CS525 Linear Programming

Open-Book Final Exam
Sunday, May 9, 1993
12:25 p.m., 3335 Sterling Hall

Note: No problem takes more than 4 tableaus to solve.

1. (10 points)

$$\begin{array}{ll} \text{maximize} & -\frac{x_1^2}{2} + x_1x_2 - \frac{x_2^2}{2} - 4x_1 + x_2 \\ \text{subject to} & \begin{array}{ccccc} x_1 & + & x_2 & \geq & 2 \\ x_1 & , & x_2 & \geq & 0 \end{array} \end{array}$$

   What is the maximum value and where is it attained?

2. (10 points) Solve the following parametric linear program for all values of t and give a summary table of your results.

$$\begin{array}{ll} \text{maximize} & (2-t)x_1 - 4x_2 \\ \text{subject to} & \begin{array}{ccccc} x_1 & - & x_2 & \leq & 1 \\ x_1 & & & \leq & 2 \\ x_1 & , & x_2 & \geq & 0 \end{array} \end{array}$$

3. (20 points) For each claim below, state first whether it is **true** or **false**. Then in no more than two sentences or a simple one- or two-line counterexample (for the false case), justify your answer. An unjustified "True" or "False" answer gets no credit.

   (a) If a primal LP is infeasible then the dual LP is also infeasible.

   (b) A solvable quadratic program must have a vertex solution.

   (c) The problem $\min_x \|Ax - b\|_\infty$ s.t. $x \geq 0$ always has a solution where A is any $m \times n$ matrix.

   (d) Let $A = -A'$, then the linear program:

$$\max\ -bx \quad \text{s.t. } Ax \leq b,\ x \geq 0$$

   is solvable if it is feasible.