

**Probability and stochastic modelling**

Code: 100104  
ECTS Credits: 8

Degree	Type	Year	Semester
2500149 Mathematics	OB	3	1

**Contact**

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**Use of Languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**Teachers**

Rosario Delgado de la Torre

**Prerequisites**

Calculus in several variables and optimization. Mathematical Analysis

**Objectives and Contextualisation**

The applications of probability include practically all the sciences

and technology, being also the theoretical basis of Statistics. In

this course we will focus both on the theory (development of the

mathematical model of random phenomena) and on the most applied

aspects of modeling (find the right probability space) of real

problems and their resolution through the techniques learned.

## 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

## Methodology

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: <http://cv.uab.cat>. Students will be able to communicate with the teachers through the email, always sent from the institutional address @e-campus.uab.cat.

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.

## Activities

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

## Assessment

Continued evaluation:

Assistance and delivery of four practices: 10% of weight.

Two partial examinations, with a weight of 45% each.

Final examination of recuperation: of the two partial examinations The marks of the partial examinations can be improved.

Presented and not presented: Students who have presented at least 50% of the subject will be qualified as presented at the end of the course. Otherwise your rating will be Non-evaluable.

## 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

## Bibliography

### Bibliografy

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](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

We will use the statistical software R.