IE 534 Linear Programming Homework 2

Date assigned: Friday 8/29/2008
Due date: Monday 9/8/2008 in class. Late homework will not be accepted.

1. Reformulate the following problem in standard form. Solve the original problem using GLPK and solve the standard form problem using MATLAB. Submit your the GLPK and MATLAB codes, and show that the two optimal solutions are the same.

$$\begin{array}{lll} \min & \zeta = -x_1 + 4x_2 + 3x_3 - 7x_4 & \\ \text{s.t.} & 2x_1 + 3x_2 + x_3 - x_4 & \leq 30 \\ & 4x_1 + x_2 + 3x_4 & \geq 20 \\ & 3x_1 - 4x_2 + 2x_3 + x_4 & = 8 \\ & 0 \leq x_1 \leq 1, x_2 \leq 7, x_3 \geq 9, x_4 \text{ free.} & \end{array}$$

2. Solve the following mixed integer program using GLPK and GLPKMEX. Submit your GLPK and MATLAB codes.

$$\begin{array}{lll} \max & \zeta = 7x_1 - 3x_2 + 9x_3 + 2x_4 & \\ \text{s.t.} & 3x_1 + x_2 - x_3 & \leq 23 \\ & x_3 + 7x_4 & \leq 11 \\ & x_1 + 4x_2 - x_3 & \geq -7 \\ & -x_2 + 9x_4 & \geq 3 \\ & x_1 \in \{3, 4, ..., 8, 9\}, x_2 \in \{0, 1\}, 0 \leq x_3 \leq 5, x_4 \geq 1. & \end{array}$$

3. Read the MATLAB help of `bintprog` and `quadprog` and solve the following mathematical programs using the two functions.

   (a)

$$\begin{array}{lll} \max & \zeta = 2x_1 - x_2 + 4x_3 & \\ \text{s.t.} & x_1 + x_2 + x_3 + x_4 & = 2 \\ & x_2 - x_3 & \geq 0 \\ & x_3 + x_4 & \leq 1 \\ & x_1, x_2, x_3, x_4 \in \{0, 1\}. & \end{array}$$

   (b)

$$\begin{array}{lll} \max & \zeta = -6x_1 + 2x_2 + 7x_3 + 3x_1^2 + 6x_2^2 + 5x_3^2 + 4x_1x_3 & \\ \text{s.t.} & 6x_1 + x_2 + 4x_3 & \leq 7 \\ & 3x_2 + 5x_3 & \leq 9 \\ & x_1, x_2 \geq 0; x_3 \geq 1. & \end{array}$$