

Nonlinear programming: Homework 8

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1 Numerical perturbation analysis

Consider the quadratic problem

$$\begin{aligned} & \text{minimize} && x^2 + 2y^2 - xy - x \\ & \text{subject to} && x + 2y \leq u, \\ & && x - 4y \leq v, \\ & && 5x + 76y \leq 1. \end{aligned}$$

1. Show that this is a convex problem.
2. Solve it with $u = -2$ and $v = -3$. Find the optimal primal solutions x^*, y^* and the optimal dual variables $\lambda_i^*, i = 1, 2, 3$. (hint: see section 3.6 of the CVX users' guide to find out how to retrieve optimal dual variables. To specify the quadratic objective, use `quad_form()`.)
3. We will now solve some perturbed versions of the QP with

$$u = -2 + \delta_1, \quad v = -3 + \delta_2$$

where δ_1 and δ_2 each take values from $\{-0.1, 0, 0.1\}$. For each combination make a prediction f_{pred}^* of the optimal value of the perturbed QP, and compare it to f_{exact}^* , the exact optimal value of the perturbed problem. Check that $p_{pred}^* \leq p_{exact}^*$.