Teaching Guide				
Identifying Data				2023/24
Subject (*)	Data Analysis in Biology		Code	610G02044
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Fourth	Optional	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Matemáticas			
Coordinador	Estevez Perez, Maria Graciela	E-mail	graciela.estevez.perez@udc.es	
Lecturers	Estevez Perez, Maria Graciela Jacome Pumar, Maria Amalia	E-mail	graciela.estevez.perez@udc.es maria.amalia.jacome@udc.es	
Web	https://sway.office.com/4iBO2Cq6U5WJleg0?ref=Link			
General description	This subject provides a first contact with advanced statistical techniques including: statistical modelling, statistical tools for data analysis, procedures to check structural assumptions on the models, and criteria to establish a critical review of the attained results, estimulating the interpretation of these results in terms of specific analyzed problem. The main objectives are: - Domain of a broad range of statistical methods in an integrated way, but emphasizing the particular properties of each of them. Specifically, the pursued targets and the required conditions for their application. - Obtaining valuable knowledge for a critical and rigorous analysis of the attained results. - Complementing the practical aspects of the learning process with the use of statistical software.			

Study programme competences	
Code	Study programme competences
A21	Deseñar modelos de procesos biolóxicos.
A26	Deseñar experimentos, obter información e interpretar os resultados.
A30	Manexar adecuadamente instrumentación científica.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B6	Organizar e planificar o traballo.
B10	Exercer a crítica científica.

Learning outcomes			
Learning outcomes	Study programme competences		
To learn how to design experiments, to acquire and develop skills to interpret and discuss statistical results.	A21 A26 A30	B2 B3 B5 B6 B10	

Developing critical and creative thinking skills to address problems in an effective way.		B2 B3 B4 B5 B6 B10	

Contents	
Topic	**Sub-topic**
Lineal regression models	Simple linear regression model Multiple linear regression model Other regression models
Design and analysis of experiments	Basic principles. Planning experiments ANOVA models with one and more than one sources of variation Complete blocks designs Designs including random effects Introduction to covariance analysis
Introduction to multivariate analysis	Description of multivariate data Principal component analysis Multivariate analysis of variance Discriminant analysis Cluster analysis

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Supervised projects	A21 A26 A30 B2 B3 B4 B5 B6 B10	4	10	14
ICT practicals	A26 A30 B2 B3 B10	14	22.4	36.4
Problem solving	A26 B2 B3 B5 B10	6	9.6	15.6
Guest lecture / keynote speech	A26 B2 B3 B6 B10	22	55	77
Short answer questions	A21 B2 B3 B6	2	0	2
Objective test	A21 A26 A30 B2 B3 B4 B6 B10	3	0	3
Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Supervised projects	Students should develop one or two practical works related to the subject contents. These works could be defended during a pre-established seminar.
ICT practicals	Practical classes in the computer lab conducted to provide some knowledge on the use of statistical software (mainly the R-commander package). These classes are specifically designed to learn the elementary use of the package and to interpret its outputs. Use of software helps to focus attention on the statistical issues rather than on the calculation.
Problem solving	Solving real problems in order to use statistical techniques fluently, empashizing their practical application.
Guest lecture / keynote speech	Lectures where the basic theoretical principles of the subject are presented together with properly illustrated practical examples.
Short answer questions	Multiple choice and short answer questions to assess the progress for each unit of the subject. They will be online using moodle.udc.es.

Objective test	Final exam on the theoretical and practical contents of the subject. This exam consists in answering a list of short questions and/or solving some longer exercises in a reasoned way.

Personalized attention	
Methodologies	**Description**
Supervised projects	There will be personalized advice sessions during the development of the practical works. These sessions will take place by means of the interaction teacher/students at the moment of solving the different activities suggested in class: solving doubts, correcting mistakes, suggesting proper approaches to deal with the proposed problems and reviewing initial versions of the works. In addition to this, students will have the opportunity of receiving personalized advice in the office of the teachers. Personalize advice may be also received via online (e-mail, virtual platform,...). Part-time students are not required to defend their works in class, but these works must be provided to the teachers for their assessment. Part-time students can also receive personalized assistance using both face-to-face and virtual approaches.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Supervised projects	A21 A26 A30 B2 B3 B4 B5 B6 B10	Application of several statistical techniques to practical cases.	40
Objective test	A21 A26 A30 B2 B3 B4 B6 B10	Test for skills assessment.	40
Short answer questions	A21 B2 B3 B6	Multiple choice and short answer questions to assess the progress for each unit of the subject.	20

