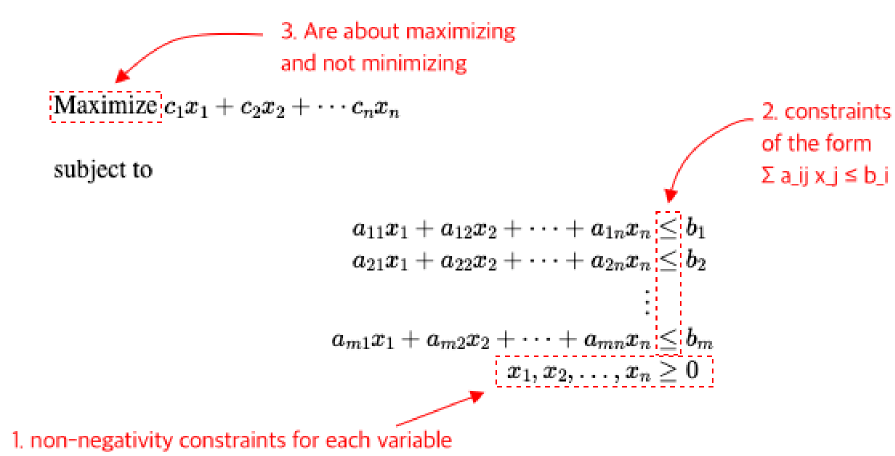
CSC373 Worksheet 6 Solution

August 12, 2020

1. **Notes:**

- **Linear Programming**
  - Is a method to achieve the best outcome (such as maximum profit or lowest cost) in a mathematical model whose requirements are represented by linear relationships. [1]
  - Is named to make it sound cool for government funding
    - Like dynamic programming
  - Applications
    - Microeconomics (maximize profits, minimize costs)
    - Company management
- **Standard Form**
  - Is a form of linear programming
  - Are about maximizing, not minimizing [2]
  - All have a positivity constraint for each variable [2]
  - All other constraints are all of the form "linear combination of variables $\leq$ constant". [2]



- **Converting Linear Programming to Standard Form**
  1) The objective function might be a minimization rather than a maximization
     - Negate coefficients of the objective function

$$\begin{array}{llcrcl} \boxed{\text{minimize} \quad -2x_1 + 3x_2} & & & & & \\ \text{subject to} & & & & & \\ & x_1 & + & x_2 & = & 7 \\ & x_1 & - & 2x_2 & \leq & 4 \\ & x_1 & & & \geq & 0 \end{array} \xrightarrow{\text{multiply by -1}} \begin{array}{llcrcl} \boxed{\text{maximize} \quad 2x_1 - 3x_2} & & & & & \\ \text{subject to} & & & & & \\ & x_1 & + & x_2 & = & 7 \\ & x_1 & - & 2x_2 & \leq & 4 \\ & x_1 & & & \geq & 0 \end{array}$$

  2) There might be variables without nonnegativity constraints
  3) There might be **equality constraints**, which have an equal sign rather than a less-than-or-equal-to sign
  4) There might be **inequality constraints**, but instead of having a less-than-or-equal-to-sign

  Example:

References:

1) Wikipedia, Linear Programming, link
2) Instituto de Mathematicas, Standard form for Linear Programs, link