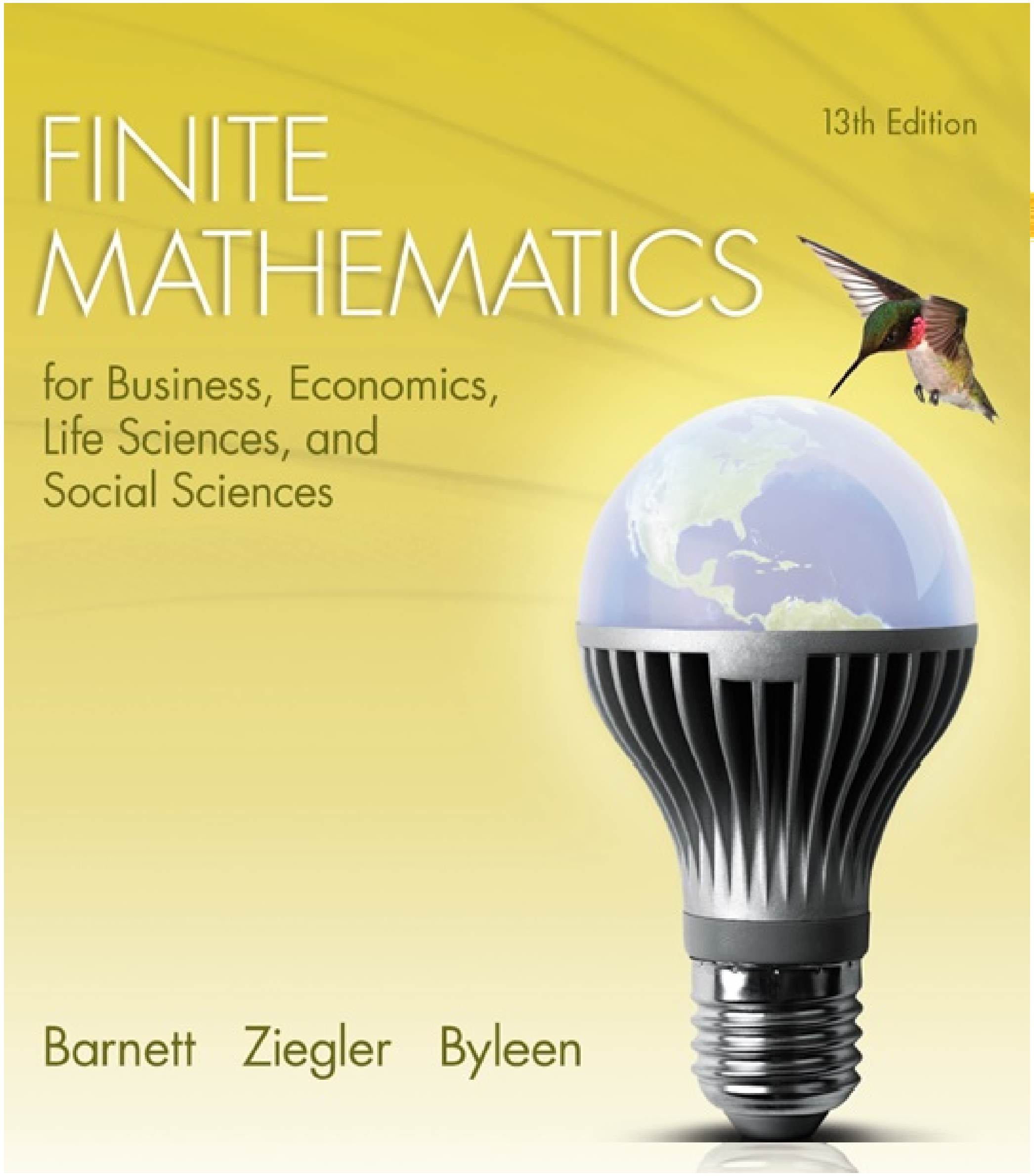

Chapter 6

Linear Programming: The Simplex Method

Section R

Review

Chapter 6 Review
Important Terms, Symbols, Concepts

- 6.1 A Geometric Introduction to the Simplex Method
  - A linear programming problem is said to be a **standard maximization problem in standard form** if its mathematical model is of the form

    Maximize the objective function

    $$P = c_1x_1 + c_2x_2 + \ldots + c_nx_n$$

    subject to problem constraints of the form

    $$a_1x_1 + a_2x_2 + \ldots + a_nx_n \leq b$$

    with nonnegative constraints $x_1, x_2, \ldots, x_n \geq 0$

Chapter 6 Review

- 6.1 A Geometric Introduction to the Simplex Method (continued)
  - A system of inequalities is converted to a system of equations by adding a **slack variable** to each inequality. Variables are divided into two groups: **basic** and **nonbasic**. Basic variables are selected arbitrarily, with the restriction that there are as many basic variables as there are equations.
  - A **basic solution** is found by setting the nonbasic variables equal to 0 and solving for the remaining basic variables.
  - A basic solution is **feasible** if it contains no negative values.

Chapter 6 Review

- 6.2 The Simplex Method: Maximization with Problem Constraints of the form $\leq$
  - Adding the objective function to the system of constraint equations produces the **initial system**.
  - Negative values of the objective function variable are permitted in a basic feasible solution, as long as all other variables are nonnegative.
  - The augmented coefficient matrix of the initial system is called the **initial simplex tableau**.

Chapter 6 Review

- 6.3 The Dual; Minimization with Problem Constraints of the form $\geq$
  - By the **Fundamental Principle of Duality**, a linear programming problem that asks for the minimum of the objective function over a region described by $\geq$ problem constraints can be solved by first forming the **dual problem** and then using the simplex method.

Chapter 6 Review

- 6.4 Maximization and Minimization with Mixed Problem Constraints
  - **The Big *M* method** can be used to find the maximum of any objective function on any feasible region.
  - The solution process involves the introduction of two new types of variables, **surplus variables** and **artificial variables**, and a modification of the objective function. The result is a **modified problem.**
  - The **preliminary simplex tableau** of the modified problem may need to be converted to an **initial simplex tableau** with a feasible solution.

Chapter 6 Review

- 6.4 Maximization and Minimization with Mixed Problem Constraints (continued)
  - Applying the simplex method to the modified problem produces a solution to the original problem, if one exists.
  - The dual method can be used to solve only **certain** minimization problems. But **all** minimization problems can be solved by using the Big *M* method to find the maximum of the negative of the objective function. The Big *M* method also lends itself to computer implementation.