Operations Research, Spring 2015
Pre-lecture Problems for Lecture 4

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Note. The deadline of submitting the pre-lecture problem is ***9:10am, March 19, 2015***. Please submit a hard copy of your work in class. Late submissions will not be accepted. Each student must submit her/his individual work. Submit ONLY the problem that counts for grades.

1. (0 point) Consider the following LP

$$\begin{aligned} \max \quad & 5x_1 + 3x_2 \\ \text{s.t.} \quad & x_1 - 4x_2 \leq 4 \\ & x_2 \leq 8 \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

   Let's use the simplex method to solve this LP.

   (a) In the first iteration, enter x_1 to show that this LP is unbounded.

   (b) In the first iteration, enter x_2. Eventually show that this LP is unbounded.

   (c) Visualize the search routes of the two above solution processes.

2. (0 point) Consider the following LP

$$\begin{aligned} \max \quad & 5x_1 + 3x_2 \\ \text{s.t.} \quad & x_1 + x_2 \leq 16 \\ & x_1 + 4x_2 \leq 20 \\ & x_2 \geq 8 \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

   (a) Find its standard form.

   (b) Find its phase-I LP.

   (c) Use the simplex method to solve the phase-I LP. Show that the original LP is infeasible.

3. (10 points) Consider the following LP

$$\begin{aligned} \max \quad & 5x_1 + 3x_2 \\ \text{s.t.} \quad & x_1 + x_2 \geq 16 \\ & x_1 + 4x_2 = 20 \\ & x_2 \leq 8 \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

   (a) (5 points) Find its phase-I LP. Use the simplex method with the smallest index rule to solve the phase-I LP. Stop when you find an initial bfs.

   (b) (5 points) Construct the phase-II LP. Use the simplex method with the smallest index rule to solve the phase-II LP. Stop when you find an optimal solution or conclude that the original LP is unbounded.