



## Teaching Guide

Identifying Data					2021/22
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, María Graciela	E-mail	graciela.estevez.perez@udc.es		
Lecturers	Estevez Perez, María Graciela González Rueda, Ángel Manuel Jacome Pumar, María Amalia	E-mail	graciela.estevez.perez@udc.es angel.manuel.rueda@udc.es maria.amalia.jacome@udc.es		
Web					
General description	<p>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, estimating the interpretation of these results in terms of specific analyzed problem. The main objectives are:</p> <ul style="list-style-type: none"><li>- 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.</li><li>- Obtaining valuable knowledge for a critical and rigorous analysis of the attained results.</li><li>- Complementing the practical aspects of the learning process with the use of statistical software.</li></ul>				



Contingency plan

1. Modifications to the contents

No changes will be performed

2. Methodologies

\*Teaching methodologies that are maintained

Short answer questions: (20% final score), it will be online using Virtual Classroom.udc.es

Supervised projects: (40% final score), they consist in the implementation of some of the different statistical methodologies to a real data set given by the teacher/s, using statistical software

\*Teaching methodologies that are modified

Guest lecture / keynote speech: non assessable. They will be given using TEAMS in the time slot the subject is assigned in the official calendar.

ICT practicals: non assessable. The face-to-face classes consisted of analyzing real data set using statistical software (R) in a computer lab. In case they cannot be carried out on-site, they will be replaced with fully detailed guidelines (PDF) so the students can follow them by themselves. The scheduled sessions in the official calendar for 4rd course in the Degree of Biology will be used to comment, correct and solve all the questions, using Teams.

Objective test: (40% final score) They will not be face-to-face anymore but online using Virtual Classroom.

3. Mechanisms for personalized attention to students

E-mail Daily, to make queries, ask for tutorial sessions and for the follow-up of the practical projects.

Videoconferencia (Teams): Individual or group tutorial sessions on request, previously scheduled using e-mail.

Virtual Classroom: Daily, according to the student's needs. In the web platform Teams, the learning material will be stored.

Discussion forums will be created linked to the units of the subject, to make queries and solve questions.

4. Modifications in the evaluation

Objective test: (40% of the final score). For each block of the subject, it will consist of multiple choice and short answer questions, related to the application of the methods explained in the subject, and the interpretation of the corresponding results. In case of technical problems, the objective test might be done in a different time or day.

Supervised projects: (40% of the final score). Practical project 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.

Short answer questions : (20% of the final score). They will be online using Virtual Classroom.udc.es, one for each unit of the subject

\*Evaluation observations:

The score of the supervised projects will be kept during the current academic course. In case one (both) supervised project(s) is (are) not submitted for the first opportunity in January, it (they) will be required for the second opportunity in July. Part-time students and/or with academic exemption must submit these supervised projects as well.

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 imply the failure grade "0" in the subject in the corresponding call, thus invalidating any grade obtained in all the evaluation activities for the extraordinary call.

5. Modifications to the bibliography or webgraphy

No changes will be performed, all the materials are available in Virtual Classroom.



(II) MODIFICATION IN CASE THE CAPACITY OF THE CLASSROOM ASSIGNED FOR THE SUBJECT IS EXCEEDED

The modification is the allocation of two or more classrooms to the subject, and teaching online using TEAMS for the students who are not in the classroom with the teacher.



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	<p>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,...).</p> <p>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.</p>

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. They will be online using moodle.udc.es.	20

Assessment comments
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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) will be required for the second opportunity in July. Part-time students and/or with academic exemption must submit these supervised projects as well.

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

<p><b>Basic</b></p>	<ul style="list-style-type: none"> <li>· Kuehl, R.O. (2001) Diseño de Experimentos. Principios estadísticos para el diseño y análisis de investigaciones. 2nded. Thomson Learning.</li> <li>· Logan, M. (2011). Biostatistical design and analysis using R: a practical guide . John Wiley &amp; Sons.</li> <li>· Milton, J.S. (2001). Estadística para Biología y Ciencias de la Salud , 3ª Edición, McGraw-Hill.</li> <li>· Montgomery, D.C. (2005) Design and Analysis of Experiments. 6th Edition J. Wiley and Sons.</li> <li>· Peña, D. (2002). Análisis de Datos Multivariantes . McGraw-Hill.</li> <li>· Peña, D. (2002). Regresión y diseño de experimentos. Alianza Editorial</li> </ul>
<p><b>Complementary</b></p>	<ul style="list-style-type: none"> <li>· Box, G.E.P., Hunter, W.G. &amp; Hunter, J.S. (1978). Statistics for Experimenters. An introduction to Design, Data Analysis, and Model Building. Wiley Series in Probability and Mathematical Statistics. John Wiley &amp; Sons, Inc.</li> <li>· Cao, R. et al. (2001). Introducción a la Estadística y sus aplicaciones. Ed. Pirámide, Madrid.</li> <li>· Dean, A. &amp; Voss, D. (1999) Design and Analysis of Experiments. Springer-Verlag, New York.</li> <li>· Gibbons, J.D. &amp; Chakraborti, S. (1992). Nonparametric Statistical Inference. 3rd ed. Marcel Dekker, New York (1992).</li> <li>· Jobson, J.D. (1992). Applied Multivariate Analysis. Vol. II: Categorical and Multivariate Methods. Springer Texts in Statistics, Springer-Verlag: New York.</li> <li>· Martín Andrés, A. &amp; De Dios Luna del Castillo, J. (1994). Bioestadística para las Ciencias de la Salud. 4ª Edición. Eds. NORMA S.A.</li> <li>· Millard, S.P. &amp; Neerchal, N.J. (2001) Environmental Statistics with S-Plus. Springer. CRC Press LLC.</li> <li>· Prat, A., Tort-Martorell, X., Groma, P. &amp; Pozueta, L. (1997). Métodos estadísticos. Control y mejora de la calidad. Edicions UPC (Universitat Politècnica de Catalunya).</li> <li>· Zar, J.H. (1996). Biostatistical Analysis. 3rd. ed. Prentice Hall International.</li> </ul>

### 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.

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.