Assignment 3

1. Consider the following information for inventory management. The item is demanded 50 weeks a year. The forecasting department does not have enough information to predict demand variability thus initial analysis will be based on constant demand.

Item Cost	\$10.00
Order Cost	\$250.00
Annual holding cost (%)	33% of item cost
Lead time	1 week
Annual demand	25,750

   (a) State the order quantity and reorder point.

   (b) Determine the annual holding and order costs.

2. Reconsider Question 1. The forecasting department estimates that the weekly demand is normally distributed with a standard deviation of 25. The firm targets to fulfill the demand 95% of the time. Answer of 1(a) and 1(b) under these added information.

3. The Economic Order Quantity (EOQ) minimizes the following function:

$$f(Q) = \frac{Q}{2}H + \frac{D}{Q}S$$

   (a) Use Calculus to show that $f(Q)$ is minimized at $EOQ = \sqrt{\frac{2SD}{H}}$.

   (b) Show that the annual holding cost and the annual ordering cost are the same when the optimal quantity is ordered.

4. Quarter-inch stainless-steel bolts are consumed in a factory at a fairly steady rate of 60 per week. The bolts cost the plant two cents each. It costs the plant \$12 to initiate an order, and holding costs are based on an annual interest rate of 25 percent.

   (a) Determine the optimal number of bolts for the plant to purchase and the time between placement of orders.

   (b) What is the yearly holding and setup cost for this item?

5. Reconsider the bolt example in Question 4. Suppose that although we have estimated demand to be 60 per week, it turns out that it is actually 120 per week (i.e., we have a 100 percent forecasting error).

   (a) If we use the lot size calculated in the previous problem (i.e., using the erroneous demand estimate), what will the setup plus holding cost be under the true demand rate?

   (b) What would the cost be if we had used the optimum lot size?

   (c) What percentage increase in cost was caused by the 100 percent demand forecasting error? What does this tell you about the sensitivity of the EOQ model to errors in the data?

6. The annual demand for a product is 15,600 units. The weekly demand is normally distributed with a mean of 300 units and a standard deviation of 90 units. The cost to place an order is $31.20, and the time from ordering to receipt is four weeks. The annual inventory carrying cost is $0.10 per unit. Find the reorder point necessary to provide a 98 percent service level. Suppose the production manager is asked to reduce the safety stock of this item by 50 percent. If she does so, what will the new service level be?

7. A mail-order firm has four regional warehouses. Weekly demand at each warehouse is normally distributed with a mean of 10,000 units and a standard deviation of 2,000 units. The company purchases each unit of product at $10. Annual holding cost of one unit of product is 25% of its value. Each order incurs an ordering cost of $1,000 (primarily from fixed transportation costs), and lead time is one week. The company wants the probability of stocking out during the lead time at each warehouse to be no more than 5%. Assume 50 working weeks in a year.

   (a) Assuming that each warehouse operates independently, how much safety stock does each warehouse hold? How much average inventory is held (at all four warehouses combined), and at what annual cost? On average, how long does a unit of product spend in the warehouse before being sold (Hint: Littles Law)?

   (b) Assume that the firm has centralized all inventories in a single warehouse and that the probability of stocking out during the lead time is still no more than 5%. Ideally, how much average inventory can the company now expect to hold, and at what cost? In this case, how long will a unit spend in the warehouse before being sold?