



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                                                               |        |                                                                                                                                                                                   |           |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                                                               |        |                                                                                                                                                                                   | 2019/20   |
| Subject (*)         | Statistics                                                                                                                                                                                                                                    |        | Code                                                                                                                                                                              | 610G02005 |
| Study programme     | Grao en Bioloxía                                                                                                                                                                                                                              |        |                                                                                                                                                                                   |           |
| Descriptors         |                                                                                                                                                                                                                                               |        |                                                                                                                                                                                   |           |
| Cycle               | Period                                                                                                                                                                                                                                        | Year   | Type                                                                                                                                                                              | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                                                         | First  | Basic training                                                                                                                                                                    | 6         |
| Language            | Spanish                                                                                                                                                                                                                                       |        |                                                                                                                                                                                   |           |
| Teaching method     | Face-to-face                                                                                                                                                                                                                                  |        |                                                                                                                                                                                   |           |
| Prerequisites       |                                                                                                                                                                                                                                               |        |                                                                                                                                                                                   |           |
| Department          | Matemáticas                                                                                                                                                                                                                                   |        |                                                                                                                                                                                   |           |
| Coordinador         | Jacome Pumar, Maria Amalia                                                                                                                                                                                                                    | E-mail | maria.amalia.jacome@udc.es                                                                                                                                                        |           |
| Lecturers           | Estevez Perez, Maria Graciela<br>González Rueda, Ángel Manuel<br>Jacome Pumar, Maria Amalia<br>López Cheda, Ana<br>Meilán Vila, Andrea<br>Novo Díaz, Silvia<br>Novoa Flores, Guido Ignacio                                                    | E-mail | graciela.estevez.perez@udc.es<br>angel.manuel.rueda@udc.es<br>maria.amalia.jacome@udc.es<br>ana.lopez.cheda@udc.es<br>andrea.meilan@udc.es<br>s.novo@udc.es<br>guido.novoa@udc.es |           |
| Web                 |                                                                                                                                                                                                                                               |        |                                                                                                                                                                                   |           |
| General description | This subject provides a first contact with the statistical techniques: statistical modelling, statistical tools to analyze data, and methods for the critical diagnosis and interpretation of the results in terms of the considered problem. |        |                                                                                                                                                                                   |           |

## 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.                    |
| B6   | Organizar e planificar o traballo.                                   |
| B10  | Exercer a crítica científica.                                        |

## Learning outcomes

| Learning outcomes                                                                        | Study programme competences |                 |  |
|------------------------------------------------------------------------------------------|-----------------------------|-----------------|--|
| To design experiments, to get information and to explain the results                     | A21<br>A26<br>A30           | B2<br>B3<br>B10 |  |
| To apply an inquisitive, logical and creative reasoning to solving problems effectively. |                             | B2<br>B3<br>B6  |  |

## Contents

| Topic                  | Sub-topic                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------|
| Probability Theory     | Basic concepts on probability theory<br>Random variables<br>Basic probability distributions in Biology |
| Descriptive Statistics | Describing univariate data<br>Describing bivariate data                                                |



|                       |                                                                                                                                                                                    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Statistical Inference | Introduction<br>Point estimation<br>Interval estimation<br>Parametric hypothesis testing of one and several samples<br>Nonparametric hypothesis testing of one and several samples |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Planning                                                                                                                        |                         |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies            | Ordinary class hours | Student's personal work hours | Total hours |
| Short answer questions                                                                                                          | A21 B2 B3 B6            | 2                    | 0                             | 2           |
| ICT practicals                                                                                                                  | A26 A30 B2 B3 B6<br>B10 | 13                   | 26                            | 39          |
| Problem solving                                                                                                                 | A21 B2 B3 B6 B10        | 8                    | 19.2                          | 27.2        |
| Guest lecture / keynote speech                                                                                                  | A21 A26 B2 B3 B10       | 24                   | 52.8                          | 76.8        |
| Objective test                                                                                                                  | A26 A30 B2 B3 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                                                                                                                                                                               |
| Short answer questions         | Short answer and/or test questions with the aim of controlling the progress in the PROBABILITY contents block.                                                                            |
| ICT practicals                 | Practicals in the computer lab to introduce a statistical software helpful to solve problems.                                                                                             |
| Problem solving                | Seminars in small groups for the explanation and discussion of problems from the different contents blocks.                                                                               |
| Guest lecture / keynote speech | Face to face keynote speeches, where the lecturer will show the fundamental parts of the theoretical program, suitably illustrated with practical examples.                               |
| Objective test                 | Final exam, with short answer questions and/or reasoned solution of practical problems, of the DESCRIPTIVE STATISTICS and STATISTICAL INFERENCE theoretical and practical content blocks. |

| Personalized attention |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies          | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ICT practicals         | <p>Optionally, some academic work consisting on the solution of a practical problem using the statistical software introduced in the ICT practicals, could be carried out.</p> <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, students will have the opportunity of receiving personalized advice in the office of the teachers.</p> <p>Personalized advice may be also received via online, by means of e-mail, virtual platform,...</p> <p>Part-time students may also perform these works and submit them 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 |
| Short answer questions | A21 B2 B3 B6 | Achievement test to assess the knowledge in the PROBABILITY THEORY block. | 40            |



|                |                   |                                                                                                          |    |
|----------------|-------------------|----------------------------------------------------------------------------------------------------------|----|
| Objective test | A26 A30 B2 B3 B10 | Achievement test to assess the knowledge in the DESCRIPTIVE STATISTICS and STATISTICAL INFERENCE blocks. | 60 |
|----------------|-------------------|----------------------------------------------------------------------------------------------------------|----|

