HW 3-2

Slack form

$\max z = 2x_1 + x_2$ s.t. $\longrightarrow$ $\max z = 2x_1 + x_2$ s.t

$x_1 + x_2 \le 10$ $\qquad$ $S_1 = 10 - x_1 - x_2$

$-x_1 + x_2 \ge 2$ $(x_1 - x_2 \le -2)$ $\qquad$ $S_2 = -2 - x_1 + x_2$

$x_1, x_2 \ge 0$ $\qquad$ $x_1, x_2, S_1, S_2 \ge 0$

Start point is infeasible

$\max\{-x_0\}$, $\max \bar{z} = 2x_1 + x_2$

s.t.

$S_1 = x_0 + 10 - x_1 - x_2 \xrightarrow{\text{sub } x_0} S_1 = 2 + \cancel{x_1} - x_2 + S_2 + 10 - \cancel{x_1} - x_2 = 12 - 2x_2 + S_2$

$S_2 = x_0 - 2 - x_1 + x_2 \xrightarrow{\text{Pivot}} x_0 = 2 + x_1 - x_2 + S_2$

$x_0, x_1, x_2, S_1, S_2 \ge 0$

$\max\{-2 - x_1 + x_2 - S_2\}$, $\max \bar{z} = 2x_1 + x_2$

s.t.

$S_1 = 12 - 2x_2 + S_2 \xrightarrow{\text{sub } x_2} S_1 = 12 - 2(2 - x_0 + x_1 + S_2) + S_2$

$x_0 = 2 + x_1 - x_2 + S_2 \xrightarrow{\text{Pivot}} x_2 = 2 - x_0 + x_1 + S_2$

$\max\{-x_0\}$, $\max \bar{z} = 2 - x_0 + 3x_1 + S_2$

$S_1 = 8 + 2x_0 - 2x_1 - S_2$

$x_2 = 2 - x_0 + x_1 + S_2$ $\qquad \leftarrow$ Phase I done

s.t. $x_0, x_1, S_1, S_2, \ge 0$

Phase II

$\max \bar{z} = 2 + 3x_1 + S_2$

s.t.

$S_1 = 8 - 2x_1 - S_2 \xrightarrow{\text{pivot}} x_1 = 4 - \frac{S_1}{2} - \frac{S_2}{2}$

$x_2 = 2 + x_1 + S_2 \xrightarrow{\text{sub } x_1} x_2 = 2 + (4 - \frac{S_1}{2} - \frac{S_2}{2}) + S_2$

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$$\max \bar{z} = 14 - \frac{s_2}{2} - \frac{3s_1}{2}$$

s.t.

$$x_1 = 4 - \frac{s_1}{2} - \frac{s_2}{2}$$

$$x_2 = 6 - \frac{s_1}{2} + \frac{s_2}{2}$$

$$x_1, x_2, s_1, s_2 \geq 0$$

$\longrightarrow$ DONE $\boxed{\max \bar{z} = 14,\ x_1 = 4,\ x_2 = 6}$

In HW 3-2, the starting point is infeasible ($s_2 = -2$); Therefore, the simplex method cannot be carried out directly. To solve this question, we must introduce x_0 ($x_0 \geq 0$) and try to convert LP so that all of right hand constants are non-negative.