

①

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$$\begin{aligned}
 x_1 + x_2 + x_3 &= 100 \\
 0.1x_1 + 0.2x_2 + x_4 &= 14
 \end{aligned}$$

$$x_1, x_2 \geq 0$$

$$x_3 \geq 0$$

$$x_4 \geq 0$$

$$A = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0.1 & 0.2 & 0 & 1 \end{bmatrix}$$

$$b = \begin{bmatrix} 100 \\ 14 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & 1 \\ 0.1 & 0.2 \end{bmatrix}$$

$$N = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$x_B = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

$$x_N = \begin{bmatrix} x_3 \\ x_4 \end{bmatrix}$$

(2)

$$C_{x \in}^T z_0 + \lambda^T x_N$$

$$\lambda = [-10 \quad 0 \quad 0 \quad -5 \quad 2]^T$$

$$x_N = 1$$

→ select most negative  $\lambda_i$

$$y = \begin{bmatrix} 1 \\ -2 \\ 5 \end{bmatrix}$$

$$x_B = \begin{bmatrix} 2 \\ 1 \\ 5 \end{bmatrix}$$

$$\underline{\epsilon?} \quad (x_B)_j - \epsilon y_j = 0$$

$$j=1$$

$$2 - \epsilon = 0$$

$$\rightarrow \epsilon = 2$$

$$j=2$$

$$1 + 2\epsilon = 0$$

$$\epsilon = -\frac{1}{2}$$

$$j=3$$

$$5 - 5\epsilon = 0$$

$$\rightarrow$$

$$\epsilon = 1$$

→ select positive  $\epsilon$

③

$$C = \begin{bmatrix} 1 \\ 5 \\ 2 \\ 3 \end{bmatrix}^T$$

4 columns

$$A = \left[ \begin{array}{c|c|c|c} 1 & & & 4 \end{array} \right] \begin{matrix} 2 \text{ rows} \end{matrix}$$

$$B = \left[ \begin{array}{c|c} 1 & 4 \end{array} \right]$$

$$x_B = [x_1 \ x_4]^T$$

$$C_B = [1 \ 3]^T$$

$$N = \left[ \begin{array}{c|c} 2 & 3 \end{array} \right]$$

$$x_N = [x_2 \ x_3]^T$$

$$C_N = [5 \ 2]^T$$

$$C^T x = \underbrace{1 \cdot x_1}_{C_B^T \cdot x_B} + \underbrace{5 \cdot x_2 + 2 \cdot x_3}_{C_N^T \cdot x_N} + \underbrace{3 \cdot x_4}_{C_B^T \cdot x_B}$$

③

$$[x, \text{val}, \text{exit\_flag}] = \text{biprog}(\dots)$$

$$\Rightarrow \text{exit\_flag} = 0$$

$$[x, \text{val}, \text{exit\_flag}] = \text{biprog}(c, A, b, Aeq, Seq, lb, ub, x)$$