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 without backorder, calculate the optimal order quantity, the optimal reorder interval, and the average cost per year (back-orders not allowed).

- (10 points) Let the ordering cost K be fixed, plot the optimal order quantity as a function of the holding cost h.

- (10 points) Let the holding cost h be fixed, plot the optimal order quantity as a function of the ordering cost K.

- (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) Let the ordering cost K and holding cost h be fixed, plot the optimal order quantity as a function of the backorder cost p.

- (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 $100 to be purchased and sells for $190. 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.

Histogram of the number of daily demand for tickets in two past years
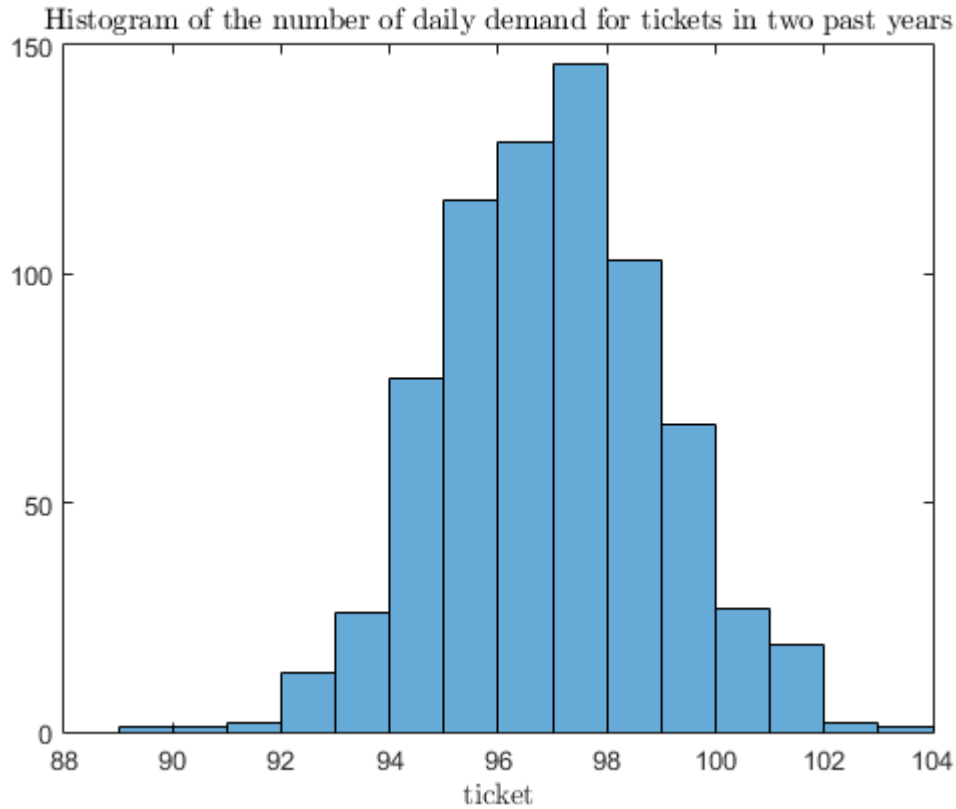
- (20 points) Based on the histogram, what is the optimal number of the tickets to be purchased by the agency?

- (20 points) If the demand considered to be distributed as a normal random variable with mean 60 and standard deviation 10. 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 80. What is the optimal number of the tickets to be purchased?

3   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 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.