Common Linear Programs and Their Duals
CS 787
Spring 2018

$$\begin{array}{c} \min\ cx \\ Ax \geq b \\ x \geq 0 \end{array} \quad \longleftrightarrow \quad \begin{array}{c} \max\ yb \\ yA \leq c \\ y \geq 0 \end{array} \tag{1}$$

$$\begin{array}{c} \min\ cx \\ Ax = b \\ x \geq 0 \end{array} \quad \longleftrightarrow \quad \begin{array}{c} \max\ yb \\ yA \leq c \end{array} \tag{2}$$

$$\begin{array}{c} \min\ cx \\ Ax = b \end{array} \quad \longleftrightarrow \quad \begin{array}{c} \max\ yb \\ yA = c \end{array} \tag{3}$$

$$\begin{array}{c} \min\ px \\ Ax \leq b \\ Cx = d \\ 0 \leq x \leq f \end{array} \quad \longleftrightarrow \quad \begin{array}{c} \max\ -ub - wf - vd \\ -uA - w - vC \leq p \\ u \geq 0 \\ w \geq 0 \end{array} \tag{4}$$

$$\begin{array}{c} \min\ px + qy \\ Bx + Cy \geq d \\ Ex + Fy = g \\ Hx + Jy \leq k \end{array} \quad \longleftrightarrow \quad \begin{array}{c} \max\ ud + vq + wk \\ uB + vE + wH \leq p \\ uC + vF + wJ = q \\ u \geq 0 \\ w \leq 0 \end{array} \tag{5}$$

Sources: (1)–(3) from E.L. Lawler, Combinatorial Optimization: Networks and Matroids, pp. 54-55; (4)–(5) from M. C. Ferris, O. L. Mangasarian, and S. J. Wright, Linear Programming with MATLAB, pp. 107-109.