Math 482 **HW3** Name: ______________________

Due Friday, September 16, 2016

Students in sections D13 and E13 (three credit hours) should solve any four of the following five problems. Students in sections D14 and E14 (four credit hours) must solve all five problems.

1. We say that here is a *tie* when selecting the pivot row if, supposing x_s is the pivot column, there is more than one row $r \in [m]$ such that $a_{r,s} > 0$ and

$$\frac{a_{r,0}}{a_{r,s}} \leq \frac{a_{i,0}}{a_{i,s}} \text{ for all } i \in [m] \text{ such that } a_{i,s} > 0.$$

   Prove that if there is a tie when selecting the pivot row, then the basic feasible solution corresponding to the next tableau is degenerate.

2. Solve the LP in Example 2.7 (pages 51–52) of the book (this example is also in a handout) using Bland's anticycling algorithm (see section 2.7). (You do not need to write down the steps that are the same in as the book.)

3. Use the first phase of the two-phase simplex method to show that the following linear program is infeasible.

$$\text{Minimize } z = 3x_1 + x_2 + 2x_3$$

   subject to

$$\begin{cases} x_1 + 3x_2 + 5x_3 - x_4 &= 10, \\ 2x_1 - x_2 - 9x_3 - x_4 &= 1, \\ 4x_1 + 5x_2 + x_3 + x_4 &= 7, \\ x_1, \ldots, x_4 &\geq 0. \end{cases}$$

4. Suppose that you are solving an LP in standard form with 5 variables $x_1, \ldots, x_5$ and 2 constraints and the following objective function

$$\min z = x_1 + 7x_2 + 5x_3 + x_4 + 6x_5.$$

   You add two artificial variables y_1 and y_2 and after the first phase of the two-phase simplex method you have the following tableau

		x_1	x_2	x_3	x_4	x_5	y_1	y_2
$-\xi$	0	0	0	8	13	14	4	0
x_1	10	1	2	2	4	5	1	0
y_2	0	0	0	-8	-13	-14	-3	1

   Drive the artificial variable out of the basis and then solve the original linear program by doing phase two of the simplex method.

5. Introduce 3 artificial variables and solve with two-phase simplex algorithm the LP represented by the tableau below.

		x_1	x_2	x_3	x_4	x_5
-z	0	4	8	14	2	10
	14	2	2	4	2	4
	12	2	4	6	2	2
	8	2	2	2	4	2