LINMA2415 Quantitative Energy Economics

Issambre L'Hermite Dumont

This summary may not be up-to-date, the newer version is available at this address:
https://github.com/SimonDesmidt/Syntheses

Academic year 2025-2026 - Q2

UCLouvain

Contents

Reminder about optimization

1.1 Formulations

Definition 1.1. The primal problem is the original optimization problem that we want to solve. It is formulated as:

$$\begin{aligned} \max_{x} \quad & c^T x \\ \text{s.t.} \quad & Ax \leq b \\ & x \geq 0 \end{aligned} \tag{1.1}$$

Definition 1.2. The dual problem is derived from the primal problem. It is formulated as:

$$\begin{aligned} \min_{y} \quad & b^T y \\ \text{s.t.} \quad & A^T y \geq c \\ & y \geq 0 \end{aligned} \tag{1.2}$$

Another way to look at the dual problem is by using the Lagrangian function. Consider now the primal under the form:

$$\begin{aligned} \min \quad & f_0(x) \\ \text{s.t.} \quad & f_i(x) \leq 0, \quad i = 1, \dots, m \\ & h_j(x) = 0, \quad j = 1, \dots, p \end{aligned} \tag{1.3}$$

Definition 1.3. The Lagrangian function is defined as:

$$L(x, \lambda, \nu) = f_0(x) + \sum_{i=1}^{m} \lambda_i f_i(x) + \sum_{j=1}^{p} \nu_j h_j(x) \tag{1.4}$$

And its dual function is the Lagrange dual function.

Definition 1.4. The Lagrange dual function is defined as:

$$g(\lambda, \nu) = \inf_{x} L(x, \lambda, \nu) \tag{1.5}$$