$\min_x \; -\sum \log(b - Ax)$

- Phase I

  Solve a piece-wise linear minimization

  $\min_x \; \max(Ax - b)$

  if $p^* \geq 0$ then no x s.t. $b - Ax > 0$
  the analytic center problem is infeasible

  if $p^* < 0$ then $\exists x$ s.t. $b - Ax > 0$
  the analytic center problem is feasible

- Solve Analytic center with newton method

  $\min: \; f(x) = -\sum \log(b - Ax)$

  $\nabla_x f(x) = A^T \, 1/(b - Ax)$

  $\nabla_x^2 f(x) = A^T \, 1/(b - Ax)^2 \, A$

  $dx = -\nabla_x^2 f(x)^{-1} \cdot \nabla_x f(x)$