C&O 350 Assignment 4, Due Thursday March 7, 1996

1. For each of the following problems, write the dual problem, and use the final tableau of the primal problem to obtain optimal solutions to both problems. Check that the optimal primal and dual values are equal.

   (a) Problem 1 from Assignment 2.

   (b) Problem 1(a) from Assignment 3. (First convert to standard inequality form.)

   (c) Problem 1 from the midterm.

2. Does the dual problem of 1(c) above have more than one optimal solution? Explain. What property of the primal problem is this related to?

3. Consider the l.p. problem (P) below:

$$\begin{array}{rrrrrcl} \text{maximize} & -2x_1 & +5x_2 & +5x_3 & +4x_4 & & \\ \text{subject to} & & & & & & \\ & x_1 & +3x_2 & -x_3 & +x_4 & \leq & 3 \\ & -x_1 & +x_2 & +2x_3 & +x_4 & \leq & 4 \\ & x_1 & +x_2 & +x_3 & -x_4 & \leq & 1 \\ & x_1, & x_2, & x_3, & x_4 & \geq & 0 \end{array}$$

   For each of the following, use complementary slackness to determine whether it is an optimal solution of (P):

   (a) $x = (1, 1, 1, 0)^t$;

   (b) $x = (0, 1, 1, 1)^t$;

   (c) $x = (2, 0, 0, 1)^t$;

   (d) $x = (1, 0, 1, 3)^t$.

4. For the l.p. of Problem 1(b) of Assignment 3, write the dual problem, and use the optimal basis to find an optimal solution of the dual problem.

5. Chvátal problem 5.2. (Use duality.)

6. Chvátal problem 9.1.