

6-17 Lila Battle has determined that the annual demand for number 6 screws is 100,000 screws. Lila, who works in her brother's hardware store, is in charge of purchasing. She estimates that it costs \$10 every time an order is placed. This cost includes her wages, the cost of the forms used in placing the order, and so on. Furthermore, she estimates that the cost of carrying one screw in inventory for a year is one-half of 1 cent. Assume that the demand is constant throughout the year.

- How many number 6 screws should Lila order at a time if she wishes to minimize total inventory cost?
- How many orders per year would be placed? What would the annual ordering cost be?
- What would the average inventory be? What would the annual holding cost be?

6-18 It takes approximately 8 working days for an order of number 6 screws to arrive once the order has been placed. (Refer to Problem 6-17.) The demand for number 6 screws is fairly constant, and on the average, Lila has observed that her brother's hardware store sells 500 of these screws each day. Because the demand is fairly constant, Lila believes that she can avoid stock-outs completely if she only orders the number 6 screws at the correct time. What is the ROP?

6-21 Ken Ramsing has been in the lumber business for most of his life. Ken's biggest competitor is Pacific Woods. Through many years of experience, Ken knows that the ordering cost for an order of plywood is \$25 and that the carrying cost is 25% of the unit cost. Both Ken and Pacific Woods receive plywood in loads that cost \$100 per load. Furthermore, Ken and Pacific Woods use the same supplier of plywood, and Ken was able to find out that Pacific Woods orders in quantities of 4,000 loads at a time. Ken also knows that 4,000 loads is the EOQ for Pacific Woods. What is the annual demand in loads of plywood for Pacific Woods?

6-31 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?

6-42 Georgia Products offers the following discount schedule for its 4- by 8-foot sheets of good-quality plywood:

ORDER	UNIT COST (\$)
9 sheets or less	18.00
10 to 50 sheets	17.50
More than 50 sheets	17.25

Home Sweet Home Company orders plywood from Georgia Products. Home Sweet Home has an ordering cost of \$45. The carrying cost is 20%, and the annual demand is 100 sheets. What do you recommend?

6-37 The demand for barbecue grills has been fairly large in the past several years, and Home Supplies, Inc., usually orders new barbecue grills five times a year. It is estimated that the ordering cost is \$60 per order. The carrying cost is \$10 per grill per year. Furthermore, Home Supplies, Inc., has estimated that the stockout cost is \$50 per unit. The ROP is 650 units. Although the demand each year is high, it varies considerably. The demand during the lead time is shown in the following table:

DEMAND DURING LEAD TIME	PROBABILITY
600	0.3
650	0.2
700	0.1
750	0.1
800	0.05
850	0.05
900	0.05
950	0.05
1,000	0.05
1,050	0.03
1,100	0.02
Total	1.00

The lead time is 12 working days. How much safety stock should Home Supplies, Inc., maintain?

6-36 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.

IDENTIFICATION CODE	UNIT COST (\$)	DEMAND IN UNITS
XX1	5.84	1,200
B66	5.40	1,110
3CPO	1.12	896
33CP	74.54	1,104
R2D2	2.00	1,110
RMS	2.08	961

- Find the total amount spent on each item during the year. What is the total investment for all of these?
- Find the percentage of the total investment in inventory that is spent on each item.
- Based on the percentages in part (b), which item(s) would be classified in categories A, B, and C using ABC analysis?
- Which item(s) should Ralph most carefully control using quantitative techniques?

6-51 The demand for product S is 100 units. Each unit of S requires 1 unit of T and 1/2 unit 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 1/2 unit 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.

- Construct a material structure tree and a gross material requirements plan for the dependent inventory items.
- Identify all levels, parents, and components.
- 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

7-14 The Electrocomp Corporation manufactures two electrical products: air conditioners and large fans. The assembly process for each is similar in that both require a certain amount of wiring and drilling. Each air conditioner takes 3 hours of wiring and 2 hours of drilling. Each fan must go through 2 hours of wiring and 1 hour of drilling. During the next production period, 240 hours of wiring time are available and up to 140 hours of drilling time may be used. Each air conditioner sold yields a profit of \$25. Each fan assembled may be sold for a \$15 profit. Formulate and solve this LP production mix situation to find the best combination of air conditioners and fans that yields the highest profit. Use the corner point graphical approach.

