Problem 1. Each month, a gas station sells 4,000 gallons of gasoline. Each time the parent company refills the station's tanks, it charges the station \$50 plus 70¢, per gallon. The annual cost of holding a gallon of gasoline is 30¢.

(a) How large should the station's orders be?

(b) How many orders per year will be placed?

(c) How long will it be between orders?

Problem 2. Suppose that the demand for a product is 30 units per month and the items are withdrawn at a constant rate. The setup cost each time a production run is undertaken to replenish inventory is \$15. The production cost is \$1 per item, and the inventory holding cost is \$0.30 per item per month.

(a) Assuming shortages are not allowed, determine how often to make a production run and what size it should be.

(b) If shortages are allowed but cost \$3 per item per month, determine how often to make a production run and what size it should be.

Problem 3. Henry Edsel is the owner of Honest Henry's, the largest car dealership in its part of the country. His most popular car model is the Triton, so his largest costs are those associated with ordering these cars from the factory and maintaining an inventory of Tritons on the lot. Therefore, Henry has asked his general manager, Ruby Willis, to develop a cost-effective policy for when to place these orders for Tritons and how many to order each time.

Ruby decides to use the stochastic continuous-review model to determine an (R, Q) policy. After some investigation, she estimates that the administrative cost for placing each order is \$1,500 (a lot of paperwork is needed for ordering cars), the holding cost for each car is \$3,000 per year (15 percent of the agency's purchase price of \$20,000), and the shortage cost per car short is \$1,000 per year. After considering both the seriousness of incurring shortages and the high holding cost, Ruby and Henry agree to use a 75 percent service level (a probability of 0.75 of not incurring a shortage between the time an order is placed and the delivery of the cars ordered). Based on previous experience, they also estimate that the Tritons sell at a relatively uniform rate of about 900 per year. After an order is placed, the cars are delivered in about two-thirds of a month. Ruby's best estimate of the probability distribution of demand during the lead time before a delivery arrives is a normal distribution with a mean of 50 and a standard deviation of 15.

(a) Determine the order quantity.

(b) Use a table for the normal distribution to solve for the reorder point.

(c) How much safety stock does this inventory policy provide?

(d) This policy can lead to placing a new order before the delivery from the preceding order arrives. Indicate when this would happen.

Problem 4. One of the largest selling items in J.C. Ward's Department Store is a new model of refrigerator that is highly energy-efficient. About 80 of these refrigerators are being sold per month. It takes about a week for the store to obtain more refrigerators from a wholesaler. The demand during this time has a uniform distribution between 10 and 30. The administrative cost of placing each order is \$100. For each refrigerator, the holding cost per month is \$15 and the shortage cost per month is estimated to be \$3.

The store's inventory manager has decided to use the stochastic continuous-review model, with a service level (measure 1) of 0.8, to determine an (R, Q) policy.

(a) Determine R and Q.

(b) What will be the average number of stockouts per year with this inventory policy?

Problem 5. A newspaper stand purchases newspapers for \$0.55 and sells them for \$0.75. The shortage cost is \$0.75 per newspaper (because the dealer buys papers at retail price to satisfy shortages). The holding cost is \$0.01 per newspaper left at the end of the day. The demand distribution is a uniform distribution between 50 and 75. Find the optimal number of papers to buy.

Problem 6. Freddie the newsboy runs a newstand. Because of a nearby financial services office, one of the newspapers he sells is the daily Financial Journal. He purchases copies of this newspaper from its distributor at the beginning of each day for \$1.50 per copy, sells it for \$2.50 each, and then receives a refund of \$0.50 from the distributor the next morning for each unsold copy. The number of requests for this newspaper range from 15 to 18 copies per day. Freddie estimates that there are 15 requests on 40 percent of the days, 16 requests on 20 percent of the days, 17 requests on 30 percent of the days, and 18 requests on the remaining days.

Use the stochastic single-period model for perishable products to determine Freddie's optimal order quantity.

Problem 7. Find the optimal ordering policy for the stochastic single-period model with a setup cost where the demand has the probability density function

$$f_D(t) = \begin{cases} \frac{1}{20}, & 0 \le t \le 20 \\ 0, & \text{otherwise} \end{cases}$$

and the costs are:
Holding cost = \$1 per item,
Shortage cost = \$3 per item,
Setup cost = \$1.50,
Production cost = \$2 per item.

Assume pre-existing inventory I on hand.