UAB
Universitat Autònoma de Barcelona

Optimisation

Code: 104396
ECTS Credits: 6

2025/2026

Degree	Type	Year
Computational Mathematics and Data Analytics	OB	2

Contact

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Teachers

Aureli Alabert Romero

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Builds on prior knowledge from Linear Algebra, Calculus (Single and Multivariable), Introduction to Programming, Numerical Methods, and Combinatorial and Graph Theory.

Objectives and Contextualisation

Learn to model decision-making problems using linear and nonlinear programming. Understand the simplex method. Solve linear programs by hand and with appropriate software. Implement nonlinear programming algorithms and use existing libraries.

Learning Outcomes

1. CM25 (Competence) Assess the difficulty of doing an analytical probability calculation in complex situations.
2. CM27 (Competence) Create reality simulation models to establish and verify hypotheses in the study of more complex problems or situations.
3. KM22 (Knowledge) Identify the basics of logistics and other fields in which operations research is applied in the technological and industrial field.
4. SM20 (Skill) Distinguish, in a problem, what is important for the construction of the mathematical model and its solution from what is not.

5. SM21 (Skill) Distinguish when analytical probability calculations can be performed and when stochastic simulation should be used.
6. SM22 (Skill) Select models of the scientific or technological reality related to a decision-making problem, expressing them in the mathematical language of optimisation problems with dynamic programming or stochastic queueing.
7. SM23 (Skill) Use computer applications for statistical analysis, numerical and symbolic calculation, graph visualisation, optimisation and others to experiment with and solve problems.

Content

1. Nonlinear Programming

- Theory of extrema
- Unconstrained optimization
- Constrained optimization

2. Linear Programming

- Modeling with linear programs
- The simplex algorithm
- Integer linear programming
- Linear network flows

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures (theoretical and practical)	49	1.96	CM25, CM27, KM22, SM20, SM21, SM22, SM23, CM25
Type: Autonomous			
Problem solving by means of programming	65	2.6	CM25, CM27, KM22, SM20, SM21, SM22, SM23, CM25
Theoretical problem solving	32	1.28	CM25, CM27, KM22, SM20, SM21, SM22, SM23, CM25

Effective learning in optimization combines three core activities: studying mathematical theory, modeling real-world problems, and solving both academic and practical problems-aligned with the applied nature of the degree. While real-world optimization problems are often complex, here "real problems" refer to simplified scenarios based on actual situations that can be reasonably addressed within the course timeframe and that illustrate the wide applicability of optimization techniques.

Theoretical content will be delivered through recommended readings and in-class lectures.

Students will practice using dedicated modeling software when available, as well as function libraries in a general-purpose programming language aligned with their prior training. Only free and/or open-source software will be used. Students will also implement complete basic algorithms and solve specific problems using them.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assignments Linear Programming	10%	0	0	CM27, KM22, SM20, SM22, SM23
Assignments NonLinear Programming	10%	0	0	CM25, SM23
Linear Programming exam	40%	2	0.08	CM27, KM22, SM20
Non linear Optimization exam	40%	2	0.08	CM25, SM21

Evaluation Criteria

- Assignments: 20% of the final grade
- Examinations: 80% of the final grade

To pass the course, students must:

- Achieve an average of 5.0 out of 10 in the exams, with no individual exam grade below 4.0
- Obtain an overall average of 5.0 out of 10, which constitutes the final course grade

Grades not meeting these requirements may be reviewed on a case-by-case basis.

Each exam will have a second sitting ("resit" in UAB's official terminology). Attending the second sitting automatically annuls the grade from the first. Assignments are not eligible for resubmission. Exams from different parts of the course may be scheduled on the same day within the same sitting.

A student will be considered eligible for evaluation if they have submitted assignments or taken exams accounting for at least 50% of the course weight, as outlined in the Evaluation Activities table. Otherwise, they will be marked as "Not Assessable."

Honors distinctions will not take into account grades from the second sitting.

Plagiarism or cheating, whether in assignments or exams, will result in an automatic fail in the course.

This subject has not single assesment

Bibliography

Essential course materials will be provided throughout the semester. Additional readings and resources will be suggested at appropriate stages of the course.

Software

Installation instructions for the required software will be provided at the appropriate time during the course.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	second semester	morning-mixed
(SEM) Seminars	1	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	morning-mixed