Math 210 Finite Mathematics

Brian Veitch • Fall 2016 • Northern Illinois University

4.3 Non-standard Simplex Problems

Definition 1: RECAP

Standard Maximization

1. Objective function to be maximized
2. All variables are non-negative
3. Each linear constraint has the form

$$ax + by \leq c$$

Standard Minimization

1. Objective function to be minimized (coefficients are non-negative)
2. All variables are non-negative
3. Each linear constraint has the form

$$ax + by \geq c$$

Maximize $P = x + 3y$

$$\begin{aligned} 5x + 4y &\leq 32 \\ -x + 2y &\leq 10 \\ x \geq 0, y \geq 0 \end{aligned}$$

Minimize $P = 21x - 3y$

$$\begin{aligned} x + y &\leq 32 \\ -3x + 2y &\leq 20 \\ x + 3y &\geq 2 \\ x \geq 0, y \geq 0 \end{aligned}$$

Example 1

Minimize $C = 2x - 3y$

$$\begin{aligned} x + y &\leq 5 \\ x + 3y &\geq 9 \\ -2x + y &\leq 2 \\ x \geq 0, y \geq 0 \end{aligned}$$

Why is this non-standard?

.

Steps 1: Simplex Method for Non-Standard Problems

1. If neccessary, rewrite the problem as a max. Minimizing C is equivalent as maximizing $-C$
2. If necessary, rewrite all constraints using $\leq$ signs
3. Introduce slack variables and set up initial simplex table
4. Scan the column of constants for negative numbers
   (a) If there are no negatives, complete the table using the standard technique
   (b) If there are negatives, go to step 5
5. Do the following:
   (a) Pick any negative number in the row in which a negative number is in the column of constants
   (b) This is your pivot column
   (c) Compute positive ratios of constants over column entry. The smallest positive ratio is the pivot row
   (d) Pivot the table around the pivot element
   (e) Return to step 4

Example 2

$$\text{Minimize } C = 2x - 3y$$

$$\begin{aligned} x + y &\leq 5 \\ x + 3y &\geq 9 \\ -2x + y &\leq 2 \\ x \geq 0, y \geq 0 & \end{aligned}$$

.

.

Example 3

$$\text{Maximize } P = 8x + 3y$$

$$\begin{aligned} 2x + y &\leq 8 \\ -x + y &\geq 2 \\ x \geq 0, y \geq 0 \end{aligned}$$

.

.