

Assignment 6:

Installation

1. Open a command prompt in the folder, and type 'pip install -r requirements.txt' to make sure that all the dependencies are installed.
2. Download GLPK from <http://sourceforge.net/projects/winglpk/files/latest/download>
3. Unzip it into (for example) : C:\glpk_is_here\
4. Add GLPK binaries to your system path before running python C:\>set
PATH=%PATH%;C:\glpk_is_here\glpk-4.55\w64 (Depends on system architecture)
5. To run the file, on a command prompt type 'python lp_solve.py'

Explanation

1. **Write the LP relaxation (P1) of (IP) and explain why the objective value of an optimal solution to (P1) is an upper bound on the value of an optimal solution to (IP)**

The LP relaxation is obtained by dropping the integrality constraint:

Maximize: $3x_1 - x_2 + 2x_3$

Subject to: $x_1 - x_2 + x_3 \leq 5$

$$2x_2 + x_3 \leq 4$$

$$x_1 \leq 3$$

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

As this increases the region of feasible solutions and we are dealing with a maximization problem, the value of an optimal solution to (P1) is an upper bound on the value of an optimal solution to (IP).

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The Value of x1 is:
x1 = 3.0
The Value of x2 is:
x2 = 0.666667
The Value of x3 is:
x3 = 2.66667
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2. Convert the problem (P1) to equational form by adding slack variables x_4, x_5, x_6 corresponding to the three in-equalities in the order from top to bottom. Next write the first simplex tableau with x_4, x_5, x_6 as the basic solution

Maximize: $3x_1 - x_2 + 2x_3$

Subject to: $x_1 - x_2 + x_3 + x_4 = 5$

$$2x_2 + x_3 + x_5 = 4$$

$$x_1 + x_6 = 3$$

$$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$$

The first simplex tableau with x_4, x_5, x_6 as basic solution is given by

$$x_4 = 5 - x_1 + x_2 - x_3$$

$$x_5 = 4 - 2x_2 - x_3$$

$$x_6 = 3 - x_1$$

$$z = 0 + 3x_1 - x_2 + 2x_3$$