Assessment comments

The objective tests, in each of the two opportunities, will consist of multiple choice and short answer questions, related to the application of the studied statistical methodologies and the interpretation of the corresponding results. The supervised projects will be practical projects in group, with the implementation of some of the different statistical methodologies to a real data set given by the teacher/s, using statistical software (R). The score of the supervised projects will be kept during the current academic course. In case one (or both) supervised project(s) is (are) not submitted for the first opportunity in January, it (they) may be submitted for the second opportunity in July. To pass the subject, it will be strictly necessary to pass each block separately. Otherwise, if only one or no blocks are passed, the final score will be 4.5 at most. To pass each block, it is necessary that the score of the objective test, for this block, is not lower than 3 out of 10 and the global score of all the assessment activities of the block is not lower than 4.5 out of 10. For any of the two opportunities to pass the subject, the ?NON PRESENTADO? grade will be given only to the students who did not submit any of the supervised projects nor take the objective test. All these remarks are applied to the part-time students and/or with academic exemption. All these remarks are applied to the December session exam. Fraud in tests or evaluation activities will directly involve the implementation of the current rules in the Assessment, review and complaint regulation of the UDC and the Student Statute of the UDC

Sources of information	
Basic	Referencias básicas: Material elaborado polo profesorado da materia e posto a disposición do alumnado a través do Campus Virtual Bibliografía complementaria: Kuehl, R.O. (2001). Diseño de Experimentos. Principios estadísticos para el diseño y análisis de investigaciones. 2nd ed. Thomson Learning.Logan, M. (2011). Biostatistical design and analysis using R: a practical guide. John Wiley & Sons.Mangiafico, S.S. (2015). An R Companion for the Handbook of Biological Statistics , version 1.3.9, revised 2023. rcompanion.org/rcompanion/. (Pdf version: rcompanion.org/documents/RCompanionBioStatistics.pdf.)McDonald JH (2014). Handbook of biological statistics. 3rd ed Sparky House Publishing, Baltimore, USA. (http://www.biostathandbook.com/small.html)Milton, J.S. (2001). Estadística para Biología y Ciencias de la Salud, 3ª Edición,McGraw-Hill.Montgomery, D.C. (2005). Design and Analysis of Experiments. 6th Edition J. Wiley and Sons.Peña, D. (2002). Análisis de Datos Multivariantes. McGraw-Hill.Peña, D. (2002). Regresión y diseño de experimentos. Alianza EditorialSarabia Alegría, J. M., Prieto Mendoza, F., & Jordá Gil, V. (2018). Prácticas de estadística con R. Comercial Grupo ANAYA, SA.Valiente, L. P., & Tejedor, I. H. (2014). Bioestadística sin dificultades matemáticas. Ediciones Díaz de Santos.
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Statistics/610G02005
Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus
Other comments
1- Attendance and participation in both theoretical and practical lectures. 2- Complete all the problems solved in the development of the classes, with and without using statistical software.3- Complement the materials provided by the teachers using the recommended references. 4- Continually review the work done in class by solving questionnaires and proposed problems. 5- Active participation in seminars scheduled for the presentation and defense of practical works.6- Regular use of statistical software.7- Application of statistical techniques to address problems arising in other subjects. 8- Take advantage of a regular participation in the personalized tutorial sessions.Green Campus Science Faculty ProgramTo contribute to achieve an immediate sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documentary works carried out in this subject:- They will be requested mostly in virtual format and electronic form.- If it is printed: - Plastics will not be used. - Double-sided prints will be made. - Recycled paper will be used. - Drafts will be avoided.Incorporation of the gender perspective- As stated in the various applicable regulations for university teaching, the gender perspective must be integrated into this subject (using non-sexist language, using bibliography from authors of both genders, encouraging the participation of male and female students in classroom...).- Efforts will be made to identify and modify sexist biases and attitudes, and the environment will be influenced to change them and promote values of respect and equality.- Situations of gender discrimination should be identified, and actions and measures will be proposed to correct them.