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# Communication and Extension Complexity

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## 1 Extended Formulations and Extension Complexity

Consider a discrete optimization problem, which usually has the formula

$$\begin{aligned} &\max_x c^T x \\ s.t.\quad &x \in V \end{aligned} \tag{1}$$

where $V \subseteq \mathbb{R}^d$ is a finite set. Linear programming (LP) is a powerful technique solving (1). Define a *polytope* as the convex hull of $V$:

$$P = conv(V) = \{x \in \mathbb{R}^d : x = \sum_{i=1}^{l} a_i v_i,\ s.t.\ v_i \in V, 0 \le a_i \le 1, \sum_{i=1}^{l} v_i = 1\}. \tag{2}$$

One can solve (1) by an LP:

$$\max c^T$$