C&O 350 Assignment 2, due Thursday, October 12, 1995

1. Solve the following LP using the simplex method, and then find a second optimal solution. Do not submit a computer printout.

$$\begin{aligned} \text{maximize } x_1 + \ & 5x_2 + 5x_3 + 5x_4 \\ & \text{subject to} \\ x_1 + \ & 4x_2 + 3x_3 + 3x_4 \le 17 \\ & x_2 + x_3 + x_4 \le 4 \\ x_1 + \ & 2x_2 + 2x_3 + 3x_4 \le 10 \\ & x_1, \ldots, x_4 \ge 0. \end{aligned}$$

2. Use LPmovie to exhibit cycling in the simplex method beginning with this dictionary, and submit a computer printout.

$$\begin{aligned} x_5 &= 2x_1 + 9x_2 + x_3 - 9x_4 \\ x_6 &= -\tfrac{1}{3}x_1 - x_2 + \tfrac{1}{3}x_3 + 2x_4 \\ z &= 2x_1 + 3x_2 - x_3 - 12x_4 \end{aligned}$$

3. Arrange the following vectors in lexicographical order from smallest to largest:

$(3,-1,0,0)$, $(3,0,0,0)$, $(2,10,0,0)$, $(3,-4,1,0)$, $(0,0,1,3)$, $(3,4,0,3)$, $(3,-4,1,1)$

4. Solve the problem of 2 using the smallest-subscript rule.

5. Prove that the variable that becomes non-basic on one iteration of the simplex method cannot become basic on the next iteration. Show that the variable that becomes basic on one iteration of the simplex method *can* become non-basic on the next iteration.

6. Construct a feasible dictionary whose basic feasible solution is optimal, but having $\bar{c}_j > 0$ for some j.

7. Chvátal 3.9(b). Do not submit a computer printout.