$L(x,u,v) = -\infty$ whenever $u \not\geq 0$

QP: $L(x,u,v) = f(x) + \sum u_i \cdot (-x_i) + \sum v_j (a_j^T x - b_j)$

$= f(x) \underbrace{- u^T x + v^T(Ax - b)}$

$= \frac{1}{2} x^T Q x + c^T x + \underbrace{\qquad\qquad}$

$= \frac{1}{2} x^T Q x + (c - u + A^T v)^T x - b^T v$

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

minimizer:

$-Q^{-1}(c - u + A^T v)$

$ax^2 + bx + c$

$-b/2a$

Quartic

$L(x,u) = x^4 - 50x^2 + 1000x - ux - 4.5u$

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

$4x^3 - 100x + 1000 - u$

LPs:

primal.

slater's: if feasible then $f^* = g^*$

dual

slater if feasible $g^* = f^*$

$-\xi_i \le 0$, $i=1..n$	$v_i \geq 0$
$1-\xi_i - y_i(x_i^T\beta + \beta_0) \le 0$ $i=1..n$	$w_i \geq 0$

$$\min_{\beta, \beta_0, \xi} \quad \frac{1}{2}\beta^T\beta - \sum y_i w_i x_i^T \beta - \left(\sum y_i w_i\right)\beta_0 + \sum w_i + \sum (C - v_i - w_i)\xi_i$$

over β_0: get constraint $w^T y = 0$

over ξ: get constraints $w_i = C - v_i$
$i=1..n$

over β:

$\frac{1}{2}\beta^T\beta - w^T\tilde{X}\beta$ $\quad$ $\tilde{X}$ is X with rows scaled by y

minimizer: $\tilde{X}^T w$

min val: $-\frac{1}{2} w^T \tilde{X}\tilde{X}^T w$