Math 364: Principles of Optimization, Lecture 7

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Standard Form

Simplex method – to solve LPs with any # variables and constraints.

"simplex" : general term for LP feasible regions.

We extend the idea of graphical solution in 2D to higher dimensions. We describe the simplex method for LPs in **standard form**.

An LP is in standard form if

1. all constraints are of "=" form (i.e., equations), and
2. all variables are ≥ 0 (non-negative).

We need to convert all inequalities to equations, and replace any ≤ 0 or urs vars with ≥ 0 vars. We will first deal with inequalities. (the case of ≤ 0 and urs variables will be discussed later).

Prob 3, pg 130

$$\min \quad z = 3x_1 + x_2$$

s.t.

$$x_1 \geq 3$$
$$x_1 + x_2 \leq 4$$
$$2x_1 - x_2 = 3$$
$$x_1, x_2 \geq 0$$

We convert the $\leq$ inequality to an equation by adding an extra variable.

$$x_1 + x_2 + s = 4, \quad s \geq 0$$

"slack" variable (hence the notation s)

Models how much slack is there between $x_1 + x_2$ and 4.

Now, let's look at $x_1 \geq 3$.

We subtract a variable e to write $x_1 - e = 3$, and add $e \geq 0$.

excess variable, hence calle

Measures by how much x_1 exceeds 3.

Here is LP in standard form.