

An Unbounded LP (Breadco)

Original LP

$$\text{maximize} \quad 36x_1 + 30x_2 - 3x_3 - 4x_4 \quad (1)$$

subject to

$$x_1 + x_2 - x_3 \leq 5 \quad (2)$$

$$6x_1 + 5x_2 - x_4 \leq 10 \quad (3)$$

$$x_1, x_2, x_3, x_4 \geq 0. \quad (4)$$

Standard form.

$$z = 36x_1 + 30x_2 - 3x_3 - 4x_4 \quad (5)$$

$$s_1 = 5 - x_1 - x_2 + x_3 \quad (6)$$

$$s_2 = 10 - 6x_1 - 5x_2 + x_4 \quad (7)$$

Pivot in x_2 . Remove s_2 from the basis

$$z = 60 + 3x_3 + 2x_4 - 6s_2 \quad (8)$$

$$x_1 = \frac{5}{3} - \frac{5x_2}{6} + \frac{x_6}{4} - \frac{s_2}{6} \quad (9)$$

$$s_1 = \frac{10}{3} - \frac{x_2}{6} + x_3 - \frac{x_6}{4} + \frac{s_2}{6} \quad (10)$$

Pivot in x_4 . Remove s_1 .

$$z = 100 - 2x_2 + 9x_3 - 12s_1 + 2s_2 \quad (11)$$

$$x_1 = 5 - x_2 + x_3 - s_1 \quad (12)$$

$$x_4 = 20 - x_2 + 6x_3 - 6s_1 + s_2 \quad (13)$$

At this point, we choose x_3 as the entering variable. But neither equation limits how much x_3 can increase. Therefore the LP is unbounded.