UAB
Universitat Autònoma de Barcelona

Simulation and Resampling

Code: 104868
ECTS Credits: 6

2025/2026

Degree	Type	Year
Applied Statistics	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

It is assumed that the student has acquired the competences of the previous courses in Statistics Inference,
Probability, and Stochastic Processes, and that they has a good level with the R programming language.

Objectives and Contextualisation

- Learn how to generate samples using a computer and apply it to the analysis of complex systems and
  process optimization.
- Learn resampling techniques in statistical inference and machine learning.

Learning Outcomes

1. KM15 (Knowledge) Identify simulation and resampling algorithms and techniques, and models for
   complex situations, fostering innovation in the field of statistics.
2. SM15 (Skill) Solve unconventional inference problems using simulation and resampling techniques.

Content

1. Permutation tests: Two-sample tests. Test with paired data. Correlation tests. Advanced examples.
2. Bootstrap and other resampling methods: Basic concepts. Estimations of standard error and bias. Parametric bootstrap. Non-parametric bootstrap. Mehtods to compute confidence intervals. Applications (linear and generalised-linear models, hyothesis testing, time series, ...).
3. Resampling for machine learning: Bagging. Boosting.
4. Simulation: Simulation of random variables and vectors. Discrete Event Simulations. Output analysis. Imput modelling. Generation of random numbers.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures (theoretical and practical)	50	2	KM15, SM15, KM15
Type: Autonomous			
Assignments	48	1.92	
Personal study of the subject	48	1.92	

The metodology will combine classroom lectures delivered by the teachers and practical work of the student with computers.

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
Exam of Resampling	40%	2	0.08	KM15, SM15
Exam of Simulation	405	2	0.08	KM15, SM15
Resampling assignments hand in	10%	0	0	KM15, SM15
Simulation Assignments hand in	10%	0	0	KM15, SM15

Assessment Criteria

- Exams: 80% of the final grade
- Assignments: 20% of the final grade

To pass the course, students must:

- Achieve an average score of 5.0 out of 10 in the exams, with no individual score below 4.0
- Obtain an overall average of 5.0 out of 10, which will represent the final course grade

Grades that do not meet these requirements may be reviewed on a case-by-case basis.

Each exam will have a resit opportunity ("recuperation" in UAB's official terminology). Attending a resit automatically annuls the original exam grade. Assignments are not eligible for resubmission. Exams from different parts of the course may be scheduled on the same day within the same resit period.

A student will be considered eligible for evaluation if they have submitted assignments or taken exams covering at least 50% of the course weight, as indicated in the Evaluation Activities table. Otherwise, their status will appear as "Not Assessable."

Grades from the resit period will not be considered for the possible awarding of Honors Distinction ("Matrícula d'Honor").

Plagiarism or copying, whether in assignments or during exams, will be treated equally and will result in an automatic fail for the course.

Single Assessment:
Students who choose the single assessment modality will be evaluated through a single comprehensive exam covering all course content, including practicals. No assignments will be submitted. Part of the exam may include an oral component. If students pass the first sitting, no resit option will be availableto improve the grade.

Bibliography

- Law (2014) Simulation. Modelling and Analysis.
- James - Witten - Hastie - Tibshirani (2013) An introduction to Statistical Learning: with applications in R. Springer (Recurs electrònic UAB).
- Efron - Hastie (2016) Computer Age Statistical Inference. Cambridge University Press.

Software

During the course the relevant installation instructions for the software to be used will be given, at the appropriate time.

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
(PLAB) Practical laboratories	1	Catalan	second semester	afternoon
(TE) Theory	1	Catalan	second semester	afternoon