CS525 Open-Book Midterm Exam

Thursday, March 7, 1996
11:00 a.m.–12:55 p.m., Room 1263 Comp. Sci. & Stat.

(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 5 pivots only!!**

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

Grades

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

1. Solve:

$$\begin{array}{rcrcrcr} -x_1 & & & + & x_3 & = & 1 \\ x_1 & + & x_2 & + & x_3 & = & -1 \\ 3x_1 & + & 2x_2 & + & x_3 & = & -4 \end{array}$$

2.

$$
\begin{array}{ll}
\text{minimize} & x_1 - x_2 + 2x_3 \\
\text{subject to} & \begin{array}{rcrcrcr}
x_1 & - & x_2 & + & x_3 & \geq & -1 \\
2x_1 & - & x_2 & + & x_3 & \geq & -2 \\
-x_1 & + & x_2 & + & 2x_3 & \geq & 0 \\
x_1 & , & x_2 & , & x_3 & \geq & 0
\end{array}
\end{array}
$$

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

$$
\begin{array}{llcrcrcl}
\text{minimize} & & & -x_1 - 2x_2 - x_3 & & & & \\
 & 2x_1 & + & x_2 & & -x_3 & \geq & -2 \\
 & 3x_1 & + & 5x_2 & & +x_3 & = & -1 \\
\text{subject to} & -x_1 & + & 3x_2 & & -2x_3 & \geq & 1 \\
 & x_1 & , & x_2 & & & \geq & 0 \\
 & & & & & x_3\text{: unrestricted} & &
\end{array}
$$

4.

$$
\begin{array}{ll}
\text{minimize} & 3x_1 + 2x_2 + x_3 \\
\text{subject to} & \begin{array}{rcrcrcl}
4x_1 & + & x_2 & + & 17x_3 & \geq & 2 \\
x_1 & - & x_2 & + & x_3 & \geq & 1 \\
6x_1 & + & 2x_2 & + & 13x_3 & \geq & 5 \\
x_1 & , & x_2 & , & x_3 & \geq & 0
\end{array}
\end{array}
$$