is $10 per order. The cost of the sandal is $5 per pair. For John's ordering policy to be correct, what would the carrying cost as a percentage of the unit cost have to be? If the carrying cost were 10% of the cost, what would the optimal order quantity be?

6-26 In Problem 6-20 you helped Lila Battle determine the optimal order quantity for number 6 screws. She had estimated that the ordering cost was $10 per order. At this time, though, she believes that this estimate was too low. Although she does not know the exact ordering cost, she believes that it could be as high as $40 per order. How would the optimal order quantity change if the ordering cost were $20, $30, and $40?

6-27 Ross White's machine shop uses 2,500 brackets during the course of a year, and this usage is relatively constant throughout the year. These brackets are purchased from a supplier 100 miles away for $15 each, and the lead time is 2 days. The holding cost per bracket per year is $1.50 (or 10% of the unit cost) and the ordering cost per order is $18.75. There are 250 working days per year.

(a) What is the EOQ?
(b) Given the EOQ, what is the average inventory? What is the annual inventory holding cost?
(c) In minimizing cost, how many orders would be made each year? What would be the annual ordering cost?
(d) Given the EOQ, what is the total annual inventory cost (including purchase cost)?
(e) What is the time between orders?
(f) What is the ROP?

6-28 Ross White (see Problem 6-27) wants to reconsider his decision of buying the brackets and is considering making the brackets in-house. He has determined that setup costs would be $25 in machinist time and lost production time, and 50 brackets could be produced in a day once the machine has been set up. Ross estimates that the cost (including labor time and materials) of producing one bracket would be $14.80. The holding cost would be 10% of this cost.

(a) What is the daily demand rate?
(b) What is the optimal production quantity?
(c) How long will it take to produce the optimal quantity? How much inventory is sold during this time?
(d) If Ross uses the optimal production quantity, what would be the maximum inventory level? What would be the average inventory level? What is the annual holding cost?
(e) How many production runs would there be each year? What would be the annual setup cost?
(f) Given the optimal production run size, what is the total annual inventory cost?
(g) If the lead time is one-half day, what is the ROP?

6-29 Upon hearing that Ross White (see Problems 6-27 and 6-28) is considering producing the brackets in-house, the vendor has notified Ross that the purchase price would drop from $15 per bracket to $14.50 per bracket if Ross will purchase the brackets in lots of 1,000. Lead times, however, would increase to 3 days for this larger quantity.

(a) What is the total annual inventory cost plus purchase cost if Ross buys the brackets in lots of 1,000 at $14.50 each?
(b) If Ross does buy in lots of 1,000 brackets, what is the new ROP?
(c) Given the options of purchasing the brackets at $15 each, producing them in-house at $14.80, and taking advantage of the discount, what is your recommendation to Ross White?

6-30 After analyzing the costs of various options for obtaining brackets, Ross White (see Problems 6.27 through 6.29) recognizes that although he knows that lead time is 2 days and demand per day averages 10 units, the demand during the lead time often varies. Ross has kept very careful records and has determined lead time demand is normally distributed with a standard deviation of 1.5 units.

(a) What Z value would be appropriate for a 98% service level?
(b) What safety stock should Ross maintain if he wants a 98% service level?
(c) What is the adjusted ROP for the brackets?
(d) What is the annual holding cost for the safety stock if the annual holding cost per unit is $1.50?

6-31 Douglas Boats is a supplier of boating equipment for the states of Oregon and Washington. It sells 5,000 White Marine WM-4 diesel engines every year. These engines are shipped to Douglas in a shipping container of 100 cubic feet, and Douglas Boats keeps the warehouse full of these WM-4 motors. The warehouse can hold 5,000 cubic feet of boating supplies. Douglas estimates that the ordering cost is $10 per order, and the carrying cost is estimated to be $10 per motor per year. Douglas Boats is considering the possibility of expanding the warehouse for the WM-4 motors. How much should Douglas Boats expand, and how much would it be worth for the company to make the expansion? Assume demand is constant throughout the year.

