Last update: 19/05/2010

26339 - MPM - Modelling in Mathematical Programming

Coordinating unit: 200 - FME - Faculty of Mathematics and Statistics

Teaching unit: 715 - EIO - Department of Statistics and Operations Research

Academic year: 2010

Degree: DEGREE IN MATHEMATICS (Syllabus 1992). (Teaching unit Optative)
DEGREE IN STATISTICAL SCIENCES AND TECHNIQUES, PLAN 99 (Syllabus 1999). (Teaching unit Optative)
MASTER IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2006). (Teaching unit Optative)
MASTER IN MATHEMATICAL ENGINEERING (Syllabus 2006). (Teaching unit Optative)
DOCTORATE IN STATISTICS AND OPERATIONAL RESEARCH (Syllabus 2007). (Teaching unit Optative)
MASTER IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2006). (Teaching unit Optative)

ECTS credits: 6 Teaching languages: Catalan

Teaching staff

Coordinator: FRANCISCO JAVIER HEREDIA CERVERA

Others: JORDI CASTRO PÉREZ

Prior skills

* Basic knowledge concerning optimization (linear, integer and nonlinear programming, flows) equivalent to that acquired on the Operations Research, Stochastic Models and Deterministic Operations Research Courses.
* Basic knowledge of programming.
* Acceptable reading ability in English.

Teaching methodology

This course has a strong applied bias. Assessment is based on assigned work (lab exercises, practical assignments and course project) undertaken by students and assessed continuously throughout the course. Intensive use is made of the course intranet via Atenea.

Theoretical sessions:
Topics 1 and 2 are studied in expository classes where student participation is encouraged and progress monitored by means of assigned practical work (lab
exercises).

Problem-solving sessions:
lab sessions during which students in groups of 2 or 3 learn how to use optimization software through assigned work in pairs (lab exercises) and three practical assignments to be carried out individually.

Practicals:
Consist of a course project. In pairs, and with the assistance of a course tutor, students must propose an original decision-making problem, its formulation and its computational resolution. The last weeks of the course are devoted to the preparation and execution of a course project, which will conclude with a session in which all the groups make a presentation of their respective work.

Learning objectives of the subject

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The overall objective of the course is for students to acquire the knowledge and the ability necessary for solving practical decision-making problems, formulated as problems of mathematical programming, which may arise during a professional or research career.
* Learn the mathematical formulation of some of the main mathematical programming models and develop the ability to formulate new ones.
* Acquire the ability to determine the most appropriate algorithm and the optimization software for solving these problems numerically.
* The ability to interpret correctly the results provided by the optimization software.

Skills to be learned
* Learn and understand some of the most important problems in linear, integer and nonlinear programming as well as network flows.
* Given the description of a new decision-making problem, be able to formulate the associated optimization problem correctly.
* The ability to implement and obtained the optimum solution for decision-making problems by selecting the most appropriate algorithm and optimization software in each particular case.

Content

Introduction to modelling in mathematical programming.

Review of the basic mathematical programming models and their algorithms.

Computational resolution of mathematical programming models.

Case studies

Qualification system

Course assessment is based on the result of the lab exercises (25 %, pairwork), the result of the practical assignments (35 %, individual) and the grade given to the course project report and presentation (40%, pairwork).

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Bibliography

Basic:

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Williams, H. P.. Model building in mathematical programming. John Wiley & Sons, 1993.

Fourer, R.; Gay, D.M.; Kernighan, B.W.. AMPL a modeling language for mathematical programming. Thomson/Brooks/Cole, 2003.

Bertsimas, D.; Freund, R.M.. Data, Models, and Decisions. The Fundamentals of Management Science. Dynamic Ideas, 2004.

Arthanari, T. S.; Dodge, Y.. Mathematical programming in statistics. Wiley, 1993.

Complementary:

Boyd, S. P.; Vandenberghe, L.. Convex optimization. Cambridge University Press, 2004.

Moré, Jorge J., Stephen J. Wright. Optimization Software Guide. SIAM Publications, 1993.

Ragsdale, Cliff T.. Spreadsheet modeling and decision analysis a practical. South-Western Publishing, 2001.