UCLouvain

linma2491

2024

Operational Research

5.00 credits	30.0 h + 22.5 h	Q2

Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	· A course in linear, non-linear, and integer programming. · An introductory course to probability theory: probability space, probability, random variable, mathematical expectation, independence, law of large numbers, '. · Knowledge of a mathematical programming language (AMPL, Matlab, OPL-Studio, ...)
Main themes	How to formulate an optimization problem in which data are prone to uncertainty? How to take into account disclosed information and revealed values of the parameters during the stages of the optimization process? How to solve the optimization models thus obtained? Stochastic optimization is the ideal framework for dealing with such issues. Various solution techniques for large-scale problems will also be discussed: Benders decomposition, Nested Bendersdecomposition, Lagrangian methods, ... Applications: Production, logistics, finance, ...
Learning outcomes	**At the end of this learning unit, the student is able to :** · Formulate problems of decision-making under uncertainty as mathematical programs, 1 • Identify mathematical structures in large-scale mathematical programs that enable their decomposition, • Design algorithms for solving large-scale optimization problems under uncertainty, • Implement algorithms for solving large-scale stochastic optimization problems, • Evaluate the quality of alternative policies for problems of decision-making under uncertainty
Evaluation methods	• Written and/or oral exam • Regular homework assignments
Teaching methods	2 hours of magistral courses per week, and 2 hours of training sessions per week. Homeworks will be evaluated by the instructor and/or the teaching assistant.
Content	• Mathematical background (LP/QP duality, probability theory) • Lagrange duality and primal reformulation of the LD of a MIP • Extended Formulations (insights) • Benders Decompositions • Stochastic programming models • Value of perfect information and the value of the stochastic solution • Cutting plane algorithms (L-shaped method, nested L-shaped decomposition) • Stochastic dual dynamic programming • Introduction to Robust Optimization: robust linear programs • Adaptive Robust Optimization: models and Benders decompositions
Inline resources	https://moodleucl.uclouvain.be/course/view.php?id=4983
Bibliography	• Notes on Moodle • Textbooks: • [Deterministic models] Conforti, M., Cornuéjols, G., Zambelli, G., Conforti, M., Cornuéjols, G. and Zambelli, G., 2014. *Integer Programming*. Springer International Publishing. • [Stochastic Programming] Birge, J.R. and Louveaux, F., 2011. *Introduction to stochastic programming*. Springer Science & Business Media. • [Robust Optimization] Sun, X.A. and Conejo, A.J., 2021. *Robust optimization in electric energy systems*. Springer International Publishing.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Mathematical Engineering	MAP2M	5		
Master [120] in Data Science Engineering	DATE2M	5		
Master [120] in Data Science: Information Technology	DATI2M	5		