Linear Programming Algorithms

Practical Exercises

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Exercise 1
If we express the linear program below, in standard from describe the various elements of this matrix formulation, respectively, n, m, A, b and c? Provide two feasible solutions to this problem and indicate the value of the objective function for each one.

Objective function:

$$\max\ 2x_1 - 3x_2 + 3x_3$$

subject to:

$$\begin{array}{rrrcr} x_1 & x_2 & -x_3 & \leq & 7 \\ -x_1 & -x_2 & +x_3 & \leq & -7 \\ -x_1 & -2x_2 & +2x_3 & \leq & 4 \end{array}$$

and

$$x_1, x_2, x_3 \geq 0$$

Exercise 2
Convert the LP formulation in Exercise 1 in Slack Form and derive N, B, A, b, c and v.

Exercise 3
Show that the following linear program is infeasible.

$$\max\ 3x_1 - 2x_2$$

subject to:

$$\begin{array}{rrcr} x_1 & +x_2 & \leq & 2 \\ -2x_1 & -2x_2 & \leq & -10 \end{array}$$

$$x_1, x_2 \geq 0$$

Exercise 4
Solve the following linear program using the Simplex algorithm:

$$\max\ 18x_1 + 12.5x_2$$

subject to:

$$\begin{aligned} x_1 + x_2 &\leq 20 \\ x_1 &\leq 12 \\ x_2 &\leq 16 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Exercise 5
Solve the following linear program using the SIMPLEX algorithm:

$$\max -5x_1 - 3x_2$$

subject to:

$$\begin{aligned} x_1 - x_2 &\leq 1 \\ 2x_1 + x_2 &\leq 2 \\ x_1, x_2 &\geq 0 \end{aligned}$$