ALY-6050 Module Four Project

Project: A Prescriptive Model for Strategic Decision-making, An Inventory Management Decision Model

The project consists of two parts. The submission of this project will consist of two attachments:

1. A text document that is prepared according to the APA standards of formatting – this refers to the page numbers and spacing. In the document, explain the experiments and their respective conclusions, and additional information as indicated in each problem. Your report should be submitted as a pdf titled as follows: ALY6050_MOD4_Project_LastName.pdf
2. You should complete this project as an R script (.R) and submit your script named as follows: ALY6050_MOD4_Project_Lastname.R

Alternatively, feel free to submit everything as a single .pdf output of a R Notebook (see lesson 1-0 for details).

Problem:

Inventories represent a considerable investment for every organization; thus, it is important that they be managed well. Excess inventories can indicate poor financial and operational management. On the other hand, not having inventory when it is needed can also result in business failure. The two basic inventory decisions that managers face are how much to order or produce for additional inventory, and when to order or produce it to minimize total inventory cost, which consists of the cost of holding inventory and the cost of ordering it from the supplier.

Holding costs, or carrying costs, represent costs associated with maintaining inventory. These costs include interest incurred or the opportunity cost of having capital tied up in inventories; storage costs such as insurance, taxes, rental fees, utilities, and other maintenance costs of storage space; warehousing or storage operation costs, including handling, recordkeeping, information processing, and actual physical inventory expenses; and costs associated with deterioration, shrinkage, obsolescence, and damage. Total holding costs are dependent on how many items are stored and for how long they are stored. Therefore, holding costs are expressed in terms of dollars associated with carrying one unit of inventory for one unit of time.

Ordering costs represent costs associated with replenishing inventories. These costs are not dependent on how many items are ordered at a time, but on the number of orders that are prepared. Ordering costs include overhead, clerical work, data processing, and other expenses that are incurred in searching for supply sources, as well as costs associated with purchasing, expediting, transporting, receiving, and inspecting. It is typical to assume that the ordering cost is constant and is expressed in terms of dollars per order.

For a manufacturing company that you are consulting for, managers are unsure about making inventory decisions associated with a key engine component. The annual demand is estimated to be 15,000 units and is assumed to be constant throughout the year. Each unit costs $80. The company's accounting department estimates that its opportunity cost for holding this item in stock for one year is 18% of the unit value. Each order placed with the supplier costs $220. The company's policy is to order whenever the inventory level reaches a predetermined reorder point that provides sufficient stock to meet demand until the supplier's order can be shipped and received; and then to order twice as many units.

Part 1

As a consultant, your task is to develop and implement a decision model to help them arrive at the best decision. As a guide, consider the following:

1. Define the data, uncontrollable inputs, model parameters, and the decision variables that influence the total inventory cost.

2. Develop mathematical functions that compute the annual ordering cost and annual holding cost based on average inventory held throughout the year and use them to develop a mathematical model for the total inventory cost.
3. Use data tables to find an approximate order quantity that results in the smallest total cost.
4. Plot the Total Cost versus the Order Quantity
5. Use R to find the order quantity which would yield a minimum total cost.
6. Conduct what-if analyses to study the sensitivity of total cost to changes in the model parameters.
7. In your report, explain your results and analyses to the vice president of operations.

Part II

Assume that all problem parameters have the same values as those in part I, but that the annual demand has a triangular probability distribution between 13,000 and 17,000 units with a mode of 15,000 units.

I. Perform a simulation consisting of 1,000 occurrences and calculate the minimum total cost for each occurrence. Next, use the results of your simulation to:
   (i) Estimate the expected minimum total cost by constructing a 95% confidence interval for it and determine the probability distribution that best fits its distribution. Verify the validity of your choice.
   (ii) Estimate the expected order quantity by constructing a 95% confidence interval for it and determine the probability distribution that best fits its distribution. Verify the validity of your choice.
   (iii) Estimate the expected annual number of orders by constructing a 95% confidence interval for it and determine the probability distribution that best fits its distribution. Verify the validity of your choice.
2. Explain your results and analyses to the vice president of operations.

Requirements

- Please do *not* include a cover letter, table-of-contents, lengthy introduction, or references in your report.
- *Do* make every effort to communicate clearly and concisely.
- Clearly indicate which part of your report corresponds to each part of the assignment.
- *No screenshots!* Please submit a PDF of an R notebook with results and figures embedded (see Lesson 1-0 for instructions).
- Use base (or at least common-place) R packages only. Your script should be able to run without requiring additional libraries.
- Emailed submissions are not accepted. Give yourself enough time to ensure your file is properly rendered and uploaded as instructed.

Grading rubric

Category Score	Characteristics
A Range ***Excellent*** **90–100 points**	• Accurate completion of 90%–100% of all R requirements. Code is well formatted and easily readable. • Complete presentation and analysis of key results. Contains all required tables, and visualizations. Provides a precise description of the analytical concepts and theories used in the analysis.
B Range ***Good*** **80–90 points**	• Accurate completion of two parts of the project. Code is poorly formatted or difficult to read. • At most one major required component missing. Report shows gaps in reasoning or conclusions not supported by the data. Missing one of the required elements (introduction, conclusion, etc.); occasional grammar or spelling errors. Imprecise.
C Range ***Satisfactory*** **70–80 points**	• Completion of only a single part of the project. Major deficiencies in readability. • Report missing major required elements; evidence for recommendations is unclear or inaccurate; lack of organization. • Missing more than one of the required elements; frequent grammatical and spelling mistakes.
F Range ***Unsatisfactory*** **0–70 points**	• Accurate completion of fewer than 70% of all requirements. Disorganized and incomplete code. • Report content mostly missing. • Missing most required elements; major formatting or grammatical errors.