Name ANSWER KEY with expected level of detail

WSU ID# _____

Math 364 Quiz – Week #4

Write the following linear program in (matrix) Standard Form:

$$\begin{aligned} \min_x \quad & z = 3x_1 + 2x_2 + x_3 \\ \text{s.t.} \quad & x_1 - x_2 + x_3 - x_4 \geq 5.7 \\ & 7x_1 + x_4 \geq 0 \\ & 2x_1 - x_3 = 4.2 \\ & x_1, x_3, x_4 \geq 0 \\ & x_2 \text{ urs} \\ & x \in \mathbb{R}^4 \end{aligned}$$

The given LP is equivalent to the following standard form LP. Positive slack variables, x_5 and x_6 have been used to convert the inequality constraints to equality constraints. Unsigned variable $x_2 = x_7 - x_8$ (written as the difference of two positive variables).

$$\begin{aligned} \min_x \quad & z = 3x_1 + x_3 + 2x_7 - 2x_8 \\ \text{s.t.} \quad & x_1 + x_3 - x_4 - x_5 - x_7 + x_8 = 5.7 \\ & 7x_1 + x_4 - x_6 = 0 \\ & 2x_1 - x_3 = 4.2 \\ & x_1, x_3, x_4, x_5, x_6, x_7, x_8 \geq 0 \\ & x \in \mathbb{R}^7 \end{aligned}$$

In matrix standard form, we have

$$\begin{aligned} \min_x \quad & z = c^T x \\ \text{s.t.} \quad & Ax = b \\ & x \geq 0 \\ & x \in \mathbb{R}^7 \end{aligned}$$

$$x = \begin{bmatrix} x_1 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \end{bmatrix}, \; c = \begin{bmatrix} 3 \\ 1 \\ 0 \\ 0 \\ 0 \\ 2 \\ -2 \end{bmatrix}, \; A = \begin{bmatrix} 1 & 1 & -1 & -1 & 0 & -1 & 1 \\ 7 & 0 & 1 & 0 & -1 & 0 & 0 \\ 2 & -1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}, \; b = \begin{bmatrix} 5.7 \\ 0 \\ 4.2 \end{bmatrix},$$

where $x_2 = x_7 - x_8$.