Math 482 **HW8** Section: __________ Name: ______________________________

Due Friday, April 8, 2016

Students in section E13 (three credit hours) need to solve any four of the following five problems. Students in section E14 (four credit hours) must solve all five problems.

1. Use the two-phase revised simplex method to solve the problem (use Bland's pivot rule).

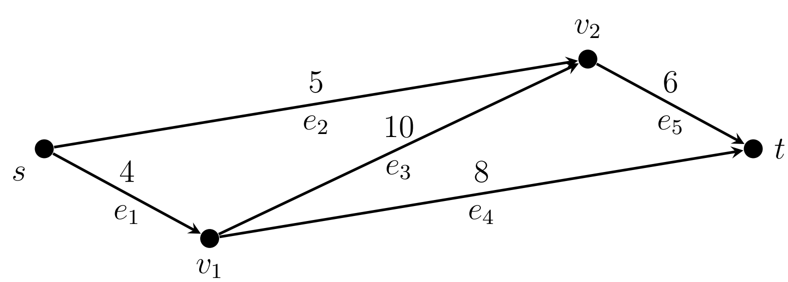
$$\text{Minimize } z = 3x_1 + x_2 + 2x_3$$

subject to

$$\begin{cases} x_1 + 3x_2 + 5x_3 - x_4 &= 10, \\ 2x_1 - x_2 - 9x_3 - x_5 &= 1, \\ 4x_1 + 5x_2 + x_3 + x_6 &= 7, \\ x_1, \ldots, x_6 &\geq 0. \end{cases}$$

   Now, what can you say about the dual problem?

2. Starting with the CARRY matrix provided, use the revised simplex method to find a maximal flow in the network below.



$-z$	6	0	0	0	0	1
f_1	4	1	0	0	0	0
s_2	3	1	1	0	0	-1
s_3	6	-1	0	1	0	0
s_4	8	0	0	0	1	0
f_2	2	-1	0	0	0	1

   Let f_1 corresponds to the (s,t)-path sv_1v_2t, f_2 corresponds to the (s,t)-path sv_2t, f_3 correspond to the (s,t)-path sv_1t, and $s_1, \ldots, s_5$ are the slack variables added to the constraints corresponding to edges $e_1, \ldots, e_5$, respectively.

   Use must make it clear that you are solving an auxiliary shortest path problems to find the pivot columns.

3. Suppose there are n men and n women and m marriage brokers (labeled $c_1, \ldots, c_m$). Each broker has a list of men and women as clients and can arrange marriages between any pairs of men and women on the list. In addition, we restrict the number of marriages that broker i can arrange to a maximum of b_i. Each man can be married to at most one women and each women can be married to at most one man. Translate the problem of finding a solution with the most marriages into one of finding the maximum flow in a flow network. (You can assume that if the capacities on the edges are all integers, than there exists a maximum flow in which the flow on every edge is an integer.)

4. THIS PROBLEM IS COUNTED AS TWO PROBLEMS. TO EARN ONE PROBLEM CREDIT, IT IS ENOUGH TO PERFORM ONE ITERATIONS CORRECTLY, I.E. YOU MUST USE THE PRIMAL-DUAL METHOD TO FIND AN UPDATED π^T AND COMPUTE J RELATIVE TO THIS UPDATED π^T.

   Starting from the dually feasible vector $\pi^T = (0, 1/3, 0)$, use the primal-dual simplex method to find an optimal solution to the problem

$$\text{Minimize } z = 4x_1 + x_2 + 3x_3 + x_4$$

subject to

$$\begin{array}{ccccccc} x_1 & +x_2 & +x_3 & & = & 3, \\ x_1 & & +x_3 & +3x_4 & = & 2, \\ & x_2 & +x_3 & +x_4 & = & 2, \\ x_1, & x_2, & x_3, & x_4 & \geq & 0. \end{array}$$