Oblig 1.
matinf3100- Linear optimization

Elsie Mestl

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Problem 1

a)

$$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad \mathbf{c} = \begin{bmatrix} -7 \\ 0 \\ 2 \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}$$

$$\mathrm{A} = \begin{bmatrix} 0 & -3 & 4 \\ 1 & -1 & 0 \\ -3 & 0 & 1 \end{bmatrix}$$

Now the LP problem given kan be written as $\max(\mathbf{c}^{\mathrm{T}}\mathbf{x})$ subject to $\mathrm{A}\mathbf{x} \leq \mathbf{0}$, $\mathbf{x} \geq \mathbf{0}$

b)

Introduce slack variables w_1, w_2, w_3, and get the following dictionary.

$$\begin{aligned} \eta &= & - & 7x_1 & & & + & 2x_3 \\ \\ w_1 &= 1 & & & + & 3x_2 & - & 4x_3 \\ w_2 &= 2 & - & x_1 & + & x_2 & & \\ w_3 &= & & 3x_1 & & & - & x_3 \end{aligned}$$

$$x_1, x_2, x_3, w_1, w_2, w_3 \geq 0$$

Since $2x_3$ is the only variable that we can increase to make the objective value increas. This means x_3 is the entering variable. And by observation on the dictionary we se that w_3 is the leaving variable and x_3 can not increas at all. After change we get the following dictionary.

$$
\begin{aligned}
\eta &= & - & x_1 & & & - & 2w_3 \\
\\
w_1 &= 1 & - & 12x_1 & + & 3x_2 & + & 4w_3 \\
w_2 &= 2 & - & x_1 & + & x_2 & & \\
x_3 &= & & 3x_1 & & & - & w_3 \\
x_1, x_2, x_3, w_1, w_2, w_3 &\geq 0
\end{aligned}
$$

Now we can not increase the objective value any more so the optimal solution is $x_1 = 0, x_2 = 0, x_3 = 0$ vith the objective value 0.

c)