in *Table 4.*

## Model Output, Interpretation, and Sensitivity

The model output was in the form of a steady state matrix in *Table 4.* This resulted in knowledge of the long term probabilities for being in each state. This was leveraged to interpret the expected value of costs in any of the given states (I.e., how much we will make, and pay with the state designated amount of TVs times the long run probability of the demand dropping us to that amount).

*Table 4: Steady State probability matrix after inverting table 4.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **-1** | **-2** | **-3** | **-4** | **-5** |
| **Probability** | 0.03 | 0.07 | 0.16 | 0.16 | 0.14 | 0.15 | 0.13 | 0.10 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Quantity** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |

The output may be interpreted as at any given state, the probability of the associated number of items sold this week. We defined this based on a system with only knowledge of last week with provided transition probabilities from initial guidelines and data. These results, without any additional analytics, show the higher probabilities lie within selling just 2 TVs and selling 6 TVs, capturing over 50% of the probabilities. Sensitivity analysis was done to acquire an individual table for each element of *Table 1* provided in the *Executive Summary*.

## Conclusion and Recommendation

BC Consulting suggests that Sers prepare and employ a new Q\R policy to enforce the maximum quantity of TVs per week at 12, and only resupply when inventory reaches below 1. This would enable Sers to obtain a profit margin as high as 56.4% of current profit. The local recommendation stands by the figure *Table 1* listed above.

The profit above is subject to constraints including TVs being the sole source of revenue and demand. By examining the smallest, middle, and most Q\R policies, we can see which location has the most attractive returns. *Table 1* provides a look at each Q\R policy and the corresponding expected weekly profit. Applying analytic methods ensured that within the grid-space defined in *Table 1*, the local optimum was acquired.