6-32 Northern Distributors is a wholesale organization that supplies retail stores with lawn care and household products. One building is used to store Neverfail lawn mowers. The building is 25 feet wide by 40 feet deep by 8 feet high. Anna Oldham, manager of the warehouse, estimates that about 60% of the warehouse can be used to store the Neverfail lawn mowers. The remaining 40% is used for walkways and a small office. Each Neverfail lawn mower

comes in a box that is 5 feet by 4 feet by 2 feet high. The annual demand for these lawn mowers is 12,000, and the ordering cost for Northern Distributors is $30 per order. It is estimated that it costs Northern $2 per lawn mower per year for storage. Northern Distributors is thinking about increasing the size of the warehouse. The company can only do this by making the warehouse deeper. At the present time, the warehouse is 40 feet deep. How many feet of depth should be added on to the warehouse to minimize the annual inventory costs? How much should the company be willing to pay for this addition? Remember that only 60% of the total area can be used to store Neverfail lawn mowers. Assume all EOQ conditions are met.

6-33 Lisa Surowsky was asked to help in determining the best ordering policy for a new product. Currently, the demand for the new product has been projected to be about 1,000 units annually. To get a handle on the carrying and ordering costs, Lisa prepared a series of average inventory costs. Lisa thought that these costs would be appropriate for the new product. The results are summarized in the following table. These data were compiled for 10,000 inventory items that were carried or held during the year and were ordered 100 times during the past year. Help Lisa determine the EOQ.

COST FACTOR	COST ($)
Taxes	2,000
Processing and inspection	1,500
New product development	2,500
Bill paying	500
Ordering supplies	50
Inventory insurance	600
Product advertising	800
Spoilage	750
Sending purchasing orders	800
Inventory inquiries	450
Warehouse supplies	280
Research and development	2,750
Purchasing salaries	3,000
Warehouse salaries	2,800
Inventory theft	800
Purchase order supplies	500
Inventory obsolescence	300

6-34 Jan Gentry is the owner of a small company that produces electric scissors used to cut fabric. The annual demand is for 8,000 scissors, and Jan produces the scissors in batches. On the average, Jan can produce 150 scissors per day, and during the production process, demand for scissors has been about 40 scissors per day. The cost to set up the production process is $100, and it costs Jan 30 cents to carry one pair of scissors for one year. How many scissors should Jan produce in each batch?

6-35 Jim Overstreet, inventory control manager for Itex, receives wheel bearings from Wheel-Rite, a small producer of metal parts. Unfortunately, Wheel-Rite can only produce 500 wheel bearings per day. Itex receives 10,000 wheel bearings from Wheel-Rite each year. Since Itex operates 200 working days each year, its average daily demand for wheel bearings is 50. The ordering cost for Itex is $40 per order, and the carrying cost is 60 cents per wheel bearing per year. How many wheel bearings should Itex order from Wheel-Rite at one time? Wheel-Rite has agreed to ship the maximum number of wheel bearings that it produces each day to Itex when an order has been received.

6-36 North Manufacturing has a demand for 1,000 pumps each year. The cost of a pump is $50. It costs North Manufacturing $40 to place an order, and the carrying cost is 25% of the unit cost. If pumps are ordered in quantities of 200, North Manufacturing can get a 3% discount on the cost of the pumps. Should North Manufacturing order 200 pumps at a time and take the 3% discount?

6-37 Linda Lechner is in charge of maintaining hospital supplies at General Hospital. During the past year, the mean lead time demand for bandage BX-5 was 60. Furthermore, the standard deviation for BX-5 was 7. Linda would like to maintain a 90% service level. What safety stock level do you recommend for BX-5?