## Assessment comments

The subject is split in two blocks: 1- Probability Theory and 2-Descriptive Statistics-Statistical Inference. Each block will be assessed independently, so that passing one block will not affect the grade of the other. To pass the whole subject, it will be strictly necessary to pass each block separately. Otherwise, the final score will be 4.5 at most.

During the course, two exemption exams might be performed, each for any of the two blocks, so that the student who passes any of the exemption exams, will have the corresponding block passed regarding the may/july final exams.

The PROBABILITY THEORY block represents 40% of the qualification, and the DESCRIPTIVE STATISTICS and STATISTICAL INFERENCE block the remaining 60%.

To get the grade/mark NP (No grade reported, absent) in may, the student should not have attended any exemption exams nor the official test. To get the grade/mark NP in july, the student should not attend the final exam.

The attendance and participation to the seminars, practicals, personalized attention, etc. is not compulsory but it could be additionally with a maximum of one point over and above the final mark.

All previous observations are applicable to part-time students and/or with academic exemption.

## Sources of information

|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic | <p>? ARRIAZA GÓMEZ, A.J. (2008) Estadística básica con R y R-Commander. Servicio PublicacionesUCA. ? BEHAR GUTIÉRREZ, R. y GRIMA CINTAS, P. (2010). 55 respuestas a dudas típicas de estadística. 2a Ed. Díaz de Santos, Madrid.? CAMPOS ARANDA, M. (2011). Más de 777 preguntas de Bioestadística y sus respuestas. Murcia, DM.? CAO ABAD, R. y otros (2001). Introducción a la estadística y sus aplicaciones. Ed. Pirámide. ? DE LA HORRA NAVARRO, J. (2001). Estadística Aplicada. 2ª Edición. Díaz de Santos.? GONICK, L. Y SMITH, W. (2001). A estatística ¡en caricaturas!. SGAPEIO.? MARTÍN, A. A. Y LUNA, J. C. (1999). Bioestadística para las Ciencias de la Salud. 4ª Edición revisada. Ediciones Norma.? MILTON, J. S. (2001). Estadística para Biología y Ciencias de la Salud.3ª edición. McGraw-Hill.? RIUS DÍAZ, F. y otros. (1999). Bioestadística: Métodos y Aplicaciones. Universidad de Málaga.? SAMUELS, M. L.; WITMER, J.A. Y SCHAFFNER, A. (2012). Fundamentos de estadística para las ciencias de la vida. 4ª edición. Pearson España? TOMELO PERUCHA V. y UÑA JUÁREZ I. (2003). Lecciones de Estadística Descriptiva. Paraninfo.? RIUS DÍAZ, F. y BARÓN LÓPEZ, F.J. (2005). Bioestadística. Thomson.</p> |
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|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Complementary | <p>? BARÓ LLINAS, J. (1988). Estadística Descriptiva, Cálculo de probabilidades e Inferencia estadística (tres volúmenes). Ed. Parramón. ? CANAVOS, G.C. (1989). Probabilidad y Estadística. Aplicaciones y métodos. MacGraw-Hill. ? CUADRAS, C.M. y otros (1989). Ejercicios de Bioestadística. Editorial Universitaria de Barcelona. ? HERNÁNDEZ, V. RAMOS, E. y YÁNEZ, I. (1995). Estadística I. ITIS. UNED. ? DANIEL, W. W. (1991). Biostatistics. A Foundation for Analysis in the Health Sciences. J. Wiley. ? FISHER, L.D. Y VAN BELL, G. (1993). Biostatistics. A Methodology for the Health Sciences. John Wiley &amp; Sons. ? JOHNSON, R. A. Y BAHTTACHARIYA, G. K. (1992). Statistical Principles and Methods. J. Wiley. ? MANN, P. S. (1995). Introductory Statistics. J. Wiley &amp; Sons, INC. ? NAVIDI, W. (2006). Estadística para ingenieros y científicos. 1ª Edición, Mc Graw-Hill. ? PAGANO, M. Y GAUVREAU, K. (2001). Fundamentos de Bioestadística. 2ª Edición. Math Learning. ? PEÑA SÁNCHEZ DE RIVERA, D. (1991). Estadística. Modelos y Métodos, 1. Fundamentos. Alianza Universidad. ? QUESADA, V., ISIDORO, A. Y LÓPEZ, L. J. (1984). Curso y Ejercicios de Estadística. Alhambra Universidad. ? ROSNER, B. (1990). Fundamentals of Biostatistics. PWS-KENT Publishing Company. ? SOKAL, R.R. Y ROHLF, F.J. (1995). Biometry. The Principles and Practice of Statistics in Biological Research. 