

Probability and stochastic modelling

Code: 100104
ECTS Credits: 8

2024/2025

Degree	Type	Year
2500149 Mathematics	OB	3

Contact

Name: Giulia Binotto

Email: giulia.binotto@uab.cat

Teachers

Giulia Binotto

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.

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
Continuous evaluation	100%	12	0.48	1, 2, 3, 9, 8, 7, 5, 6, 4, 12, 11, 10

Continuous assessment:

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

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

Single assessment:

- Mandatory attendance at practices.
- On the day scheduled to take the second partial exam: delivery of the four practical assignments (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.

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.

"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.

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.

Language list

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	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed

PROVISIONAL