6-38 Linda Lechner has just been severely chastised for her inventory policy. (See Problem 6-37.) Sue Surrowski, her boss, believes that the service level should be either 95% or 98%. Compute the safety stock levels for a 95% and a 98% service level. Linda knows that the carrying cost of BX-5 is 50 cents per unit per year. Compute the carrying cost that is associated with a 90%, a 95%, and a 98% service level.

6-39 Ralph Janaro simply does not have time to analyze all of the items in his company's inventory. As a young manager, he has more important things to do. The following is a table of six items in inventory along with the unit cost and the demand in units.

(a) Find the total amount spent on each item during the year. What is the total investment for all of these?

(b) Find the percentage of the total investment in inventory that is spent on each item.

⚖:6-57 Consider the Emarpy Appliance situation in Problem 6-56. If Richard Feehan wants to minimize the total annual inventory cost, how many refrigerators should be produced in each production run? How much would this save the company in inventory costs compared with the current policy of producing 400 in each production run?

6-58 This chapter presents a material structure tree for item A in Figure 6.12. Assume that it now takes 1 unit of item B to make every unit of item A. What impact does this have on the material structure tree and the number of items of D and E that are needed?

6-59 Given the information in Problem 6-58, develop a gross material requirements plan for 50 units of item A.

6-60 Using the data from Figures 6.12–6.14, develop a net material requirements plan for 50 units of item A assuming that it only takes 1 unit of item B for each unit of item A.

6-61 The demand for product S is 100 units. Each unit of S requires 1 unit of T and 0.5 ounce of U. Each unit of T requires 1 unit of V, 2 units of W, and 1 unit of X. Finally, each unit of U requires 0.5 ounce of Y and 3 units of Z. All items are manufactured by the same firm. It takes two weeks to make S, one week to make T, two weeks to make U, two weeks to make V, three weeks to make W, one week to make X, two weeks to make Y, and one week to make Z.

(a) Construct a material structure tree and a gross material requirements plan for the dependent inventory items.

(b) Identify all levels, parents, and components.

(c) Construct a net material requirements plan using the following on-hand inventory data:

ITEM	S	T	U	V	W	X	Y	Z
On-Hand Inventory	20	20	10	30	30	25	15	10

6-62 The Webster Manufacturing Company produces a popular type of serving cart. This product, the SL72, is made from the following parts: 1 unit of Part A, 1 unit of Part B, and 1 unit of Subassembly C. Each subassembly C is made up of 2 units of Part D, 4 units of Part E, and 2 units of Part F. Develop a material structure tree for this.

6-63 Blair H. Dodds, III, runs a medium-to-large-sized home eBay business dealing in vintage photographs. The annual demand for his photos is approximately 50,000. The annual overhead cost (excluding the purchase price) to buy the photographs is $4,000 per year. Given that this cost represents the optimal annual ordering cost and the optimal ordering quantity is 400 photographs at a time determine the ordering cost and the average inventory level.

6-64 The lead time for each of the parts in the SL72 (Problem 6-62) is one week, except for Part B, which has a lead time of two weeks. Develop a net materials requirements plan for an order of 800 SL72s. Assume that currently there are no parts in inventory.

6-65 Refer to Problem 6-64. Develop a net material requirements plan assuming that there are currently 150 units of Part A, 40 units of Part B, 50 units of Subassembly C, and 100 units of Part F currently in inventory.

Internet Homework Problems

See our Internet home page, at **www.pearsonhighered.com/render**, for additional homework problems, Problems 6-66 to 6-73.

Case Study

Martin-Pullin Bicycle Corporation

Martin-Pullin Bicycle Corp. (MPBC), located in Dallas, is a wholesale distributor of bicycles and bicycle parts. Formed in 1981 by cousins Ray Martin and Jim Pullin, the firm's primary retail outlets are located within a 400-mile radius of the distribution center. These retail outlets receive the order from Martin-Pullin within two days after notifying the distribution center, provided that the stock is available. However, if an order is not fulfilled by the company, no backorder is placed; the retailers arrange to get their shipment from other distributors, and MPBC loses that amount of business.