# Mathematics Applied to Management

Code: 106929
ECTS Credits: 6

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2503743 Management of Smart and Sustainable Cities | FB | 1 |

## Contact

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## Teachers

Carles Pedret Ferré

## Teaching groups languages

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

## Prerequisites

The knowledge required to complete the subject is, basically, the basic mathematics skills of the middle school level.

It is also recommended to have passed, or at least completed, the subject of the first semester of the first year of the degree itself, especially the Mathematics applied to Engineering.

## Objectives and Contextualisation

The subject of Mathematics Applied to Management has two main objectives:

- Introduce the basic probability and statistical tools to analyze data from the description of natural phenomena or experiments, focusing on their correct use and the interpretation of the results.
- Introduce Operational Research concepts that are especially useful in management and include linear optimization, decision-making tools and graphs for project management: CPM and PERT methods.

The theory and problem classes will be complemented with practical classes with the aim of the student doing complementary work in order to achieve the objectives.

## Learning Outcomes

1. CM02 (Competence) Use applied mathematics in innovative solutions to solve projects related to the management, equity and sustainability of cities.
2. KM03 (Knowledge) Distinguish the main statistical sources of urban data.
3. SM01 (Skill) Identify situations characterised by the presence of randomness and analyse them using basic probabilistic tools.
4. SM03 (Skill) Use mathematical tools to solve urban or regional management and planning problems.

## Content

BLOCK I: STATISTICS

Topic 1. Descriptive statistics. Data analysis: Dispersion index, position and shape.
Descriptive study of a variable: categorical (sector diagram) and quantitative (frequency tables, bar diagram and histogram).

Topic 2. Two-dimensional descriptive statistics. Descriptive study of two variables: categorical (contingency tables) and quantitative (regression line, correlation coefficient). Linear relationship between two continuous variables: covariance and correlation.

Topic 3. Continuous probability models. Normal distribution. Typified Normal Distribution.

BLOCK 2: Operations Research.

Topic 4: Introduction to graph theory and applications. Eulerian and Hamiltonian graphs. Fleury's algorithm for path finding. Adjacency matrix and its applications. Dijkstra's algorithm for minimum cost paths. Graph coloring for assignment problems.

Topic 5: Linear programming. Modeling linear optimization problems. Solution using the graphical method. SIMPLEX algorithm. Solution with Excel.

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Classes Magistrals | 26 | 1.04 | CM02 |
| Ploblems Sessions | 18 | 0.72 | SM01, SM03 |
| Type: Supervised | | | |
| Practices | 6 | 0.24 | KM03, SM03 |
| Type: Autonomous | | | |
| Problems Desenvolupment | 40 | 1.6 | CM02, SM01, SM03 |
| Study | 42 | 1.68 | CM02, KM03, SM01 |

The teaching methodology to be followed is oriented towards the learning of the subject by the student continued

This process is based on the realization of three types of activities that will be developed in throughout the course: theoretical classes, problem seminars and practice sessions:

Theoretical classes: The student acquires the specific knowledge of the subject by attending lectures and supplementing them with cases to reinforce knowledge in theory classes. The teacher will provide information on the knowledge of the subject and on strategies to acquire, extend and organize this knowledge. The active participation of students during these sessions will be encouraged, for example by raising discussions on those points that have a higher conceptual load.

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Problem seminars: The knowledge acquired in theoretical classes is applied through practical cases. In the classroom practices there must be an understanding of the concepts introduced in the theoretical classes. Students will have to participate actively to consolidate the knowledge acquired by solving, presenting and debating related problems. Students will work individually or in groups depending on the activity

Practice Sessions: students will have to work in teams of several people in the solving mathematical problems using computational tools. Then they willhave to present them through oral and written reports. Note: 15 minutes of a class will be reserved, within the calendar established by the center/degree, so that students complete the evaluation surveys of the teaching staff's performance and the evaluation of the subject/module.

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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 |
|---|---|---|---|---|
| Block 1 Exam | 35 | 2 | 0.08 | CM02, KM03 |
| Block 2 Exam | 35 | 2 | 0.08 | CM02, KM03 |
| Consolidation proposals | 10 | 10 | 0.4 | KM03, SM01 |
| Practices | 20 | 4 | 0.16 | KM03, SM01, SM03 |

The evaluation of the subject will be done progressively and continuously throughout the semester.

