UCL Université catholique de Louvain

LINMA2471

2016-2017

Optimization models and methods

5.0 credits	30.0 h + 22.5 h	1q

Teacher(s) :	Glineur François ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	Course documents (notes, slides, exercises and homeworks) are available on Moodle. > https://moodleucl.uclouvain.be/course/view.php?id=8194
Prerequisites :	A basic optimization course (such as LINMA1702) and basic knowledge in real analysis and linear algebra (such as provided by FSAB1101 and FSAB1102)
Main themes :	Linear optimization, convex optimization (including structured conic optimization) ; duality and applications ; interior-point methods ; first-order methods ; trust-region methods ; use of a modeling language.
Aims :	Learning outcomes: AA1.1, AA1.2, AA1.3 AA2.1, AA2.2, AA2.4, AA2.5 AA5.3, AA5.5 More specifically, at the end of the course the student will be able to : -- recognize the possiblity of formulating or converting a problem into a linear, convex or conic optimization program -- exploit the concept of duality in order to understand a problem, produce optimality or impossibility certificates, carry out sensitivity analysis or formulate robust problems -- describe, analyze and implement advanced algorithms to solve linear, convex or non-linear optimization problems -- use a modeling language to formulate and solve optimization problems, while understanding and exploiting the formal separation between model, data and resolution algorithm Transversal learning outcomes : -- use a numerical/computational software tool such as MATLAB, or a modeling language such as AMPL -- formulate, analyze and solve optimization models, in a small group -- write a report about the formulation, analysis and resolution of optimization models, in a small group *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Students will be evaluated with an individual written exam, based on the above-mentioned objectives. Students also carry out a series of homeworks in small groups (also taken into account for the final grade).
Teaching methods :	The course is comprised of lectures, exercise sessions and computer labs (for the AMPL modeling language).
Content :	Models: Advanced modeling techniques for linear and convex optimization ; theorem of the alternative, linear and convex duality ; sensitivity analysis and robust optimization ; conic optimization (linear, conic quadratic and semidefinite programming) ; Lagrangian duality Methods: interior-point methods for linear optimization (short- and long-step path-following methods) and for convex optimization (self-concordant barriers), first-order methods for convex optimization, algorithmic complexity ; trust-region methods ; introduction to the AMPL modeling language. Applications in various domains, such as data analysis, machine learning, finance, shape or structural optimization (mechanics), telecommunications, etc.

Bibliography :	-- Convex Optimization, Stephen Boyd et Lieven Vandenberghe, Cambridge University Press, 2004. -- Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications, Aharon Ben-Tal, Arkadi Nemirovski, SIAM 2001. -- Interior point methods for linear optimization, Cornelis Roos, Tamas Terlaky, Jean-Philippe Vial, Springer, 2006. -- Introductory Lectures on Convex Optimization: A Basic Course, Yurii Nesterov, Kluwer, 2004. -- Trust-region methods, A. Andrew R. Conn, Nicholas I. M. Gould, Ph. Philippe L. Toint, SIAM, 2000.
Faculty or entity in charge:	MAP

Programmes / formations proposant cette unité d'enseignement (UE)

Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Master [120] in Mathematical Engineering	MAP2M	5	-	
Master [120] in Biomedical Engineering	GBIO2M	5	-	
Master [120] in Computer Science	SINF2M	5	-	
Master [120] in Computer Science and Engineering	INFO2M	5	-	