Lecture 9 Dual simplex algorithm

Ex Consider the dietary problem

Nutrients \ Food	F_1	F_2	Req amount of nutrients
N_1	1	2	6
N_2	2	1	8
unit cost	3	5	

- Minimize $f(x) = 3x_1 + 5x_2$

$$(P)\begin{cases} 1\cdot x_1 + 2\cdot x_2 \geq 6 \\ 2x_1 + 1\cdot x_2 \geq 8 \\ x_1, x_2 \geq 0 \end{cases} \quad (S) \quad \begin{matrix} |\cdot(-1)| + x_3 \\ |\cdot(-1)| + x_4 \end{matrix}$$

Since (P) has no standard form, in order to apply the simplex algo we transform this problem in another equivalent problem written in standard form

$$(P_{std})\begin{cases} \text{Minimize } f_{std}(x) = 3x_1 + 5x_2 \\ -x_1 - 2x_2 + x_3 = -6 \\ -2x_1 - x_2 + x_4 = -8 \\ x_1 \dots x_4 \geq 0 \end{cases} \quad (S_{std})$$

$x_3 = x_1 + 2x_2 - 6$; $x_4 = 2x_1 + x_2 - 8$; $x_1, x_2 \geq 0$

$n = 4 \quad m = 2$

$c = (c_1, c_2, c_3, c_4) = (3, 5, 0, 0)$

$$A = \begin{pmatrix} -1 & -2 & \overbrace{1 & 0}^{\text{base}} \\ -2 & -1 & 0 & 1 \end{pmatrix} \qquad b = \begin{pmatrix} -6 \\ -8 \end{pmatrix}$$

$A^1 \quad A^2 \quad A^3 \quad A^4$