$$x_1 + x_2 \le 5$$
$$x_1 + 2x_2 \le 7$$

either-or constraint (恰有一成立)

$$\boxed{\begin{array}{c} x_1 + x_2 \le 5 + My \\ x_1 + 2x_2 \le 7 + M(1-y) \\ y \in \{0,1\} \end{array}}$$

$$\Updownarrow$$

$$\boxed{\begin{array}{c} x_1 + x_2 \le 5 + My_1 \\ x_2 + 2x_2 \le 7 + My_2 \\ y_1 + y_2 = 1 \\ y_1, y_2 \in \{0,1\} \end{array}}$$

$$x_1 + x_2 \le 5$$
$$3x_1 + 2x_2 \ge 10$$

either-or

$$\boxed{\begin{array}{c} x_1 + x_2 \le 5 + My \\ -3x_1 - 2x_2 \le -10 + M(1-y) \\ y \in \{0,1\} \end{array}}$$

$$\Updownarrow$$

$$\boxed{\begin{array}{c} x_1 + x_2 \le 5 + My_1 \\ 3x_1 + 2x_2 \ge 10 - My_2 \\ y_1 + y_2 = 1 \\ y_1, y_2 \in \{0,1\} \end{array}}$$

$$x_1 + x_2 \le 5$$
$$x_1 + 2x_2 \le 7$$

at most one equation is satisfied

至多一式成立

$$\boxed{\begin{array}{c} x_1 + x_2 \le 5 + My_1 \\ x_1 + 2x_2 \le 7 + My_2 \\ y_1 + y_2 \ge 1 \\ y_1, y_2 \in \{0,1\} \end{array}}$$

$x_1 + x_2 \leq 5$
$x_1 + 2x_2 \leq 7$

at least one equation is satisfied.

$$\boxed{\begin{aligned} x_1 + x_2 &\leq 5 + My_1 \\ x_1 + 2x_2 &\leq 7 + My_2 \\ y_1 + y_2 &\leq 1 \\ y_1, y_2 &\in \{0, 1\} \end{aligned}}$$

$x_1 + x_2 \leq 5$
$x_1 + 2x_2 \leq 7$
$10x_1 - x_2 \geq 1$

at least two equations are satisfied.

$$\boxed{\begin{aligned} x_1 + x_2 &\leq 5 + My_1 \\ x_1 + 2x_2 &\leq 7 + My_2 \\ 10x_1 - x_2 &\geq 1 - My_3 \\ y_1 + y_2 + y_3 &\leq 1 \\ y_1, y_2, y_3 &\in \{0, 1\} \end{aligned}}$$

$x_1 = 2$ or 4 or 6 One of them is satisfied

$$x_1 = 2y_1 + 4y_2 + 6y_3$$
$$y_1 + y_2 + y_3 = 1$$
$$y_1, y_2, y_3 \in \{0, 1\}$$

$|2x_1 + x_2 + x_3| = 2$ or 4 or 6 One of them is satisfied

$$2x_1 + x_2 + x_3 = -2y_1 - 4y_2 - 6y_3 + 2y_4 + 4y_5 + 6y_6$$
$$y_1 + y_2 + y_3 + y_4 + y_5 + y_6 = 1$$
$$y_1, y_2, y_3, y_4, y_5, y_6 \in \{0, 1\}$$

All-or-nothing

$0 \le x_1 \le 30 \Rightarrow x_1 = 0$ or $x_1 = 30$
希望

$x_1 = 30 y_1 \quad y_1 \in \{1, 0\}$

$x_1 = 0$ or $x_1 \ge 30$

$x_1 \ge 30 y_1$

$x_1 \le M y_1 \quad y \in \{1, 0\}$

If-then constraint

If $f(x_1, x_2, \ldots, x_n) > 0$ then $g(x_1, x_2, \ldots, x_n) \ge 0$

$-g(x_1, x_2, \ldots, x_n) \le My$

$f(x_1, x_2, \ldots, x_n) \le M(1-y)$

Linearizing Minimax and Maximin Objective function

$\text{Min } Z = \max\{x_1 + x_2, -x_1 + 2x_2\}$

s.t. $x_1 + x_2 \le 5$

$x_1, x_2 \ge 0$

$\text{Min } Z = f$

$f \ge x_1 + x_2$

$f \ge -x_1 + 2x_2$

$x_1 + x_2 \le 5$

$x_1, x_2 \ge 0$

$\text{Max } Z = \min\{x_1 + x_2, -x_1 + 2x_2\}$

s.t. $x_1 + x_2 \le 5$

$x_1, x_2 \ge 0$

$\text{Max } Z = f$

$f \le x_1 + x_2$

$f \le -x_1 + 2x_2$

$x_1 + x_2 \le 5$

$x_1, x_2 \ge 0$

Min deviation objective function

Min $4|x_1 - x_2| + 4|y_1 - y_2|$

$\cdots\cdots$

Let S_i^+ : positive difference in absolute value term i

S_i^- : negative difference in absolute value term i

$$\boxed{\begin{aligned} &\text{Min } 4(S_1^+ + S_1^-) + 4(S_2^+ + S_2^-) \\ &\cdots\cdots \\ &\text{st.} \\ &\quad x_1 - x_2 = S_1^+ - S_1^- \\ &\quad y_1 - y_2 = S_2^+ - S_2^- \end{aligned}}$$

Max $Z = |+x_1 + x_2 + x_3|$

st. $2x_1 + 3x_2 - x_3 \le 10$

$$\boxed{\begin{aligned} &\text{Max } Z = S_1^+ + S_1^- \\ &\text{st.} \quad x_1 + x_2 + x_3 = S_1^+ - S_1^- \\ &\quad 2x_1 + 3x_2 - x_3 \le 10 \\ &\quad x_1, x_2, x_3, S_1^+, S_1^- \ge 0 \end{aligned}}$$