3ª Edición. W. H. Freeman and Company. ? VIEDMA, J. A. (1976). Bioestadística (Métodos Estadísticos Aplicados a la Biología y Medicina). Ed. del autor. ? ZAR, J.H. (1996). Biostatistical Analysis. Prentice Hall International Editions. RECURSOS WEB ? BARÓN LÓPEZ, F.J. Bioestadística. <a href="https://www.bioestadistica.uma.es/baron/apuntes/clase/apuntes/pdf/bioestadistica-libro.pdf">https://www.bioestadistica.uma.es/baron/apuntes/clase/apuntes/pdf/bioestadistica-libro.pdf</a> ? SÁEZ CASTILLO, A.J. (2010). Métodos estadísticos con R y R Commander. <a href="https://cran.r-project.org/doc/contrib/Saez-Castillo-RRCmdrv21.pdf">https://cran.r-project.org/doc/contrib/Saez-Castillo-RRCmdrv21.pdf</a> ? SEEFELD, K. Y LINDER, E. (2007). Statistics Using R with Biological Examples. <a href="https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf">https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf</a> BLOGS Y REPOSITARIOS ? <a href="https://365datascience.com/explainer-videos/#statistics">https://365datascience.com/explainer-videos/#statistics</a> Vídeos de curta duración que explican de forma intuitiva e gráfica conceptos básicos de Estatística Descriptiva, Cálculo de Probabilidades e Inferencia. Ainda que están en inglés, baixo o vídeo podes ler exactamente o texto do audio. ? <a href="https://estadisticaorquestainstrumento.wordpress.com/Curso-de-Estadística">https://estadisticaorquestainstrumento.wordpress.com/Curso-de-Estadística</a>, escrito nunha linguaxe sinxela e clara, por Jaume Llopis Pérez. ? <a href="https://www.cienciasinseso.com/estadistica/Os-contidos-versan-sobre-temas-metodoloxicos-estadisticos-xerais-e-están-dirixidos-a-persoal-biosanitario-e-científico-en-xeral,-dunha-forma-amena-e-asequible-a-persoas-non-especializadas-nestes-temas.-https://www.fisterra.com/formacion/metodologia-investigacion/Fisterra-é-un-repositorio,-producto-de-Elsevier,-que-proporciona-aos-profesionais-relacionados-coas-ciencias-da-saude-un-acceso-doado-e-rápido-á-información-mais-rigurosa-e-de-actualización-constante.BASES-DE-DATOS?https://vincentarelbundock.github.io/Rdatasets/datasets.html">https://www.cienciasinseso.com/estadistica/Os-contidos-versan-sobre-temas-metodoloxicos-estadisticos-xerais-e-están-dirixidos-a-persoal-biosanitario-e-científico-en-xeral,-dunha-forma-amena-e-asequible-a-persoas-non-especializadas-nestes-temas.-https://www.fisterra.com/formacion/metodologia-investigacion/Fisterra-é-un-repositorio,-producto-de-Elsevier,-que-proporciona-aos-profesionais-relacionados-coas-ciencias-da-saude-un-acceso-doado-e-rápido-á-información-mais-rigurosa-e-de-actualización-constante.BASES-DE-DATOS?https://vincentarelbundock.github.io/Rdatasets/datasets.html</a> Bases de datos dispoñibles en paquetes de R. Indícase o nome do paquete, o nome do arquivo de datos, número de observacións e tipo de variables. Permite a descarga directa en formato CSV e doc. ? <a href="https://stats.idre.ucla.edu/other/dae/Bases-de-datos-clasificadas-polas-diferentes-técnicas-estadísticas-para-as-que-serviron-de-exemplo.-http://www.statsci.org/data/first.html">https://stats.idre.ucla.edu/other/dae/Bases-de-datos-clasificadas-polas-diferentes-técnicas-estadísticas-para-as-que-serviron-de-exemplo.-http://www.statsci.org/data/first.html</a> Ofrece exemplos con datos reais das técnicas estadísticas máis básicas.</p> |
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## Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Data Analysis in Biology/610G02044

## Other comments

Highly recommended: 1- Attendance and participation in the keynote sessions, practicals and seminars. 2- To solve every explained exercise, both with and without the statistical software. 3- To supplement the course material with the sources of information. 4- To study the course material and to solve the proposed problems frequently. 5- Active involvement in the practicals and seminars. 6- To become familiar with the statistical software by using it constantly and regularly.

7- To try to use the statistical techniques in other different subjects. 8- Attendance to and taking advantage of the personalized attention sessions.



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