\* 7-16 A candidate for mayor in a small town has allocated \$40,000 for last-minute advertising in the days preceding the election. Two types of ads will be used: radio and television. Each radio ad costs \$200 and reaches an estimated 3,000 people. Each television ad costs \$500 and reaches an estimated 7,000 people. In planning the advertising campaign, the campaign manager would like to reach as many people as possible, but she has stipulated that at least 10 ads of each type must be used. Also, the number of radio ads must be at least as great as the number of television ads. How many ads of each type should be used? How many people will this reach?

7-18 The dean of the Western College of Business must plan the school's course offerings for the fall semester. Student demands make it necessary to offer at least 30 undergraduate and 20 graduate courses in the term. Faculty contracts also dictate that at least 60 courses be offered in total. Each undergraduate course taught costs the college an average of \$2,500 in faculty wages, and each graduate course costs \$3,000. How many undergraduate and graduate courses should be taught in the fall so that total faculty salaries are kept to a minimum?

7-19 MSA Computer Corporation manufactures two models of minicomputers, the Alpha 4 and the Beta 5. The firm employs five technicians, working 160 hours each per month, on its assembly line. Management insists that full employment (i.e., all 160 hours of time) be maintained for each worker during next month's operations. It requires 20 labor hours to assemble each Alpha 4 computer and 25 labor hours to assemble each Beta 5 model. MSA wants to see at least 10 Alpha 4s and at least 15 Beta 5s produced during the production period. Alpha 4s generate \$1,200 profit per unit, and Beta 5s yield \$1,800 each. Determine the most profitable number of each model of minicomputer to produce during the coming month.

7-22 Solve the following LP problem using the corner point graphical method:

$$\begin{aligned} \text{maximize profit} &= 4X + 4Y \\ \text{subject to:} & \quad 3X + 5Y \leq 150 \\ & \quad X - 2Y \leq 10 \\ & \quad 5X + 3Y \leq 150 \\ & \quad X, Y \geq 0 \end{aligned}$$

7-23 Consider this LP formulation:

$$\begin{aligned} \text{minimize cost} &= \$X + 2Y \\ \text{subject to:} & \quad X + 3Y \geq 90 \\ & \quad 8X + 2Y \geq 160 \\ & \quad 3X + 2Y \geq 120 \\ & \quad Y \leq 70 \\ & \quad X, Y \geq 0 \end{aligned}$$

Graphically illustrate the feasible region and apply the isocost line procedure to indicate which corner point produces the optimal solution. What is the cost of this solution?

7-28 Graph the following LP problem and indicate the optimal solution point:

$$\begin{aligned} \text{maximize profit} &= \$3X + \$2Y \\ \text{subject to:} & \quad 2X + Y \leq 150 \\ & \quad 2X + 3Y \leq 300 \end{aligned}$$

- Does the optimal solution change if the profit per unit of X changes to \$4.50?
- What happens if the profit function should have been  $\$3X + \$3Y$ ?

7-29 Graphically analyze the following problem:

$$\begin{aligned} \text{maximize profit} &= \$4X + \$6Y \\ \text{subject to:} & \quad X + 2Y \leq 8 \text{ hours} \\ & \quad 6X + 4Y \leq 24 \text{ hours} \end{aligned}$$

- What is the optimal solution?
- If the first constraint is altered to  $X + 3Y \leq 8$ , does the feasible region or optimal solution change?

Table 6.8

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Summary of ABC Analysis

INVENTORY GROUP	DOLLAR USAGE (%)	INVENTORY ITEMS (%)	ARE QUANTITATIVE CONTROL TECHNIQUES USED?
A	70	10	Yes
B	20	20	In some cases
C	10	70	No