Chapter 2 – Formulations

2.1 Introductions

In this course we will consider the following problems;

$$\min\{f(x)\colon g_i(x) \leq b_i, (1 \leq i \leq m), x \in \mathbb{R}^n\}$$

Whereby,

- $n, m \in \mathbb{N}$
- $b_1, \ldots, b_m \in \mathbb{R}$
- $f, g_1, \ldots, d_m$ are functions.

Definition: A function $f\colon \mathbb{R}^n \to R$ is **affine** if $f(x) = a^T x + \beta$ for $a \in \mathbb{R}^n$, $b \in \mathbb{R}$. We say that it is **liner** if $\beta = 0$. ◁

Definition: The optimization problem

$$\min\{f(x)\colon g_i(x) \leq b_i, \forall\ 1 \leq i \leq m, x \in \mathbb{R}^n\}$$

is called a **linear** program if f is **affine** and $g_1, \ldots, d_m$ is **finite** and number of **linear** functions.

Remark 2.1: We place the non-negativity constraints in the last row. We write $x \geq \mathbb{O}$ as a short form that denote that all variables are non-negative. THe following are not allowed,

- Dividing by variables.
- Strict inequalities are not allowed. (Non-equality inequalities)
- Must have a finite number of constraints.

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