



IE407 - Homework 3

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1 Simplex Method

1.1 Formulation

Decision Variables

s = Amount of **Sweet Corn** used in the mix (grams)

b = Amount of **Barbeque** used in the mix (grams)

Constraints

$s + b = 100$	Weight of the package
$b - s \leq 35$	Difference between sweet corn and barbeque
$s - b \leq 35$	Difference between sweet corn and barbeque
$1.5 \cdot s + 3.5 \cdot b \geq 250$	Protein
$4 \cdot s + 6 \cdot b \leq 550$	Calories
$s, b \geq 0$	Non-negativity

Objective Function

$$\text{Minimize Total Cost} = 0.5 \cdot s + 0.7 \cdot b$$

1.2 Solution

1.2.1 Convert to Standard Form

$$\begin{array}{rclclclclcl}
 z & -0.5 \cdot s & -0.7 \cdot b & & & & & & = & 0 \\
 & s & + b & + a_1 & & & & & = & 100 \\
 & b & - s & & + s_1 & & & & = & 35 \\
 & s & - b & & & + s_2 & & & = & 35 \\
 & 1.5 \cdot s & + 3.5 \cdot b & & & & - e_1 & + a_2 & = & 250 \\
 & 4 \cdot s & + 6 \cdot b & & & & & + s_3 & = & 550
 \end{array}$$

Where, $s, b, s_1, s_2, s_3, e_1, a_1, a_2$ are non-negative.

This is a system of equations with 6 equations and 9 variables.

1.2.2 Finding a Basic Feasible Solution

Two-phase method will be used to find a basic feasible solution.

Objective: Minimize $w' = a_1 + a_2$

$$\begin{array}{rclclclcl}
 w' & & & -a_1 & & -a_2 & = & 0 \\
 & s & +b & +a_1 & & & = & 100 \\
 & b & -s & & +s_1 & & = & 35 \\
 & s & -b & & & +s_2 & = & 35 \\
 1.5 \cdot s & +3.5 \cdot b & & & & -e_1 & +a_2 & = 250 \\
 4 \cdot s & +6 \cdot b & & & & & +s_3 & = 550
 \end{array}$$

Add row 1 and 4 to row 0 to get rid of a_1 and a_2 in row 0.

$$\begin{array}{rclclclcl}
 w' & +2.5 \cdot s & +4.5 \cdot b & & & -e_1 & = & 350 \\
 & s & +b & +a_1 & & & = & 100 \\
 & b & -s & & +s_1 & & = & 35 \\
 & s & -b & & & +s_2 & = & 35 \\
 1.5 \cdot s & +3.5 \cdot b & & & & -e_1 & +a_2 & = 250 \\
 4 \cdot s & +6 \cdot b & & & & & +s_3 & = 550
 \end{array}$$

2 Software Solution

3 Changing the Constraints

4 Finding the Shadow Price

5 Examining other Shadow Prices