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Problem 0

<div style="border:1px solid">Points:</div>

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(a) I worked with Yug Jarodiya.

(b) I did not consult with anyone in my group members.

(c) I did not consult any non-class materials.

Problem 1

Points:

Problem 2

Points:

maximize $\Rightarrow 2x_1 + 7x_2 + x_3$

subject to $\Rightarrow x_1 - x_3 = 7$

$$3x_1 + x_2 \geq 24$$

$$x_2 \geq 0$$

$$x_3 \leq 0$$

Here, $(x_1 - x_3 = 7)$ will undergo equality to inequality which in turn make the constraints as $(x_1 - x_3 \leq 7)$ and $(x_1 - x_3 \geq 7)$.

Now, $(x_1 - x_3 \geq 7)$, $(3x_1 + x_2 \geq 24)$ and $(x_3 \leq 0)$ has the wrong inequality direction so we will multiple both sides by -1 to change the inequality which results into $(x_3 - x_1 \leq -7)$, $(-3x_1 - x_2 \leq -24)$, and $(-x_3 \geq 0)$ (non-negative constraint).

Here, non-negative constraint of x_1 is missing. So, $x_1 \geq 0, x_1 \leq 0$. We want to combine these two constraints in a way that we can enforce both these conditions together. We will rewrite $x_1 = x_1^+ - x_1^-$ in all the above equations.

Final answer:

maximize $\Rightarrow 2(x_1^+ - x_1^-) + 7x_2 + x_3$

subject to $\Rightarrow (x_1^+ - x_1^-) - x_3 \leq 7$

$$x_3 - (x_1^+ - x_1^-) \leq -7$$

$$(-3)(x_1^+ - x_1^-) - x_2 \leq -24$$

$$x_2 \geq 0$$

$$(-x_3) \geq 0$$

$$x_1^+ \geq 0$$

$$x_1^- \geq 0$$

According to Standard form 1:

$$\text{maximize} \Rightarrow \begin{bmatrix} 2 & -2 & 7 & 1 \end{bmatrix} \times \begin{bmatrix} x_1^+ \\ x_1^- \\ x_2 \\ x_3 \end{bmatrix}$$

$$\text{Subject to} \Rightarrow \begin{pmatrix} 1 & -1 & 0 & -1 \\ -1 & 1 & 0 & 1 \\ -3 & 3 & -1 & 0 \end{pmatrix} \times \begin{pmatrix} x_1^+ \\ x_1^- \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 7 \\ -7 \\ -24 \end{pmatrix}$$

$x_1^+, x_1-, x_2, -x_3 \geq 0$