

ISE 2004

Group Paper: Presenting Results/Solutions

Due Date: Wednesday, December 11th in Canvas (Turn-it in)

To be completed in groups of 2-3 (do NOT have to be your presentation groups)

Motivation

- In several of your remaining ISE courses, you will need to complete a term project and then write a group paper that summarizes your results. **For this assignment, you will be writing a report that resembles a project from ISE 3414: Probabilistic Operations Research.**
- This project involves analyzing different inventory policies to see which one makes the most sense for a potential client.
- In addition to correct mathematical analysis for determining the best policy, students must prepare a written report to showcase their work and present the proposed solution to the client. Frequently students find good solutions but are unable to put together a strong report. In real life, when you are working on a project, the way you present your work is critical! You need to convince your client that your work was thorough and show them that your solution is significantly better than what they are doing currently. Otherwise, you will likely lose the client.
- On the following pages, you will find a simplified description of a term project that could be assigned in ISE 3414. Clearly, you do not yet know how to do the analysis. However, you can find a spreadsheet that contains a summary of the results obtained by a team of former students in the Group Technical Report assignment in Canvas.
- Your job is to write a report for this project that includes an executive summary and introduction, along with results and conclusions. ***Details about what to include are shown on page 3 of this assignment.*** (In an actual term project, you would also need to include an analysis section to explain the work that was completed. Since you are being given the output and are not being asked to complete any analysis, you will not have an analysis section.)
- Be sure to review the material presented in lecture about written reports.

Details

- Turn in a typed report at the end of the day (11:59pm) on **Wednesday, December 11th.**
- Your report should be typed on letter-size paper. It should be single-sided and double-spaced with 1-inch margins.
- Use font that is at least 12 point.
- Include a cover sheet that lists the team members.
- Limit the *body* of your report (not including the executive summary, cover sheet, or appendix) to four pages.

Project Description

Laura Savage, the CEO of *Let Sleeping Dogs Lie Dog Beds* (the leading provider of dog crates in the New River Valley), has sent along the following information:

We need to improve management of our premium XL crate inventory. We need to decide how much inventory to keep on hand and how often to order. If we order more often we are less likely to run out of crates (and lose potential customers as a result). If we order in bulk less often, we will keep delivery costs low, but will need more storage space. We want to maximize profit, considering all these costs: inventory space, delivery costs, and lost sales. I have been told that your group is well-qualified to perform an analysis of the situation and come up with a recommended strategy.

The store is open Monday through Friday, and at most can hold 20 of the premium XL crates. The goal is an inventory policy controlled by an (s, S) rule with $0 \leq s < S$. Under this rule, s is value that triggers ordering up to a quantity S . Implementation is as follows:

Check the inventory level each week at the close of business on Friday. If there are s or fewer crates in stock at that time, then we will place a call to our regional supplier and order enough to bring the overall inventory level up to S at the start of business on Monday morning. We refer to s as the re-order point and S as the stock-up level. Our current policy for premium crates uses $(s, S) = (5, 10)$.

Revenue, Costs, and Profits:

- A premium XL crate sells for \$200, so \$200 in Revenue
- To place an order to replenish our crates, the supplier charges a fixed delivery fee of \$300 (regardless of order size). In addition, we pay a \$50 handling per item. For example, if we order 5 crates, then the total order fee is calculated as follows: $\$50(5) + \$300 = \$550$. Our store also has inventory related costs (cleaning services, insurance, taxes, etc.) estimated to be \$10 per unit remaining at the close of business each week. Thus, the total cost of our operation includes an order fee (including fixed delivery cost and handling fees) and inventory holding costs. We are looking for values of s and S that will maximize the total expected profit (revenue-costs), while simultaneously assuring a high level of customer satisfaction. In particular, we wanted to ensure that the percentage of customers who show up to purchase a crate and none is available, is low.

Demand each week follows the distribution shown in the table below.

Number of crates bought	0	1	2	3	4	5	6	7	8
Probability	0.05	0.10	0.10	0.10	0.15	0.15	0.20	0.10	0.05

We are very nervous that customers will want to make a purchase when no crates are available. In our experience, those customers are likely to go to an online store rather than waiting to come back the next week. In addition to losing out on the profit from selling to those customers, we will mostly likely also lose out on the potential income that we would

generate through other peripheral purchases. Specifically, we estimate that each customer we turn away will cause us \$50 of harm.

The student group was asked to examine how the current policy works, as well as to find alternative inventory strategies that would work better. Specifically, they were asked to provide the following long-run averages for each policy analyzed.

- the long-run average number of sales in a week
- the long-run fraction of weeks in which an order is placed
- the long-run fraction of weeks in which a shortage occurs (demand exceeds supply)
- the long-run average fraction of lost demand (proportion of customers who want to buy a but did not because of no inventory)
- the long-run average order cost (including delivery and handling charges)
- the long-run average inventory holding cost
- the long-run average weekly profit

NOTES

- Find a spreadsheet of the student team's results under the **Group Paper Folder**.
- The team did a very thorough job of analyzing this system and you need decide what information to include in your report (and how/where).
- The student team was not sure how to handle the idea of a penalty for missed sales. They calculated two different values for profit.
 - The first is just the straight-forward profit described in the background (income – inventory costs – ordering costs).
 - The second method also tracked the number of unsatisfied customers each week and included a cost for each.
 - Your group should decide which number(s) to present to the client.

For the ISE 2004 Group Writing Assignment, your report should include the following five main sections.

1. Executive Summary: This is a separate, one-page summary that will go directly to the CEO, so it should be non-technical. It should give a brief summary of your work, including clear summaries of your findings and recommendations. (The report body will go to the engineering department, so it can include more technical details.)
2. Introduction: This section should include a brief description of the problem.
3. Results: This should include a summary of relevant results in words, along with appropriate tables and/or graphs.
4. Conclusions: This section should clearly state what policy you are recommending, as well as the impact that it will have on the store.
5. Appendix: This should include the details of your analysis that are not included in the main report body. Information that is important (such as the results for your recommended policy or a concise summary of overall results) should not be buried in the appendix, but should be presented and explained in the main report. Your entire report (including the appendix) should look professional.