Optimisation Discrete

David Wiedemann

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Lecture 1: Introduction

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1 What is optimization ?

Given $f : X \to \mathbb{R}$ find

$$\max \{f(x) : x \in S\} \text{ where } S \subset \mathbb{R}^n$$

f is called the objective function and S the feasible region.
The answer will be a point $x_0 \in S$ such that $f(x_0) \geq f(x)$ for all other $x \in S$.
A solution is anything you can plug into f.
A feasible solution is something in S and the x_0 would be called an optimal solution.
We consider feasible regions described by intersection of equalities and inequalities.
A constraint is "active" or "tight" if f satisfies it with equality.

1.1 New lagrange multipliers

We should try to satisfy $\nabla f = \sum_i \lambda_i \nabla g_i$ where $\lambda_i = 0$ whenever g_i is not active. Feasible regions split into nice ones and not so nice ones.
A region S is convex if $\forall x, y \in S$ and all $\lambda \in [0, 1]$, then $\lambda x + (1 - \lambda)y \in S$