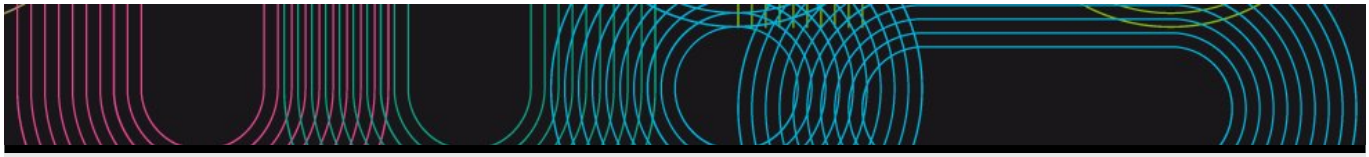

IDENTIFYING DATA				
Statistics				
Subject	Statistics			
Code	V10G061V01107			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	#EnglishFriendly Galician			
Department				
Coordinator	Rodríguez Álvarez, María José			
Lecturers	Rodríguez Álvarez, María José			
E-mail	mxrodriguez@uvigo.es			
Web				
General description	Subject destined to the knowledge and use of the fundamental statistical techniques for the treatment of and analysis of experimental data. English Friendly subject: International students may request from the teachers: 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 can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C2	Acquire basic knowledge of mathematics (differential and integral calculation) and statistics.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject	Training and Learning Results			
Know the importance of information and be able to assess and classify it in each decision area.	A2	B2	C2	D1
Know how to correctly apply and interpret the basic descriptive techniques for the analysis of unidimensional and bidimensional variables.	A3 A4 A5	B4		D2
Understand the concept of hypothesis testing.	A3 A5		C2	D1 D2
Understand the principles of multivariate analysis.	A3 A5		C2	D1 D2
Effectively solve problems and issues of each of the lessons using the appropriate quantitative method.	A5	B2		D1 D2
Introduce the students in the manage of computer packages related to statistics: R and RStudio. And so favor a positive attitude towards the quantitative methods, in general, and statistics, in particular, as well as their computer manipulation.	A3 A5	B2 B4		D1 D2

Understand the importance of statistical analysis when taking decisions and learn when to apply each technique and interpret the results obtained.	A3 A4	B2	D1 D2
To awaken the taste for the use and study of statistics, seeing it as a tool that allows us to learn more about our own field of knowledge and to start carrying out our own research.	A3 A5		D1 D2

Contents

Topic	
1. Introduction to statistics. Basic concepts.	Population. Individual. Sample. Random variable. Types of variables: qualitative and quantitative. Descriptive and inferential statistics.
2. Descriptive statistics and exploratory data analysis.	- One-dimensional case: frequency distribution. Measures of location (mean, median, mode and quantiles), dispersion (range, interquartile range, standard deviation and variance) and shape (skewness). - Two-dimensional case: double-entry frequency tables. Correlation. Measures of centralization and dispersion by subgroups. - One-dimensional and two-dimensional graphical representations.
3. Introduction to probability theory, random variables and main probability distributions.	Basic concepts: sample space, events and elementary events, basic rules of probability, main probability theorems, conditional probability and independence, probability distribution. Probability mass function. Distribution and density function. Main discrete probability distributions: binomial, multinomial, Poisson. