CS525 Open-Book Midterm Exam

Thursday, March 5, 1998, 7:30 a.m.–9:25 a.m.
Room 1240 Computer Sciences & Statistics

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

(ii) Solve each problem using as few pivots as possible. The whole exam can be solved by a 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:

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

Scratch Sheet

2.

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

Scratch Sheet

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

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

Scratch Sheet

4.

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

Scratch Sheet