$A \in \mathbb{R}^{r \times n}$

$A x^*(t) = b \qquad h_i(x^*(t)) < 0 \quad i = 1, \dots n$

$$\nabla f(x^*(t)) + \sum_{i=1}^{m} \underbrace{\frac{-1}{h_i(x^*(t))t}}_{u_i^*(t)} \nabla h_i(x^*(t)) + A^T \underbrace{\frac{w}{t}}_{v^*(t)} = 0$$

for some $w \in \mathbb{R}^r$

define $(u^*(t), v^*(t))$ by:

$$u_i^*(t) = \frac{-1}{t h_i(x^*(t))} \qquad V_i^*(t) = \frac{w}{t}$$

<u>claim</u> $(u^*(t), v^*(t))$ are feasible for original problem

$$\min_x f(x)$$
$$\text{st} \quad h_i(x) \le 0 \quad i = 1, .. m$$
$$Ax = b$$

- Sign check: $u_i^*(t) = \dfrac{-1}{t h_i(x^*(t))} \geq 0$ all i
- domain check:

$$g(u,v) = \min_x L(x,u,v)$$

domain of g is all points (u,v), $u \geq 0$, such that $\min_x L(x,u,v) > -\infty$

$L(x, u^*(t), v^*(t))$ minimized at $x = x^*(t)$

✓ comes from centrality condition

$$\boxed{(A + aa^T)}\, x = b$$

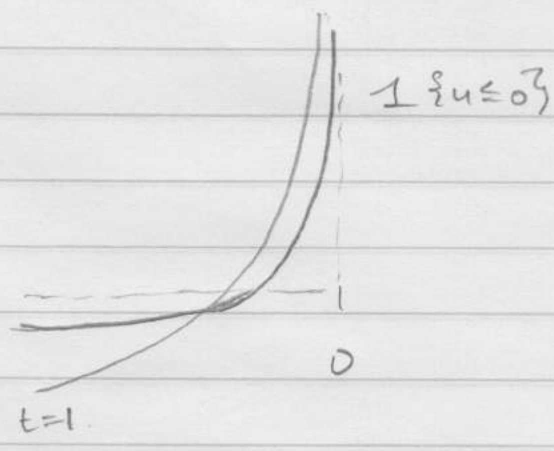
$$\min \ \tfrac{1}{2}x^TQx + c^Tx \quad \text{s.t.} \quad Ax = b$$

$$\begin{bmatrix} Q & A^T \\ A & 0 \end{bmatrix} \begin{bmatrix} x \\ v \end{bmatrix} = \begin{bmatrix} -c \\ 0 \end{bmatrix}$$

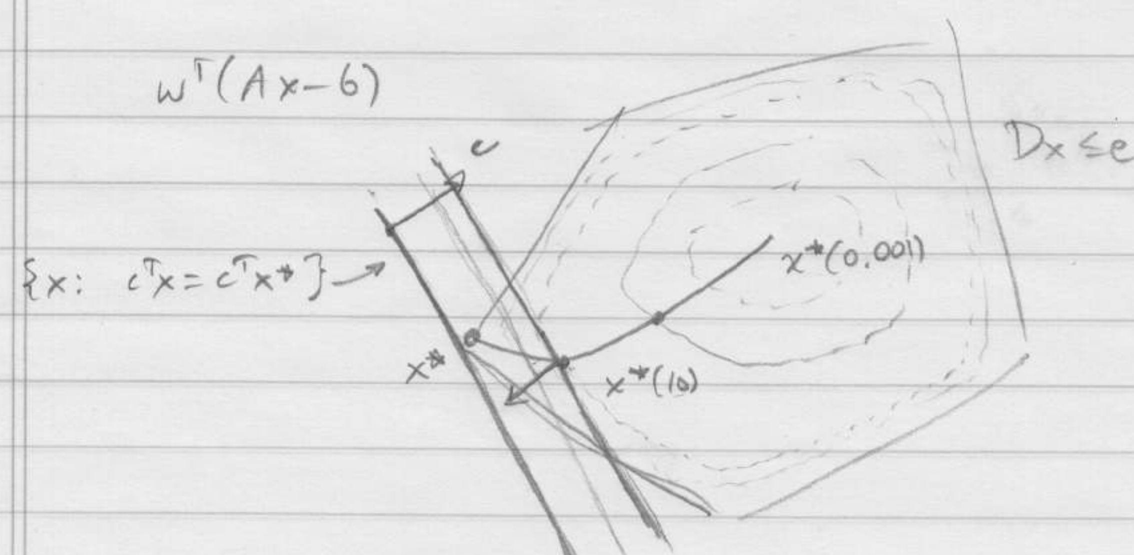
$$\min \ f(x) \quad \text{s.t} \quad Ax = b$$

$$\min \ f(x) \quad \text{st} \quad Ax = b$$
$$h_i(x) \le 0 \quad i = 1, \dots m$$

$-\frac{1}{t}\log(-u)$



$w^T(Ax - b)$



$$\min_{\beta} \; L(\beta) + \lambda R(\beta)$$

solve over λ.

$$L(\beta) = \|y - X\beta\|_2^2$$
$$R(\beta) = \|\beta\|_2^2$$

$$\min \; \|y - X\beta\|_2^2$$
$$\|\beta\|_2^2 \leq t$$