WonderMarket
Section B – Client Report

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MATH3202 Assignment 1
Due 29/03/2019 12:00 pm

Abstract

In this report, we propose a solution to optimise your supply chain logistics, to minimise costs while ensuring all demands are met.

Solution

We have considered your requirements of weekly demand, DC capacity, northside capacity and surge demands. We propose the following assignment of stores to distribution centres for each communication.

Communication 1

Only considering each store's demand without any capacity constraints resulted in a cost of $150212. The solution is described below (in truckloads per week).

Store	DC0	DC1	DC2
S0	0.00	0.00	18.00
S1	7.00	0.00	0.00
S2	0.00	0.00	21.00
S3	0.00	0.00	15.00
S4	0.00	0.00	17.00
S5	0.00	0.00	10.00
S6	0.00	6.00	0.00
S7	0.00	0.00	8.00
S8	0.00	0.00	7.00
S9	7.00	0.00	0.00

Communication 2

With DC capacity considered, the cost was $174952 with the following assignments (truckloads per week).

Store	DC0	DC1	DC2
S0	3.00	0.00	15.00
S1	7.00	0.00	0.00
S2	21.00	0.00	0.00
S3	0.00	15.00	0.00
S4	17.00	0.00	0.00
S5	0.00	0.00	10.00
S6	0.00	6.00	0.00
S7	0.00	0.00	8.00
S8	0.00	0.00	7.00
S9	7.00	0.00	0.00

Communication 3

With the northside capacity limit as well, the cost was $179882 with the following assignments (truckloads per week).

Store	DC0	DC1	DC2
S0	0.00	0.00	18.00
S1	7.00	0.00	0.00
S2	21.00	0.00	0.00
S3	0.00	15.00	0.00
S4	17.00	0.00	0.00
S5	0.00	3.00	7.00
S6	0.00	6.00	0.00
S7	0.00	0.00	8.00
S8	0.00	0.00	7.00
S9	0.00	7.00	0.00

Communication 4

Considering the surge scenarios, we developed the following assignment, with a regular (non-surge) cost of $199661.44 per week. We have verified that these assignments can scale up to the surge scenarios provided without exceeding and of your capacity limits. The following are the percentages of demand each store should receive from each distribution centre.

Store	DC0	DC1	DC2
S0	0.00%	0.00%	100.00%
S1	100.00%	0.00%	0.00%
S2	100.00%	0.00%	0.00%
S3	0.00%	100.00%	0.00%
S4	58.82%	0.00%	41.18%
S5	0.00%	83.86%	16.14%
S6	0.00%	100.00%	0.00%
S7	0.00%	64.77%	35.23%
S8	0.00%	64.77%	35.23%
S9	100.00%	0.00%	0.00%

Applying these percentages to normal demand, we have the following truckloads per week.

Store	DC0	DC1	DC2
S0	0.00	0.00	18.00
S1	7.00	0.00	0.00
S2	21.00	0.00	0.00
S3	0.00	15.00	0.00
S4	10.00	0.00	7.00
S5	0.00	8.39	1.61
S6	0.00	6.00	0.00
S7	0.00	5.18	2.82
S8	0.00	4.53	2.47
S9	7.00	0.00	0.00

Insights

General Observations

While optimising the assignments with the data you provided us, we made the following observations.

- With the exception of surge scenario 4, the capacity at DC1 is never fully used. Normal demand and scenarios 0 – 3 use at most 54 truckloads per week from DC1. However, reducing its throughput (by any amount) would make surge scenario 4 impossible.
- DC0's capacity of 72 is never fully utilised. At most, 45.6 truckloads are required from it per week (during scenario 4).
- Surge scenario 4 is the limit of your current system. It requires 161 truckloads in total. Because DC0 and DC2 together can only supply 85 and DC1 can supply 76, this is exactly 161 truckloads per week.

Marginal Costs

These are the effects of slight adjustments to the capacity of DCs you have provided us. These may be useful to improve your management of distribution centres.

- Increasing DC0 or DC1's capacity (by any amount) will not reduce the cost, as they are not bottlenecks of your supply chain.
- Increasing DC2's capacity by 1 truckload would reduce the regular demand cost by $496, to $199165.44.
- Increasing the northside capacity by 1 truckload per week would reduce your normal demand cost by $387.02, to $199274.43. The northside is the limiting constraint in 3 of the 5 surge scenarios.