UAB
Universitat Autònoma de Barcelona

Probability and Stochastic Modelling

Code: 100104
ECTS Credits: 8

2025/2026

Degree	Type	Year
Mathematics	OB	3

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

Calculus in different variables and optimization.
Mathematical analysis.

Objectives and Contextualisation

The theory of probability has its origins in the 17th century with the first formalizations of the notion of chance mo

In this subject, we will focus both on the theory (development of the mathematical model of random phenomena)

Competences

- Apply critical spirit and thoroughness to validate or reject both one's own arguments and those of others.
- Formulate hypotheses and devise strategies to confirm or reject them.
- Identify the essential ideas of the demonstrations of certain basic theorems and know how to adapt them to obtain other results.
- Recognise the presence of Mathematics in other disciplines.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Work in teams.

Learning Outcomes

1. Apply critical spirit and thoroughness to validate or reject both one's own arguments and those of others.
2. Calculate probabilities in different spaces.
3. Identify the main inequalities and discriminations in terms of sex/gender present in society.
4. Recognise real situations in which the most common probabilistic distributions appear.
5. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
6. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
7. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
8. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
9. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.

10. Use random variables and know how to use them to model real phenomena.
11. Use the concept of independence and apply central limit theorem to simple cases.
12. Work in teams

Content

1. Probabilistic models

2. Random variables and vectors

3. Mathematical expectation

4. Convergence of random variables

5. Laws of large numbers

6. Central limit theorem

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classes of problems	30	1.2	1, 2, 9, 8, 6, 4, 11, 10
Classes of theory	30	1.2	1, 2, 9, 8, 6, 4, 11, 10
Type: Supervised			
Sessions of practice	6	0.24	1, 2, 9, 8, 6, 4, 11, 10
Type: Autonomous			
Personal study	118	4.72	1, 2, 9, 8, 6, 4, 11, 10

There will be three types of face-to-face activities: theory classes, problem classes and practical classes. Attendance at the practice sessions is mandatory.

This subject will use a Moodle Classroom in the UAB Virtual Campus.

For this course, the use of AI technologies is permitted exclusively for support tasks, such as bibliographic or information searches, text correction, and translations. Students must clearly indicate which parts have been generated using this technology, specify the tools used, and include a critical reflection on how these tools have influenced both the process and the final outcome of the activity. Failure to be transparent about the use of AI in this assessed activity will be considered academic dishonesty and may result in a partial or total penalty on the activity's grade, or more serious sanctions in severe cases.

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
Continuous evaluation	100%	12	0.48	1, 2, 3, 9, 8, 7, 5, 6, 4, 12, 11, 10
Exam of recuperation	90%	4	0.16	1, 2, 3, 9, 8, 7, 5, 6, 4, 12, 11, 10

Continuous assessment:

- Attendance and evaluation of four practices: 10% of the grade.
- Two partial exams, with a weight of 45% each.

Single assessment:

- Mandatory attendance at practices.
- On the day scheduled to take the second partial exam: evaluation or delivery of the four practices (10%) and completion of two exams (45% each), where the first and second parts of the course will be evaluated, respectively.
- To pass the subject, a minimum of 3.5 (out of 10) will be required in each exam and in the practice grade.

Evaluation of the practices: The grade for the practices may be complemented with related questions included in the partial exams.

Recovery exam: It will be worth 90% and the grade of the partials can be improved. Participating in recovery involves renouncing the grade already obtained.

Minimum grade: To pass the subject, a minimum of 3.5 will be required in each partial (or its recovery) and in the practices.

"Matrícules d'Honor": They will be decided before the recovery exam.

Assessable and Non-assessable: Students who have been evaluated for at least 50% of the subject will be qualified as assessable at the end of the course. Otherwise, their rating will be Non-assessable.

Bibliography

Xavier Bardina. *Càlcul de Probabilitats*. Servei de Publicacions UAB, 2004.

Marta Sanz-Solé . *Probabilitats*. Edicions Universitat de Barcelona, 1999.

Quentin Berger, Francesco Caravenna, Paolo Dai Pra. *Probabilità. Un primo corso attraverso esempi, modelli e applicazioni.* UNITEXT, volume 127, Springer, 2021.

Aureli Alabert. *Mesura i Probabilitat (2a ed.).* Servei de Publicaciones UAB, 1997. (Disponible a *http://gent.uab.cat/aureli_alabert/content/teaching*)

Olga Julià, David Márquez, Carles Rovira i Mònica Sarrà. *Probabilitats: Problemes i més problemes*. Publicacions i edicions Universitat de Barcelona, 2005.

Software

R software will be used in practical classes.

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
(PAUL) Classroom practices	1	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	2	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	1	Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	2	Spanish	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed