

## Optimisation

Code: 104396  
ECTS Credits: 6

**2024/2025**

Degree	Type	Year
2503740 Computational Mathematics and Data Analytics	OB	2

## Contact

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## Teachers

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## Teaching groups languages

You can view this information at the [end](#) of this document.

## Prerequisites

Pre-taught knowledge will be used in the subjects of Linear Algebra, Calculation in a Variable, Computation in Several Variables, Initiation in Programming, Numerical Calculation, and Algorithmism and Combining in Graphs.

## Objectives and Contextualisation

Learn to model decision-making problems in terms of linear and non-linear programs. Understand the mechanism of the simplex method. Solve linear programs, by hand and with addient software. Program non-linear programming algorithms, and use existing libraries.

## Learning Outcomes

1. CM25 (Competence) Assess the difficulty of doing an analytical probability calculation in complex situations.
2. CM25 (Competence) Assess the difficulty of doing an analytical probability calculation in complex situations.
3. CM25 (Competence) Assess the difficulty of doing an analytical probability calculation in complex situations.
4. CM25 (Competence) Assess the difficulty of doing an analytical probability calculation in complex situations.

5. CM27 (Competence) Create reality simulation models to establish and verify hypotheses in the study of more complex problems or situations.
6. CM27 (Competence) Create reality simulation models to establish and verify hypotheses in the study of more complex problems or situations.
7. KM22 (Knowledge) Identify the basics of logistics and other fields in which operations research is applied in the technological and industrial field.
8. KM22 (Knowledge) Identify the basics of logistics and other fields in which operations research is applied in the technological and industrial field.
9. SM20 (Skill) Distinguish, in a problem, what is important for the construction of the mathematical model and its solution from what is not.
10. SM21 (Skill) Distinguish when analytical probability calculations can be performed and when stochastic simulation should be used.
11. 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.
12. 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.
13. 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 extremes. Optimization without restrictions. Optimization with restrictions.

2- Linear Programming: Modeling in terms of linear programs. The simplex algorithm. Full Linear Programming. Linear flows over networks.

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures (theoretical and practical)	49	1.96	
Type: Autonomous			
Problem solving by means of programming	65	2.6	
Theoretical problem solving	32	1.28	

The efficient learning of the optimization must combine three activities: The study of the mathematical theory, the modeling of real problems, and the effective resolution of academic and real problems. All within the eminently practical character of the degree. The real optimization problems are very complex. When we talk about "real problems" here, we refer to simplifications of real situations that can be attacked within a reasonable time in the development of the course, which at the same time give a good image of the transversality of the fields of application of the optimization

The study of the theory will be done through recommended readings and master class lessons. It will tend to apply the methodology of the reversed classroom: Students must work the subject on their own and prepare the classes through recommended previous readings; In class the remarkable aspects are discussed, the

issues raised by the students are resolved and additional aspects of interest are incorporated.

It will be practiced with specific modeling software, where possible, and with function libraries in a general programming language (C / C ++ or Python) appropriate to the student's previous training. Free and / or free software will always be used. The student will also program complete basic algorithms and solve specific problems with them.

In all aspects of teaching / learning activities, the best efforts will be made by teachers and students to avoid language and situations that can be interpreted as sexist. In order to achieve continuous improvement in this topic, everyone should collaborate to show the deviations that you observe regarding this objective.

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

### Continuous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assignments Linear Programming	Thirteen percent	0	0	CM25, CM27, KM22, SM20, SM22, SM23
Assignments NonLinear Programming	Thirteen percent	0	0	CM25, SM23
Exam Linear Programming	Thirty seven percent	2	0.08	CM25, KM22, SM20, SM22, SM23
Exam NonLinear Programming	Thirty seven percent	2	0.08	CM25, SM21

The evaluation is based on:

- Homework deliveries (26% of the final grade)
- Exams (74% of the final grade).

To pass the course your must:

- Get a minimum grade of 4.0/10 in each of the exams.
- Get a global mean of 5.0/10, which will be the final grade.

Grades not satisfying these conditions can be studied case by case.

Each of the two exams will have a resit test ("recuperació" in the official terminology of the UAB). The attendance to the resit test shall automatically invalidate the grade of the first one. There is no second call for the homework deliveries.

The student that has attended exams or hand-in homework for a total of 50% or more of the course, according to the weight that appears in the Evaluation Activities table, will be evaluated. Otherwise they will be considered "not evaluable".

The plagiarism in the homework deliveries will be considered an offense as serious as any kind of cheating in an exam, and shall be penalised with an automatic course failure.

## Bibliography

During the course the essential material will be provided to follow it. Bibliographical references and other resources will be suggested at the opportune moment of the course.

## Software

To be determined

## Language list

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