

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:

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

Scratch Sheet

2.

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

Scratch Sheet

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

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

Scratch Sheet

4.

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

Scratch Sheet