UCLouvain

lboe2112

2026

Data analysis and modeling of biological systems

5.00 credits	30.0 h + 45.0 h	Q1

Teacher(s)	Schtickzelle Nicolas ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	The student masters the bases of statistics and data analysis, including probabilities, statistical inference method, analysis of variance, linear regression. The student masters programming in the R language.
Main themes	Advanced statistical analysis techniques for biological data: multivariate statistics, generalized linear mixed models.
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 **Contribution of the teaching unit to the program's AA reference framework** In line with the BOE2M program's competency framework, this teaching unit contributes to the development and acquisition of the following skills: 3 (3.3, 3.4, 3.5, 3.6) 2 **Course-specific learning outcomes :** The student expands her/his knowledge in data visualization and statistical analysis, with a specific focus on multivariate statistical methods and generalized mixed linear models
Evaluation methods	The two modules will be evaluated separately, each module contributing 10/20 to the final score. As the final score must be an integer number, the sum of the two notes will be rounded up if both modules are passed (at least 5/10) and down if it is not the case. *Module 1 (Linear statistical modelling) :* Open book exam, including two exercises on LMM and GLM(M) on R (based on practical sessions and first seminar) and one case study (based on second seminar). *Module 2 (Multivariate data analysis) :* Open book written exam consisting of multiple choice questions, open questions and practical solution of exercises with R software on a computer. The exam is conducted on Moodle, in a computer room on campus. Unless otherwise stated in the exam instructions on Moodle, only the use of the UCLouvain computer in the computer room is authorized to access the exam and electronic documentation, and the use of artificial intelligence is prohibited.
Teaching methods	Lectures, seminars, and exercise sessions in a computer room. The student is encouraged to interactivity for all these activities. Exercises : learn to solve a statistical problem. Find the appropriate analysis when faced with a problem, check the application conditions relating to the use of this analysis, perform the statistical test on the R software, interpret the results obtained and illustrate them.
Content	Module 1 : *Linear statistical modeling* • Chapter 1 – Recap of basic concepts • Chapter 2 – Recap of normal linear models • Chapter 3 – Generalized linear models • Chapter 4 – Linear mixed models Module 2 : *Multivariate data exploration* This module contains the following chapters • Chapter 1 - Multivariate data and their visualization • Chapter 2 - A first technique in detail: ordination by Principal Component Analysis (PCA) • Chapter 3 - Ordination of a contingency table: Correspondence Analysis (CA) • Chapter 4 - Expanding to other ordination techniques: Multidimensional scaling • Chapter 5 - Grouping objects: Clustering • Chapter 6 - Assigning objects to groups: Discriminant analysis
Inline resources	All resources are available on the Moodle website: visuals of the lectures and practical sessions, data sets and R scripts, links to additional resources and supporting books.

Other infos	A basic knowledge of the R software is required: the student is expected to be able to create and modify R-data sets independently and perform basic data management and statistical analysis procedures. If such knowledge is not acquired, the student must be trained autonomously in these skills, e.g. by means of the many resources available online for free.
Faculty or entity in charge	BIOL

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Biology of Organisms and Ecology	BOE2M	5		
Master [60] in Biology	BIOL2M1	5		