COMP566 Discrete Optimization - I
Homework 2 Due: Thursday, October 9 2003

Page numbers refer to Linear Programming, V. Chvátal

1. Solve the following problem by the two phase simplex method with Dantzig's pivoting rule (largest coefficient for entering variable).

$$\max x_1 - 4x_2 - x_3 - 2x_4 + 3x_5$$

$$x_1 + x_2 + x_3 - x_4 + 2x_5 \le 6$$

$$x_1 - 2x_2 - x_3 - x_4 - x_5 \le -9$$

$$x_i \ge 0, \quad i = 1, \ldots, 5$$

Give: initial dictionary for phase I, a list of pivots (leaving and entering variables), final dictionary for phase I, a list of pivots, final dictionary for phase II.
Read off the dual variables from the final dictionary and verify the duality theorem.

2. For ex 1.6, P.11
(a) Formulate the primal and give the optimum primal solution
(b) Formulate the dual and give the optimum dual solution.
(c) Verify the Duality Theorem, and Complementary Slackness conditions (Theorems 5.1, 5.2, and 5.3).
(d) Give an economic interpretation of the dual variables and the complementary slackness conditions for this problem.

3. Refer to Theorem 5.3, p. 63. Find an example of a linear program with the properties:
(a) System (5.22) does not have a unique solution $y_1*, \cdots, y_m*$;
(b) At least one of the solutions $y_1*, \cdots, y_m*$ satisfies (5.23) and at least one does not.

Hint: See Theorem 5.4.