LP Standard form

$$\min_{x} f(x) = c^T x$$

$$\text{s.t.} \quad Ax = b$$

$$x \geq 0$$

- Rewriting to standard form

① max $\longrightarrow$ $-$min

② $Ax \leq b \longrightarrow$ dummy variables $s \geq 0$ with $Ax + Is = b$

③ $x \in R^n \longrightarrow x = x^+ - x^-$, $x^+, x^- \geq 0$

Method 1: Graphical Solution

Easy to understand = just skip

Method 2: Simplex Methods

- Basic Solutions:

Split columns of A into 2 groups:

- Understanding About B_j choice:

During this process, comparing to simplex method studied in Bachelor:

① Actually, when solving $By = N_i$, we are finding a combination between Taking-in variable and Basic Variables (that are already in X_B)

② By finding y, then we are actually considering:

if we turn the Basic varible correspond y_i into taking-in variable, what is the boundary? then we choose the small one.

Situation 1. $|x_1+x_2-2x_3+x_4+x_5| \le 2$

Solution: $-2 \le x_1+x_2-2x_3+x_4+x_5 \le 2$

Situation 2: $\min e^{2x_1+2x_2}$

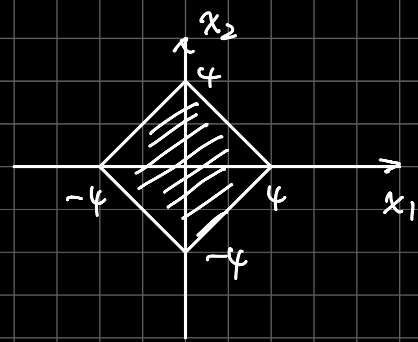
s.t. $|x_1|+|x_2| \le 4$

Solution: ① $y=e^x$ monotonous

$\therefore \min e^{2x_1+2x_2} \Longleftrightarrow \min 2x_1+2x_2$

② $|x_1|+|x_2| \le 4$

$$\Rightarrow \begin{cases} x_1+x_2 \le 4 \\ -x_1-x_2 \ge 4 \\ x_1-x_2 \le 4 \\ x_2-x_1 \ge -4 \end{cases}$$



Intuitively Explanation:

- Why A can be divided

  $\text{Column}(A) \geq \text{rows}(A)$

  Otherwise: numbers of constraints > variables

- Why B^{-1} always exists

  If B^{-1} do not exists, means several constraints are not independent