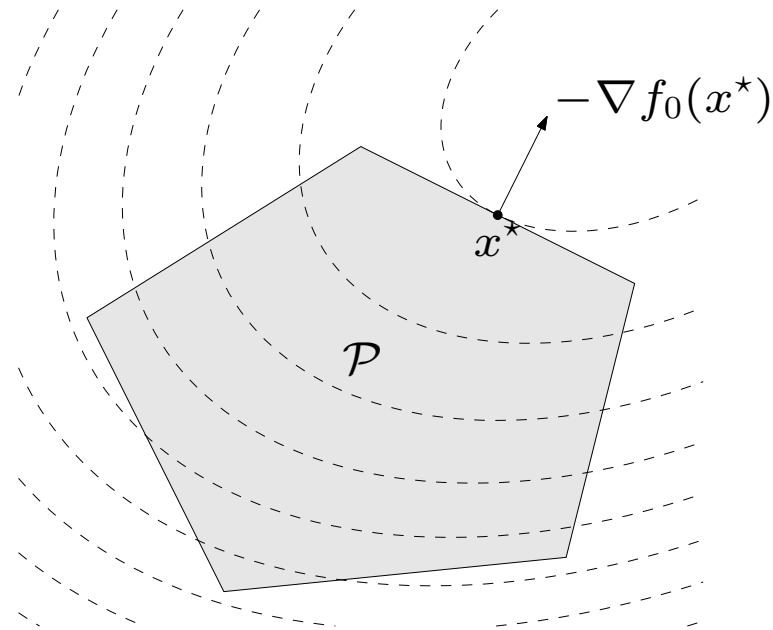


Quadratic program (QP)

$$\begin{aligned} & \text{minimize} && (1/2)x^T P x + q^T x + r \\ & \text{subject to} && Gx \preceq h \\ & && Ax = b \end{aligned}$$

- $P \in \mathbf{S}_+^n$, so objective is convex quadratic
- minimize a convex quadratic function over a polyhedron



Examples

least-squares

$$\text{minimize} \quad \|Ax - b\|_2^2$$

- analytical solution $x^* = A^\dagger b$ (A^\dagger is pseudo-inverse)
- can add linear constraints, *e.g.*, $l \preceq x \preceq u$

linear program with random cost

$$\begin{aligned} &\text{minimize} && \bar{c}^T x + \gamma x^T \Sigma x = \mathbf{E} c^T x + \gamma \mathbf{var}(c^T x) \\ &\text{subject to} && Gx \preceq h, \quad Ax = b \end{aligned}$$

- c is random vector with mean \bar{c} and covariance Σ
- hence, $c^T x$ is random variable with mean $\bar{c}^T x$ and variance $x^T \Sigma x$
- $\gamma > 0$ is risk aversion parameter; controls the trade-off between expected cost and variance (risk)