ADS Tutorial 6

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Problem 1

Solve the following linear program using the simplex method.

$$\begin{aligned} \text{maximise} \quad & 6x_1 + 6x_2 + 5x_3 + 9x_4 \\ \text{subject to} \quad & 2x_1 + x_2 + x_3 + 3x_4 \leq 5 \\ & x_1 + 3x_2 + x_3 + 2x_4 \leq 3 \\ & x_1, x_2, x_3, x_4 \geq 0 \end{aligned}$$

Show each dictionary and each basic feasible solution produced during the execution of the algorithm. Explain which variable is the entering variable and which one is the leaving variable and why.

Problem 2

Consider the following linear program.

$$\begin{aligned} \text{maximise} \quad & 2x_1 + x_2 \\ \text{subject to} \quad & 2x_1 + x_2 \leq 4 \\ & 2x_1 + 3x_2 \leq 3 \\ & 4x_1 + x_2 \leq 5 \\ & x_1 + 5x_2 \leq 1 \\ & x_1, x_2 \geq 0 \end{aligned}$$

A. Solve the LP above using the simplex method. Show each dictionary and each basic feasible solution produced during the execution of the algorithm. Explain which variable is the entering variable and which one is the leaving variable and why.

B. Solve the LP above by drawing the feasible region in two dimensions and checking the objective function value on each of its vertices.

Problem 3

Solve the following linear program using the simplex method.

$$\begin{aligned} \text{maximise} \quad & 2x_1 - 6x_2 \\ \text{subject to} \quad & -x_1 - x_2 - x_3 \leq -2 \\ & 2x_1 - x_2 + x_3 \leq 1 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

Show each dictionary and each basic feasible solution produced during the execution of the algorithm. Explain which variable is the entering variable and which one is the leaving variable and why.

Note: *If you are interested in practising more with the simplex method, you can solve the rest of the exercises from Chapter 2 in Vanderbei.*