Linear Fractional Program

$$\min f_0(x) = \frac{c^T x + d}{e^T x + f} \leftarrow \text{not a convex function}$$
$$Gx \leq h$$
$$Ax = b$$

$$\text{dom } f_0 = \{x \mid e^T x + f > 0\}$$

convexity is hidden!

Charnes-Cooper transform : $\quad y = \dfrac{x}{e^T x + f} \qquad t = \dfrac{1}{e^T x + f}$

$$e^T y + ft = \frac{e^T x + f}{e^T x + f} = 1$$

Also : $\quad x = \dfrac{y}{t}$

$$Gx \leq h \qquad \Longleftrightarrow \qquad \frac{Gx}{e^T x + f} \leq \frac{h}{e^T x + f}$$

$$\Longleftrightarrow \quad Gy \leq ht$$

$$Ax = b \qquad \Longleftrightarrow \qquad Gy = bt$$

$$\frac{c^T x + d}{e^T x + f} = c^T y + dt$$

$$\min \; c^T y + dt \qquad (LP)$$
$$e^T y + ft = 1$$
$$Gy \leq ht$$
$$Ay = bt$$

other transformations
also possible