Assignment No.1 - Chapter 2, Introduction to Linear Programming

Problem 7 - Page 62

7. Identify the feasible region for the following set of constraints:

$$\begin{aligned} 0.5A + 0.25B &\geq 30 \\ 1A + 5B &\geq 250 \\ 0.25A + 0.5B &\leq 50 \\ A, B &\geq 0 \end{aligned}$$

Problem 10 - Page 62

10. For the linear program

$$\begin{aligned} \text{Max} \quad & 2A + 3B \\ \text{s.t.} \quad & \\ & 1A + 2B \leq 6 \\ & 5A + 3B \leq 15 \\ & A, B \geq 0 \end{aligned}$$

find the optimal solution using the graphical solution procedure. What is the value of the objective function at the optimal solution?

Problem 12 - Page 62

12. Consider the following linear programming problem:

$$\begin{aligned} \text{Max} \quad & 3A + 3B \\ \text{s.t.} \quad & \\ & 2A + 4B \leq 12 \\ & 6A + 4B \leq 24 \\ & A, B \geq 0 \end{aligned}$$

a. Find the optimal solution using the graphical solution procedure.
b. If the objective function is changed to $2A + 6B$, what will the optimal solution be?
c. How many extreme points are there? What are the values of A and B at each extreme point?

Problem 14 - Page 63

14. RMC, Inc., is a small firm that produces a variety of chemical products. In a particular production process, three raw materials are blended (mixed together) to produce two products: a fuel additive and a solvent base. Each ton of fuel additive is a mixture of 2/5 ton of material 1 and 3/5 of material 3. A ton of solvent base is a mixture of 1/2 ton of material 1, 1/5 ton of material 2, and 3/10 ton of material 3. After deducting relevant costs, the profit contribution is $40 for every ton of fuel additive produced and $30 for every ton of solvent base produced.

RMC's production is constrained by a limited availability of the three raw materials. For the current production period, RMC has available the following quantities of each raw material:

Raw Material	Amount Available for Production
Material 1	20 tons
Material 2	5 tons
Material 3	21 tons

Assuming that RMC is interested in maximizing the total profit contribution, answer the following:

a. What is the linear programming model for this problem?

b. Find the optimal solution using the graphical solution procedure. How many tons of each product should be produced, and what is the projected total profit contribution?

c. Is there any unused material? If so, how much?

d. Are any of the constraints redundant? If so, which ones?

Note: A redundant constraint is a constraint which, if removed, will result in no impact on the feasible region!

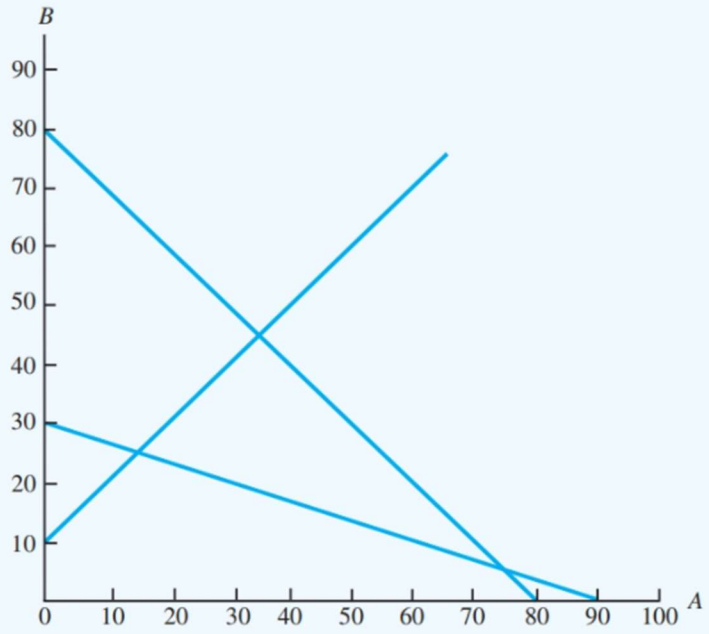
Problem 21 - Pages 64-65

21. Consider the following linear program:

$$\begin{aligned} \text{Max} \quad & 2A + 3B \\ \text{s.t.} \quad & \\ & 5A + 5B \leq 400 \quad \text{Constraint 1} \\ & -1A + 1B \leq 10 \quad \text{Constraint 2} \\ & 1A + 3B \geq 90 \quad \text{Constraint 3} \\ & A, B \geq 0 \end{aligned}$$

Figure 2.22 shows a graph of the constraint lines.

FIGURE 2.22 GRAPH OF THE CONSTRAINT LINES FOR EXERCISE 21



a. Place a number (1, 2, or 3) next to each constraint line to identify which constraint it represents.
b. Shade in the feasible region on the graph.
c. Identify the optimal extreme point. What is the optimal solution?
d. Which constraints are binding? Explain.
e. How much slack or surplus is associated with the nonbinding constraint?

Problem 31 - Pages 68-69

31. Consider the following linear program:

$$\begin{aligned} \text{Min} \quad & 3A + 4B \\ \text{s.t.} \quad & \\ & 1A + 3B \geq 6 \\ & 1A + 1B \geq 4 \\ & A, B \geq 0 \end{aligned}$$

Identify the feasible region and find the optimal solution using the graphical solution procedure. What is the value of the objective function?

Problem 36 - Pages 69-70

36. As part of a quality improvement initiative, Consolidated Electronics employees complete a three-day training program on teaming and a two-day training program on problem solving. The manager of quality improvement has requested that at least 8 training programs on teaming and at least 10 training programs on problem solving be offered during the next six months. In addition, senior-level management has specified that at least 25 training programs must be offered during this period. Consolidated Electronics uses a consultant to teach the training programs. During the next quarter, the consultant has 84 days of training time available. Each training program on teaming costs $10,000 and each training program on problem solving costs $8000.

a. Formulate a linear programming model that can be used to determine the number of training programs on teaming and the number of training programs on problem solving that should be offered in order to minimize total cost.

b. Graph the feasible region.

c. Determine the coordinates of each extreme point.

d. Solve for the minimum cost solution.