PROBLEMS

Group A

§4.5

1 Use the simplex algorithm to solve the Giapetto problem (Example 1 in Chapter 3).

2 Use the simplex algorithm to solve the following LP:

$$\begin{aligned} \max z &= 2x_1 + 3x_2 \\ \text{s.t.} \quad x_1 + 2x_2 &\le 6 \\ 2x_1 + x_2 &\le 8 \\ x_1, x_2 &\ge 0 \end{aligned}$$

3 Use the simplex algorithm to solve the following problem:

$$\begin{aligned} \max z &= 2x_1 - x_2 + x_3 \\ \text{s.t.} \quad 3x_1 + x_2 + x_3 &\le 60 \\ x_1 - x_2 + 2x_3 &\le 10 \\ x_1 + x_2 - x_3 &\le 20 \\ x_1, x_2, x_3 &\ge 0 \end{aligned}$$

§4.6

3 Use the simplex algorithm to find the optimal solution to the following LP:

$$\begin{aligned} \min z &= 2x_1 - 5x_2 \\ \text{s.t.} \quad 3x_1 + 8x_2 &\le 12 \\ 2x_1 + 3x_2 &\le 6 \\ x_1, x_2 &\ge 0 \end{aligned}$$

4 Use the simplex algorithm to find the optimal solution to the following LP:

$$\begin{aligned} \min z &= -3x_1 + 8x_2 \\ \text{s.t.} \quad 4x_1 + 2x_2 &\le 12 \\ 2x_1 + 3x_2 &\le 6 \\ x_1, x_2 &\ge 0 \end{aligned}$$

Group A

§4.11

1 Even if an LP's initial tableau is nondegenerate, later tableaus may exhibit degeneracy. Degenerate tableaus often occur in the tableau following a tie in the ratio test. To illustrate this, solve the following LP:

$$\begin{aligned} \max z &= 5x_1 + 3x_2 \\ \text{s.t.} \quad 4x_1 + 2x_2 &\le 12 \\ 4x_1 + x_2 &\le 10 \\ x_1 + x_2 &\le 4 \\ x_1, x_2 &\ge 0 \end{aligned}$$

Group A

§4.12

Use the Big M method to solve the following LPs:

1
$$\begin{aligned} \min z &= 4x_1 + 4x_2 + x_3 \\ \text{s.t.} \quad x_1 + x_2 + x_3 &\le 2 \\ 2x_1 + x_2 &\le 3 \\ 2x_1 + x_2 + 3x_3 &\ge 3 \\ x_1, x_2, x_3 &\ge 0 \end{aligned}$$

2
$$\begin{aligned} \min z &= 2x_1 + 3x_2 \\ \text{s.t.} \quad 2x_1 + x_2 &\ge 4 \\ x_1 - x_2 &\ge -1 \\ x_1, x_2 &\ge 0 \end{aligned}$$

3
$$\begin{aligned} \max z &= 3x_1 + x_2 \\ \text{s.t.} \quad x_1 + x_2 &\ge 3 \\ 2x_1 + x_2 &\le 4 \\ x_1 + x_2 &= 3 \\ x_1, x_2 &\ge 0 \end{aligned}$$

§4.14

PROBLEMS

Group A

1 Suppose that Mondo no longer must meet demands on time. For each quarter that demand for a motorcycle is unmet, a penalty or shortage cost of \$110 per motorcycle short is assessed. Thus, demand can now be backlogged. All demands must be met, however, by the end of quarter 4. Modify the formulation of the Mondo problem to allow for backlogged demand. (*Hint:* Unmet demand corresponds to $i_t \le 0$. Thus, i_t is now urs, and we must substitute $i_t = i_t' - i_t''$. Now i_t'' will be the amount of demand that is unmet at the end of quarter t.)

2 Use the simplex algorithm to solve the following LP:

$$\begin{aligned} \max z &= 2x_1 + x_2 \\ \text{s.t.} \quad 3x_1 + x_2 &\le 6 \\ x_1 + x_2 &\le 4 \\ x_1 \ge 0,\ x_2 &\text{ urs} \end{aligned}$$