The evaluation system is based on the following rules:

Activity A: Practices. Presentation of reports, in writing and orally, relating to the practices, worked on during the course, with the aim of following the evolution of each student in the understanding and use of the tools worked on in the subject, and to enhance the at the same time the acquisition of transversal skills. This activity counts for 20% of the final grade of the subject. The final mark for this activity will be the average of the marks obtained in each practice.

Activity B: Exam Block I (Statistics). Examination of the contents of Block I. This activity counts for 35% of the final mark of the subject.

Activity C: Exam Block II (Operations Research). Examination of the contents of Blocks 2. This activity counts for 35% of the final mark of the subject.

Activity D: Proposals for consolidation in the classroom throughout the course. The proposed activities count for 10% of the final grade of the subject.

In order to pass the subject, a minimum grade of 5is essential in each of the three assessment activities (A, B and C). Note that Activity A is not recoverable.

Apart from the partial tests already announced in the exam calendar for the degree, the dates for the rest of the assessment activities will be announced on the Virtual Campus. You must regularly consult this platform where various information about the operation of the subject will also be provided

a) Programming of evaluation activities
The schedule of assessment activities will be given on the first day of the subject and will be made public through the Virtual Campus (Moodle) and on the website of the School of Engineering, in the exams section.

The following schedule is planned:

Activity A: It will be communicated in the first week of class.
Activity B: Exam Block 1: dates to be determined by the School.
Activity C: Exam Block 2
Activity D: Activities that will be proposed throughout the course.
Recovery: Recovery of the Block 1 and 2 exams: dates to be determined by the School

b) Recovery process
For those students who, at the end of the evaluation process, have not obtained a grade equal to or higher than 5 in the block 1 and block 2 exams, there will be a re-evaluation. This will consist of taking, on the date planned by the School, an exam for each of the parts not passed.

If a student does not reach the minimum grade of 5 in any of the activities and for this reason does not pass the subject, the final grade will be a maximum of 4.5, i.e. equal to the value of the weighted average if is less than 4.5 or 4.5 if greater.

c) Qualification review procedure
For each assessment activity, a review place, date and time will be indicated in which the student can review the activity with the teacher. In this context, claims can be made about the grade of the activity, which will be evaluated by the teaching staff responsible for the subject. If the student does not submit to this review, this activity will not be reviewed later.

d) Qualifications
The final grade of the subject will be calculated according to the percentages mentioned above. It should be noted that:

Honor matriculations. Awarding an honors matriculation grade is solely the decision of the teaching staff responsible for the subject. UAB regulations indicate that MH can only be granted to students who have obtained a final grade equal to or higher than 9 and in an amount not exceeding 5% of the number of students.

Not assessable. A student who has not taken any A, B or C activities will be considered "not assessable".

e) Irregularities by the student, copying and plagiarism

Without prejudice to other disciplinary measures that are deemed appropriate, and in accordance with current academic regulations, irregularities committed by the student that may lead to a variation in the qualification of an act of evaluation.

Therefore, plagiarizing, copying or letting any assessment activity be copied will result in failing it with a zero and cannot be recovered in the same academic year. Therefore, this subject will be suspended directly, with no opportunity to recover it in the same course.

f) Evaluation of repeat students

For repeat students, the grade of the activities is not saved from one course to the next. Repeat students follow the same assessment rules as any other student.

## Bibliography


- A. Gilat, J. A. Macías, Matlab, Una introducción con ejemplos prácticos, 2006.
- N. Quezada, Estadística para Ingenieros, Ed. Marcombo, 1º Edición, 2020.
- A. Herrero de Egaña, M. Matilla García, A. Muñoz Cabanes, Cálculo Diferencial para Economía y Empresa, Mc-Graw-Hill, 1º Edición, 2020.
- Hermoso Gutiérrez, J.A. y Hernández Bastida, A. (2000). Curso básico de Estadística Descriptiva y Probabilidad. Némesis.
- Alzate Montoya, Paola M., Investigación de operaciones: conceptos fundamentales, Ediciones de la U., 2018.


## Software

The subject will use Microsoft Excel for the Statistics part.

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (PAUL) Classroom practices | 611 | Catalan | second semester | morning-mixed |
| (PAUL) Classroom practices | 612 | Catalan | second semester | morning-mixed |
| (TE) Theory | 61 | Catalan | second semester | morning-mixed |