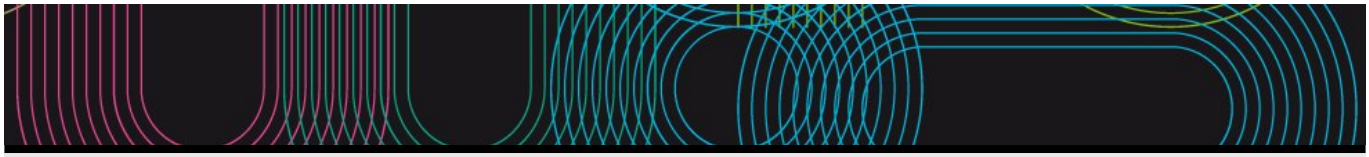

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Statistics: Biostatistics** | | | | |
| Subject | Statistics:<br>Biostatistics | | | |
| Code | V02G031V01107 | | | |
| Study programme | Grado en Biología | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Basic education | 1st | 2nd |
| Teaching language | #EnglishFriendly<br>Spanish<br>Galician | | | |
| Department | | | | |
| Coordinator | Sánchez Rodríguez, María Estela | | | |
| Lecturers | Sánchez Rodríguez, María Estela | | | |
| E-mail | esanchez@uvigo.es | | | |
| Web | http://moovi.uvigo.gal/ | | | |
| General description | English Friendly subject: International students may request from the teachers:<br>a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English. | | | |

| Training and Learning Results | |
|---|---|
| Code | |
| A2 | Students should know how to apply their knowledge to their work or vocation in a professional way. They also should have the competences that are usually proved through the elaboration and defence of arguments and the resolution of problems within their study field. |
| A3 | Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics. |
| A4 | Students should able to communicate information, ideas, issues and solutions to all audiences (specialist and unskilled audience). |
| B2 | Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology. |
| B4 | Draft and write reports, documents and projects related to Biology. Proceed to their presentation and debate in the teaching and specialized areas, highlighting the competences of the degree. |
| B6 | Develop analysis and synthesis, critical reasoning and argumentation skills, applying them in Biology and other scientific-technical disciplines. |
| C1 | Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools. |
| C12 | Writing reports and technical dossiers, as well as directing and executing projects on topics related to biology and its applications. |
| D4 | Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements. |
| D5 | Communicate effectively and appropriately, including the use of computer tools and English. |

| Expected results from this subject | Training and Learning Results | | | |
|---|---|---|---|---|
| Present and interpret the main statistics of a data set. | A3 | | C1 | |
| Study probability models | | B2 | C1 | |
| Use random variables to model uncertainty. | | B2 | C1 | |
| Identify the nature of the experimental variables for their subsequent analysis. | A4 | | C1 | D4 |
| Interpret hypothesis tests. | A2<br>A3 | B4<br>B6 | C12 | |
| Use statistical techniques to perform biological analysis. | A2<br>A4 | B4<br>B6 | C1<br>C12 | D4 |

| | | | | |
|---|---|---|---|---|
| Apply knowledge and technology related to statistics to design models of biological processes. | A3<br>A4 | B4<br>B6 | C1 | D5 |
| Obtain information, develop experiments and interpret the results. | A2<br>A3 | B2<br>B6 | C1<br>C12 | D4<br>D5 |
| To understand the social projection of Biostatistics and its repercussion in the professional practice of the biologist. | A2<br>A3<br>A4 | | C12 | D4<br>D5 |
| To know and handle the concepts, terminology and scientific-technical instrumentation related to statistical techniques. | | | C1<br>C12 | D4 |

