1. (Economic Lot Size Model) Understand the classic Economic Lot Size Model in Section 3.2.1 of the text.

   (a) Demand for the Deskpro computer at Best Buy is 1000 units per month. Best Buy incurs a fixed order placement, transportation, and receiving cost of $4000 each time an order is placed. Each computer costs Best Buy $500 and the retailer has a holding cost of $100 per year. Plot the order cost, holding cost and total cost as a function of the order quantity. Evaluate the number of computers that the store manager should order in each replenishment lot.

   (b) The store manager at Best Buy would like to reduce the optimal lot size to 200. For this lot size reduction to be optimal, the store manager wants to evaluate how much the order cost per lot should be reduced.

   (c) Best Buy sells three models of computers, the Litepro, Medpro, and Heavypro, and they are managed by three independent product managers. Annual demands for the three products are $D_L = 12000$ units for the LitePro, $D_M = 1200$ units for the Medpro, and $D_H = 120$ for the Heavypro. Assume that each model costs Best Buy $500. A fixed transportation cost of $4000 is incurred each time an order is delivered. Evaluate the lot sizes that each Best Buy manager should order if lots for each products are ordered and delivered independently. Also evaluate the annual cost of such a policy. (Use the EOQ formula.)

   (d) Suppose now that the three product managers have decided to aggregate and order all three models each time they place an order. The fixed cost is now $7000. Evaluate the optimal lot size for each model, and evaluate the annual cost. (Use the EOQ formula.)

2. Prefab, a furniture manufacturer, uses 20,000 square feet of plywood per month. Their trucking company charges Prefab $400 per shipment independent of the quantity purchased. The manufacturer offers an all unit quantity discount with a price of $1 per square foot for orders under 20,000 square feet, $0.98 per square foot for orders between 20,000 square feet, and $0.96 per square foot for orders larger than 40,000 square feet. Prefab incurs a holding cost of 20 percent (i.e., 20 percent of the purchase cost per year). What is the optimal lot size for Prefab? What is the annual cost of such a policy? What is the cycle inventory of plywood at Prefab? How does it compare with the cyclic inventory if the manufacturer did not offer a quantity discount but sold all plywood at $0.96 per square foot?

3. Consider a DAG supermarket selling chicken noodle soup manufactured by the Campbell Soup Company. Customer demand for chicken noodle soup is R cans per year. The price Campbell charges is $C per can. DAG incurs a holding cost of $\$\alpha C$. The ordering cost is $\$K$ per order. Using the EOQ formula, DAG normally orders in the following lot sizes:

$$Q^* = \sqrt{\frac{2RK}{\alpha C}}$$

Campbell announces that it is offering a one-time-only discount of $\$d$ per can. Let Q^d be the lot size ordered at the discounted price. Let $t := Q^d/Q^*$.

(a) Assume t is integer. Without any discounting, show that the total cost (material cost + ordering cost + holding cost) during the next $t(Q^*/R)$ time units is:

$$C^1(t) = \frac{\alpha ct \cdot (Q^*)^2}{R} + ct \cdot Q^*.$$

(b) With discounting, show that the total cost during the next Q^d/R time units is:

$$C^2(t) = K + \frac{tQ^*}{R}[\frac{\alpha(c-d)t \cdot Q^*}{2} - dR - \alpha cQ^*].$$

(c) Suppose t^* minimizes $C^2(t) - C^1(t)$. Show

$$t^*Q^* = \frac{dR}{(c-d)\alpha} + \frac{cQ^*}{c-d}.$$

4. Use the Supply_Contracts.xls spreadsheet included in the textbook's CD-ROM to answer the following questions on supply chain coordination. We say a supply chain is *coordinated* if it achieves the global optimal solution.

   (a) For the buy-back contract, the retail DC selects the ordering quantity depending on the buy-back price. Set the manufacturer's selling price (cell B9) to \$80. Plot the retail DC's expected profit, manufacturer's profit, and the total supply chain profit as a function of the buy-back price (cell B11). Find, if it exists, a buy-back price that would coordinate this supply chain, and compare profits of the manufacturer and the distributor. If it does not exist, briefly explain.

   (b) Set the manufacturer's selling price to \$70, and repeat the above question.

   (c) For the revenue-sharing contract, the retail DC selects the ordering quantity depending on the whole-sale price and revenue-sharing percentage. Find, if exists, a pair of a whole-sale price (cell B9) and revenue-sharing percentage (cell B11) that would coordinate this supply chain. Can you find another pair?

5. Read the Sport Obermeyer case in the textbook (Pages 76-90).

   (a) Did you read the case? (Answer Yes or No.)

   (b) Text, page 90, Question 1. You may assume that the demand for each parka has a normal distribution with given mean and standard deviation values. Also assume that there is no production minimum.