

Assignment 1

Assignment answers should be submitted on Moodle in PDF format.

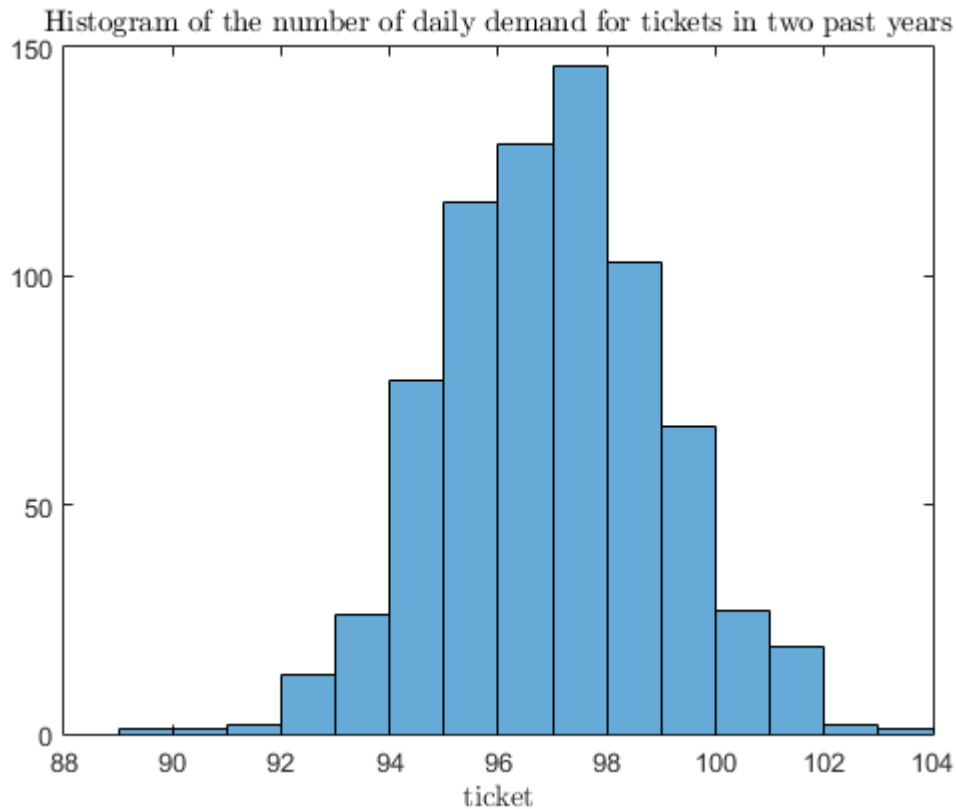
1 EOQ

Suppose that the university cafeteria has a steady demand of 1500 meals per month. The cafeteria pays \$5 for ingredients of each meal purchased from the wholesaler and sells each meal \$12. The process of order ingredients incurs a fixed cost of \$60 and requires 2 weeks to be supplied (lead time). The holding costs (warehouse, refrigerator, insurance, etc.) add up to \$1 per month per meal.

- (10 points) Using the EOQ model, calculate the optimal order quantity, the optimal reorder interval, and the average cost per year (back-orders not allowed).
- (20 points) Now suppose that back-orders are allowed (students get a restaurant voucher), and each back-order incurs a stock-out penalty of \$24 per stock-out meal per day. Using the EOQ model, calculate the optimal order quantity, reorder interval and average cost per year.
- (10 points) Derive the EOQ solution when the inventory good perishes at a rate of $\mu > 0$.
- (10 points) Derive the EOQ solution with a shipping lead time of $\tau > 0$.

2 Newsboy

A travel agency purchases 100 tickets from an airline at the start of the day and resells them to its customers. Each ticket costs \$110 to be purchased and sells \$132. Passengers who wish to buy this ticket but find it out of stock choose another flight and the travel agency not only loses the revenue, but also gives a future credit of \$50 for each shortfall. The unsold tickets are sold back to the airline for \$75. Suppose that the distribution of daily demand for the ticket is estimated by the following histogram of demand over the past two years.



- (20 points) Based on the histogram, what is the optimal number of the tickets to be purchased by the agency?
- (20 points) If the demand considered to be distributed as a normal random variable with mean 96 and standard deviation 8. What is the optimal number of the tickets to be purchased?
- (20 points) If the demand is distributed as a Poisson random variable with the mean 96. What is the optimal number of the tickets to be purchased?

3 Bass Model

(20 points) Check that the function F_T in the notes indeed solves the differential equation for the Bass model.

4 A more realistic the beer game

1. (10 points) If all players to know the demand at the same time as the retailer, how should each player take this information into account in his or her order sizes?

2. (20 points) If each player knows the inventory level of each other player, how would it affect his or her order size?
3. (30 points) Design a new more realistic beer game where each player has a finite amount of money, each player sets prices for his goods, orders cost money. Write a document with figures explaining in detail the rules for this new game, following the template of the document on beergame.org.
 - (a) You may add any rule that you like to make this game more realistic.
 - (b) For example, this new game ends when all players goes bankrupt. A bankrupt player cannot order anything and loses all inventory. The winner is the player with most money at the end.