CS525 Open-Book Final Exam

Thursday May 18, 2000
5:05 p.m., 1240 Computer Sciences & Statistics

Answer all questions: 1, 2, 3 & 4. If any question is missing from your sheets, inform the instructor.

Exam can be solved by a total of 6 pivots only.

"Solving" a problem means either finding a solution or determining that no solution exists. In the latter case a justification is needed.

Last Name (Print): ____________________

First Name: ______________________

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Do not write anything on this page.

Grades

1. **Question 1:**__________
2. **Question 2:**__________
3. **Question 3:**__________
4. **Question 4:**__________
5. **Total:**_____________

1. (10 points)

$$
\begin{array}{ll}
\text{minimize} & \frac{1}{2}x_1^2 + x_1x_2 + \frac{1}{2}x_2^2 + x_1 - x_2 \\
\text{subject to} & \begin{array}{rcrcr} x_1 & + & x_2 & \geq & -2 \\ -2x_1 & + & x_2 & \geq & -1 \\ x_1 & , & x_2 & \geq & 0 \end{array}
\end{array}
$$

Answer: $x_1 =$ $x_2 =$ Minimum=

Problem 1 Sheet

2. (10 points) Solve: $\min\limits_{x \geq 0} \|Ax - b\|_\infty$ for the system $Ax = b$:

$$\begin{array}{rcrcl} x_1 & + & x_2 & = & 1 \\ x_1 & - & 2x_2 & = & 6 \end{array}$$

Note that $x \geq 0$.

Answer: $\boxed{x_1 = \qquad x_2 = \qquad \text{Minimum=} \qquad\qquad\qquad}$

Problem 2 Sheet

3. (10 points) Solve for all values of the parameter t in the interval $(-\infty, \infty)$. Fill in the summary table below.

$$\begin{array}{ll} \text{minimize} & x_1 + t(-x_1 - x_2) \\ & \begin{array}{rcrcr} x_1 & - & x_2 & \geq & -2 \\ -2x_1 & + & x_2 & \geq & -4 \\ x_1 & , & x_2 & \geq & 0 \end{array} \end{array}$$

subject to

Paremeter t Range	Minimum Value $z(t)$	Solution $x_1,\ x_2$

Problem 3 Sheet

4. Suppose that x and (x, u) solve the dual quadratic programs:

$$\min_{x} \frac{1}{2}x'Qx + p'x \quad \text{s.t.} \quad Ax \geq b,\ x \geq 0,$$

$$\max_{(x,u)} -\frac{1}{2}x'Qx + b'u \quad \text{s.t.} \quad Qx - A'u + p \geq 0,\ u \geq 0,$$

where Q is symmetric positive semidefinite.

(a) Can $p'x > b'u$? Give a "Yes" or "No" answer and justify in a couple of lines.

(b) Give the **most general** condition (a single equation in x!) that ensures that $p'x = b'u$. Justify.

Answer(a): **Yes:**... **No:**...

Answer(b): **p′x = b′u when:**.........

Justification (a):

Justification (b):

Extra Sheet