## Contents

| Topic | |
|---|---|
| DATA EXPLORATORY ANALYSIS | Measures of central tendency, variability, skewness and kurtosis. Graphical representations. Biological variability. Linear and nonlinear transformations. Outliers and box plots. Mean and variance in subpopulations. Descriptive introduction to Anova. |
| PROBABILITY | Random experiments. Axiomatic definition of probability. Addition rule. Conditional probability. Total probabilities and Bayes' theorem. Independence of events. Assignment of probabilities. Applications: diagnostic test, relative risk and odds ratio. |
| MAIN DISTRIBUTIONS | Discrete and continuous random variables. Mean and variance. Main discrete and continuous distributions.<br>Binomial and multinomial models. Other discrete models: hypergeometric, Poisson, negative binomial.<br>Continuos models: Normal, log-normal, exponential, chi-square, t-student, F Fisher-Snedecor. |
| INTRODUCTION TO HYPOTHESIS TESTS. FREQUENCY TABLES: MEASURES AND TESTS | Introduction to hypothesis testing: type I error, type II error, significance level and p-value. Parametric and non-parametric statistical techniques. Tests for the mean and for the variance of a normal population. Confidence intervals.<br>Frequency tables. Measures of association in frequency tables: nominal and ordinal variables. Prediction and concordance.<br>Goodness-of-fit tests. Proportions, chi-square test.<br>Independence and homogeneity tests. Normality test. |
| REGRESSION AND CORRELATION | Scatter plot. Least squares line. Correlation and determination coefficient. ANOVA and residual analysis. Other models: parabolic, exponential, potential. Introduction to multiple linear regression. Predictions. |
| INFERENCE TECHNIQUES TO COMPARE GROUPS | Comparisons between 2 groups. F test to compare variances. Student's t-test to compare means. Comparisons of more than 2 groups. ANOVA and multiple comparisons tests. Homogeneity of variances. Model hypothesis testing and alternative nonparametric techniques. |
| LABORATORY | EXCEL and open access software R: the Project for Statistical Computing |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Seminars | 5 | 12 | 17 |
| Laboratory practical | 15 | 12.5 | 27.5 |
| Autonomous problem solving | 0 | 33.5 | 33.5 |
| Lecturing | 28 | 30 | 58 |
| Essay questions exam | 2 | 12 | 14 |

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

| | Description |
|---|---|
| Seminars | Activities focused on working on specific topics of the program. |
| Laboratory practical | Use of statistical software to complement the theoretical classes and seminars. |
| Autonomous problem solving | Work with problems of the different topics. |
| Lecturing | Exposition of the theory of the corresponding topics, illustrated with exercises. |

## Personalized assistance

| Methodologies | Description |
|---|---|
| Autonomous problem solving | Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule. |

| | |
|---|---|
| Seminars | Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule. |
| Laboratory practical | Any doubts that may arise at individual or group level will be answered. Students have a tutoring schedule. |

## Assessment

| | Description | Qualification | Training and Learning Results | | | |
|---|---|---|---|---|---|---|
| Seminars | Written exam on seminar contents and topics 4, 5 and 6 | 30 | A2<br>A3<br>A4 | B2<br>B4<br>B6 | C1 | D4<br>D5 |
| Laboratory practical | Exam with the R statistical programme analysing biological data | 40 | A2<br>A3<br>A4 | B2<br>B4<br>B6 | C12 | D5 |
| Essay questions exam | Exam with exercises and questions on topics 1, 2 and 3. | 30 | A2<br>A3 | B2 | C1 | |

## Other comments on the Evaluation

**Continuous assessment system (AC first opportunity):** 3 tests will be carried out throughout the course, with a weighting of 30% (Test of essay questions in the month of February), 30% (Seminar Test) and 40% (Laboratory Test).

- AC qualification =0.3 Developmental questions test +0.3 Seminar test +0.4 Laboratory test.

In the case of not achieving a minimum mark of 5 points, the student will have to take the Final Examination:

- AC qualification =0.3 Final Exam +0.3 Seminar test +0.4 Laboratory test.

**Continuous Assessment System (AC second opportunity):**

- AC second opportunity qualification =0.6 Final Exam +0.2 Seminar Test +0.2 Lab Test

**Global assessment system (AG first and second opportunity):**

- AG qualification = Final Exam

The calendar of final exams can be consulted at the following link: http://bioloxia.uvigo.es/es/docencia/examenes

Appointments for tutorials can be requested through the Online Secretariat or by filling in the form https://esanchez.webs8.uvigo.es/contacto/

## Sources of information

### Basic Bibliography

Mirás Calvo, M.A., Sánchez Rodríguez, E., **Técnicas estadísticas con hoja de cálculo y R. Azar y variabilidad en las ciencias naturales**, Servicio publicacións Universidad de Vigo, 2018

### Complementary Bibliography

Delgado de la Torre, R., **Probabilidad y estadística para ciencias e ingenierías**, Delta, 2008
Devore, Jay L, **Probability and statistics for engineering and sciences**, Brooks/Cole, 2010
Susan Milton, J., **Estadística para Biología y Ciencias de la Salud**, Tercera, McGraw-Hill, 2007

## Recommendations

### Other comments

The timetable of the classes can be consulted at the following link.