Homework 1, Due: September 15, 2009

Problem 1: Use the enumeration method to solve the following linear program

$$\begin{array}{lll} \max & x_1 + 2x_2 & \\ \text{s.t.} & x_1 + 3x_2 & \leq 12 \\ & x_1 - x_2 & \leq 3 \\ & x_1 \geq 0, \quad x_2 \geq 0. & \end{array}$$

Problem 2: Transform the following general linear program to (1) standard form and (2) canonical form, with effort to reduce the size of the resulting problems:

$$\begin{array}{lll} \max & 3x_1 - 4x_2 - x_3 + 6 & \\ \text{s.t.} & x_1 + x_2 + x_3 & = 0 \\ & x_1 - 2x_2 - x_3 & \geq 4 \\ & x_3 \geq -3 & \\ & x_1 + x_2 - x_3 & = 5 \end{array}$$

Problem 3:(Problem 1.12 in Textbook) Consider a set P described by linear inequality constraints, that is

$$P = \{x \ : a_i^T x \leq b_i, \ i = 1, \cdots, m\}.$$

A ball with center y and radius r is the set of all points within Euclidean distance r from y. Formulate a linear program which can find the largest ball entirely contained in the set P. Hint: Consider those points $y + r\frac{a_i}{\|a_i\|}$.