

$$\begin{aligned} \min \quad & c^T x \\ \text{st.} \quad & Dx \leq e. \end{aligned}$$

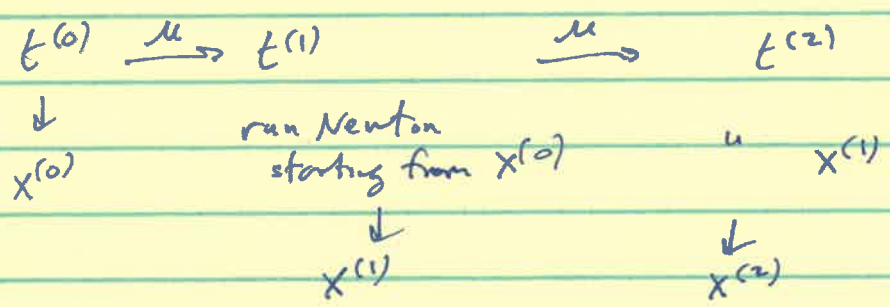
LP

$$\begin{aligned} \min \quad & f(x) + \frac{1}{t} \phi(x) \\ \text{st.} \quad & Ax = b. \end{aligned}$$

$$\begin{aligned} \min \quad & f(x) + \sum_i \frac{1}{t} \{h_i(x) \leq 0\} \\ \text{st.} \quad & Ax = b \end{aligned}$$

barrier

orig



$\log(Y\varepsilon)$   
 $\log \log(Y\varepsilon)$

last time:

KKT conds for barrier prob.

↳  $X, W$ .

↳ introduced  $u_i = -\frac{1}{t h_i(x)}$   $i=1, \dots, m$

$v = W/t$ .

↳ Rewrite KKT in terms of  $x, u, v$ .

↳ perturbed KKT conds.

$$\begin{bmatrix} \nabla f(x) + Dh(x)^T u + A^T v \\ - \text{diag}(u) h(x) - \tau \mathbf{1} \\ Ax - b \end{bmatrix} = 0.$$

$$\text{diag}(u) = \begin{pmatrix} u_1 & & 0 \\ & \ddots & \\ 0 & & u_m \end{pmatrix}$$

$$\text{diag}(u) h(x) = \begin{pmatrix} u_1 h_1(x) \\ \vdots \\ u_m h_m(x) \end{pmatrix}$$

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$$0 = \nabla f(x) := F(x)$$

$$\begin{aligned} \Delta x &= -(DF(x))^{-1} F(x) \\ &= -(\nabla^2 f(x))^{-1} \nabla f(x) \end{aligned}$$

$$\downarrow$$

$$(DF(x))^{-1} \Delta x = -F(x)$$

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$$\begin{aligned} F(y) &= 0. & F(y) &= r(x, u, v) \\ y &= (x, u, v) \\ \Delta y &= -(DF(y))^{-1} F(y) \\ DF(y) \Delta y &= -F(y). \end{aligned}$$

Barrier:  
 $\log(m/\epsilon)$

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$$\begin{aligned} \eta &= -\sum u_i h_i(x) = m/\tau \\ \epsilon &= m/\eta. \end{aligned}$$