

Homework #8
Engineering Optimization (ISyE 4231) - Spring 2001
Due March 30, 2001

Show all your steps to get full credit.

Reading assignment: Read Chapters 5 and 6.

1. (10 points) Answer questions 3 and 4 of the case.
2. Consider the following linear program.

$$\begin{array}{ll} \text{Max} & x_1 + x_2 \\ \text{S.t.} & -x_1 + x_2 \geq 2 \\ & 2x_1 - x_2 \leq 6 \\ & x_1, x_2 \geq 0 \end{array}$$

- (a) (5 points) Show graphically that the model is unbounded.
- (b) (10 points) Place the model in standard form and apply the simplex algorithm finding an improving feasible direction at each iteration (do not use the tableau form). At your final iteration, explain how you conclude that the model is unbounded.

3. Consider the linear program

$$\begin{array}{ll} \text{Max} & x_1 + 4x_2 \\ \text{S.t.} & x_1 - 3x_2 \geq 6 \\ & x_1 + x_2 \leq 4 \\ & x_2 \geq 2 \\ & x_1, x_2 \geq 0 \end{array}$$

- (a) (5 points) Show graphically that this model is infeasible.
- (b) (2 points) Add slacks and artificial variables to create a Phase I model in standard form.
- (c) (8 points) Using the tableau format, apply the simplex algorithm to the Phase I model and show that the original problem is infeasible.

4. Consider the linear program in the figure below.

- (a) (3 points) Mark the basic feasible solutions using letters A, B, Identify all basic feasible solutions that are degenerate.
- (b) (7 points) Remember that in case of degeneracy, more than one basis corresponds to the same basic solution (or extreme point). Associate a slack variable s_j for each constraint $j, j=1, \dots, 6$. For one of the degenerate basic solutions, write all the bases that define that solution and for each basis indicate the basic variables which have value zero.

