Universitat Autònoma de Barcelona

2020/2021

Simulation and Resampling

Code: 104868
ECTS Credits: 6

Degree	Type	Year	Semester
2503852 Applied Statistics	OB	3	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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

Other comments on languages

This document is an unsupervised translation. In case of discrepancy, the Catalan version shall prevail.

Teachers

Roger Borras Amoraga

External teachers

Aureli Alabert Romero

Prerequisites

It is assumed that the student has acquired the competencies of the Statistics Inference, Probability Calculation, and Stochastic Processes, and that he has a good level and practice with the R programming.

Objectives and Contextualisation

Learn how to generate samples with a computer and apply it to the analysis of complex systems, the optimization of processes and the techniques of remorting in inference.

Competences

- Correctly use a wide range of statistical software and programming languages, choosing the best one for each analysis, and adapting it to new necessities.
- Critically and rigorously assess one's own work as well as that of others.
- Make efficient use of the literature and digital resources to obtain information.
- Select and apply the most suitable procedures for statistical modelling and analysis of complex data.

- 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.
- Use quality criteria to critically assess the work done.
- Work cooperatively in a multidisciplinary context, respecting the roles of the different members of the team.

Learning Outcomes

1. Critically assess the work done on the basis of quality criteria.
2. Describe the advantages and disadvantages of algorithmic methods compared to the conventional methods of statistical inference.
3. Identify the statistical assumptions associated with each advanced procedure.
4. Identify, use and interpret the criteria for evaluating compliance with the requisites for applying each advanced procedure.
5. Implement bootstrap methods.
6. Make effective use of references and electronic resources to obtain information.
7. Reappraise one's own ideas and those of others through rigorous, critical reflection.
8. Solve inference problems through simulations.
9. Solve problems in calculating probabilities and stochastic processes through simulation.
10. 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.
11. 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.
12. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
13. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
14. Work cooperatively in a multidisciplinary context, accepting and respecting the roles of the different team members.

Content

Simulation: Simulation of random variables based on uniform law. Simulation of discrete events. Simulation with the simmer package. Analysis of the output, reduction of the variance. Generation of uniform variables.
Permutational tests: Tests for two samples. Paired test of data. Correlation test. Advanced examples
Bootstrap and other remotencing methods: Basics. Standard and bias error estimates. Parametric Bootstrap. Non-parametric Bootstrap. Methods for calculating trusted intervals. Examples of application (generalized linear and linear models, hypothesis tests, temporary series, ...).
Remuestreig for automatic learning: Bagging. Boosting

Methodology

Teaching will combine classroom lessons by teachers and practical work for students with a computer.

In all aspects of teaching / learning activities, the best efforts will be made by
teachers and students to avoid language and situations that can be interpreted as sexist. To
To achieve continuous improvement in this subject, everyone should collaborate in highlighting them
Deviations that you observe regarding this objective.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom lectures (theoretical and practical)	52	2.08	
Type: Autonomous			
Assignments	64	2.56	
Personal study of the subject	30	1.2	

Assessment

An exam will be done for each of the two parts of the subject (simulation and remotion), which will include both the theory and the practical part. The resulting grade will represent 60% of the final grade. The evaluation of practical assignments will represent the remaining 40% of the final mark.

To pass the course, you must:

Obtain an overall average of 5 out of 10. (Notes starting at 4.8 will be assessed on a case by case basis). Obtain a minimum of 4 out of 10 in each of the two parts of the course (simulation and remotion), both in practice assignments and in examinations.

From each one of the examinations there will be a second call to recover / improve the note. The delivery of this second exam will automatically annul the note of the first call. The deliveries are NOT recoverable. In the same call, the examinations of the different parties do not necessarily have to be on different days.

The student who has submitted works or has taken exams for a total of at least 50% of the subject will be considered evaluable, according to the weight that appears in the following table of Evaluation activities. Otherwise, it will appear in the Minutes as Non-Valuable.

The notes of the second call will not be taken into account for the allocation of Honor Matriculations.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam of Resampling	Thirty per cent	2	0.08	2, 3, 5, 13, 10, 8, 9
Exam of Simulation	Thirty per cent	2	0.08	2, 3, 5, 13, 10, 8, 9
Resampling assignments hand in	Twenty per cent	0	0	7, 1, 3, 4, 5, 12, 10, 11, 8, 9, 14, 6
Simulation Assignments hand in	Twenty per cent	0	0	7, 1, 3, 4, 5, 12, 10, 11, 8, 9, 14, 6

Bibliography

- Ross, Sheldon (2013) Simulation. Elsevier (Recurs electrònic UAB).
- Efron, Bradley (1982) The jackknife, the bootstrap and other resampling plans. Society for Industrial and Applied Mathematics.
- Efron, Bradley (1993) An Introduction to the Bootstrap. Chapman & Hall.
- Gareth, J. et al. (2013) An introduction to Statistical Learning: with Application in R. Springer.