Let's go exercises with the Simplex Method

Solve the following LP problems with the Simplex Method

$$\begin{array}{l}\max\ 5x_1+6x_2+9x_3+8x_4\\ \left\{\begin{array}{rrrrcl} x_1+ & 2x_2+ & 3x_3+ & x_4 & \leq & 5\\ x_1+ & x_2+ & 2x_3+ & 3x_4 & \leq & 3\\ x_1,x_2,x_3,x_4\geq 0 & & & & & \end{array}\right.\end{array}$$

Taken from Chapter 2 of the book "Linear Programming" of V. Chvátal.

$$\begin{array}{l}\max\ 2x_1+x_2\\ \left\{\begin{array}{rrcl} 2x_1+ & 3x_2 & \leq & 3\\ x_1+ & 5x_2 & \leq & 1\\ 2x_1+ & x_2 & \leq & 4\\ 4x_1+ & x_2 & \leq & 5\\ x_1,x_2\geq 0 & & & \end{array}\right.\end{array}$$

Taken from Chapter 2 of the book "Linear Programming" of V. Chvátal.

Understanding the set of all optimal solutions with the Simplex Method

Given the following LP problem, employ the Simplex Method to produce a description of the set of all optimal solutions.

$$\begin{array}{l}\max\ 2x_1+3x_2+5x_3+4x_4\\ \left\{\begin{array}{rrrrcl} x_1+ & 2x_2+ & 3x_3+ & x_4 & \leq & 5\\ x_1+ & x_2+ & 2x_3+ & 3x_4 & \leq & 3\\ x_1,x_2,x_3,x_4\geq 0 & & & & & \end{array}\right.\end{array}$$

Taken from Chapter 2 of the book "Linear Programming" of V. Chvátal.

How to obtain an initial feasible solution

Solve the following LP problems introducing first the respective auxiliary problems and employing the Two Phases Simplex Method.

$$\begin{array}{l}\max\ 3x_1+x_2\\ \left\{\begin{array}{rrcl} x_1- & x_2 & \leq & -1\\ -x_1- & x_2 & \leq & -3\\ 2x_1+ & x_2 & \leq & 4\\ x_1,x_2\geq 0 & & & \end{array}\right.\end{array}$$

$$\max\ 3x_1 + x_2$$
$$\begin{cases} x_1 - x_2 \leq -1 \\ -x_1 - x_2 \leq -3 \\ 2x_1 + x_2 \leq 2 \\ x_1, x_2 \geq 0 \end{cases}$$

$$\max\ 3x_1 + x_2$$
$$\begin{cases} x_1 - x_2 \leq -1 \\ -x_1 - x_2 \leq -3 \\ 2x_1 - x_2 \leq 2 \\ x_1, x_2 \geq 0 \end{cases}$$

Taken from Chapter 3 of the book "Linear Programming" of V. Chvátal.

Have fun!