

14D006

Stochastic Models and Optimization

3 ECTS

Stochastic Models and Optimization

Overview and Objectives

The main objective of the course is to introduce students to quantitative decision making under uncertainty through Dynamic Programming. Along the way, it presents mathematical formulations and solution concepts for important managerial problems such as inventory management, asset selling, and portfolio selection. The course also highlights applications and extensions of the general methodology that are relevant to Data Science, e.g., problems with imperfect state information and computational DP techniques.

Course Outline

Introduction to Dynamic Programming

Stochastic Optimization Problems
Dynamic Programming Algorithm

Shortest Path Problems

Label Correcting Methods
Hidden Markov Models and Viterbi Algorithm

Inventory Management

Newsvendor Model
(s, S) Inventory Replenishment Policy
Inventory Pooling

Asset Selling

Optimal Stopping Problems
One-Step Lookahead Policy

Portfolio Selection

Mean-Variance Formulations
Portfolio Diversification
Dynamic Portfolio Analysis

Linear-Quadratic Control

Linear State Feedback
Steady State Control and Stability

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Sequential Hypothesis Testing

Sufficient Statistics

Sequential Probability Ratio Test

Infinite-Horizon Discounted Problems

Monotonicity and Contraction

Computational Methods

Instructor

Mihalis G. Markakis, Assistant Professor of Operations Research, Universitat Pompeu Fabra.

Evaluation criteria

Weekly problem sets account for 60% of the final grade, while the remaining 40% comes from a final project. Both the problem sets and the final project are carried out in teams of four students.

Textbook

D.P. Bertsekas, "Dynamic Programming and Optimal Control," 3rd Ed., *Athena Scientific*.