Linear programming using simplex.jar

The aim of this lab session is to introduce the student to the computer application called: simplex.jar. The application executes an implementation of the simplex algorithm to solve linear models. When the model has two variables the graphical solution is also available. Thus, the student can compute the solutions algebraically (in the tableaux) and identify them in the graphical solution. It is interesting to analyze the whole solution process, by computing an initial solution and studying the improvement until the optimal solution is found.

Besides the graphical and algebraic solution, the application also gives the possibility to study theoretical concepts, because the simplex algorithm is available and the computations performed at each iteration of the algorithm are explained. The user interface was developed in two languages: Spanish and Basque, and can be downloaded from:

http://www.sc.ehu.es/ccwikera/soft/simplex.jar

1. Consider the following linear model:

$$\begin{aligned} \max \ z = x_1 + x_2 \\ \text{subject to} \quad\quad \\ 2x_1 - x_2 \geq -6 \\ x_1 - 3x_2 \leq 6 \\ x_1 + 2x_2 \leq 16 \\ x_1, x_2 \geq 0 \end{aligned}$$

   Use the application simplex.jar to answer the following questions:

   1.1 Look at the graphical solution. Compute the extreme points of the feasible region, and identify the optimal extreme point. Compute the optimal objective value.

   1.2 Look at the simplex tableaux. Extract from the tableaux the basic feasible solutions ($\mathbf{x}_B \geq \mathbf{0}$) corresponding to each basis, and find the optimal basic solution and the optimal objective value.

   1.3 For each basic feasible solution extracted from the tableaux, identify its corresponding extreme point in the graphical representation, and show the progress of the algorithm.

2. Consider the following linear model:

$$\begin{aligned} \max \ z = 3x_1 + 5x_2 \\ \text{subject to} \\ 5x_1 + 3x_2 \leq 15 \\ 3x_1 + 5x_2 \leq 15 \\ x_1 - x_2 \leq 2 \\ 2x_1 + x_2 \geq 1 \\ x_1, x_2 \geq 0 \end{aligned}$$

Use the application simplex.jar to answer the following questions:

2.1 Look at the graphical solution. Compute the extreme points of the feasible region, and identify the optimal extreme point. Compute the optimal objective value.

2.2 Look at the simplex tableaux. Extract from the tableaux the basic feasible solutions ($\mathbf{x}_B \geq \mathbf{0}$) corresponding to each basis, and find the optimal basic solution and the optimal objective value.

2.3 For each basic feasible solution extracted from the tableaux, identify its corresponding extreme point in the graphical representation, and show the progress of the algorithm.