

$$\begin{aligned} \max \quad & c^T x \\ \text{subject to} \quad & Ax \leq b \\ & x \geq 0 \end{aligned}$$

"primal problem"

$$\min \quad b^T y$$

$$A^T y \geq c$$

$$y \geq 0$$

"dual problem"

x is feasible, not necessarily optimal

Weak duality: If x is a solution to the primal problem and y is a solution to the dual problem, then $c^T x \leq b^T y$

Proof: $c^T x = x^T c \leq x^T A^T y = (Ax)^T y \leq b^T y$

Strong duality: If the primal problem has an optimal solution, then the dual problem has an optimal solution, and $c^T x = b^T y$