CS525 Open-Book Midterm Exam

Thursday, October 24, 1996
11:00 a.m.–12:55 p.m., Room 174 Mechanical Enginering

(i) If a problem has no solution, many solutions, or an unbounded objective function, you must clearly state so and **justify** your claim.

(ii) The whole exam can be solved by a **grand total of 4 pivots only!!**

Last Name (Print):——————
First Name: ——————

Grades

1. **Question 1:**————
2. **Question 2:**————
3. **Question 3:**————
4. **Question 4:**————
5. **Total:**————

1. Solve:

$$\begin{array}{rcrcrcrl} & & x_2 & - & x_3 & - & x_4 = & -1 \\ -x_1 & + & x_2 & & & - & 2x_4 = & 0 \\ -x_1 & + & 2x_2 & - & x_3 & - & 3x_4 = & 0 \end{array}$$

2.

$$
\begin{array}{ll}
\text{minimize} & -4x_1 + x_2 - 2x_3 + x_4 \\
\text{subject to} & \begin{array}{rcrcrcrcr}
-13x_1 & - & x_2 & + & x_3 & + & 3x_4 & \geq & -1 \\
2x_1 & - & x_2 & + & x_3 & + & 2x_4 & \geq & -2 \\
-x_1 & + & x_2 & + & 2x_3 & + & x_4 & \geq & -1 \\
x_1 & , & x_2 & , & x_3 & , & x_4 & \geq & 0
\end{array}
\end{array}
$$

3. Solve **without** changing the number of variables or constraints:

$$
\begin{array}{lrcrcrcrcr}
\text{minimize} & & & -x_1 + x_2 - 2x_3 - 3x_4 & & & & & & \\
 & x_1 & - & x_2 & & & & & \geq & -1 \\
 & 2x_1 & - & x_2 & + & 2x_3 & + & 4x_4 & = & 1 \\
\text{subject to} & x_1 & + & x_2 & - & 2x_3 & + & 2x_4 & \geq & -2 \\
 & x_1 & , & & & x_3 & , & x_4 & \geq & 0 \\
 & & & x_2\text{: free} & & & & & &
\end{array}
$$

4.

$$
\begin{array}{ll}
\text{minimize} & 2x_1 + 0x_2 + 3x_3 + x_4 \\
\text{subject to} & \begin{array}{ccccccccc}
7x_1 & + & 4x_2 & + & 3x_3 & + & x_4 & \geq & -1 \\
x_1 & - & x_2 & + & x_3 & + & x_4 & \geq & 1 \\
x_1 & , & x_2 & , & x_3 & , & x_4 & \geq & 0
\end{array}
\end{array}
$$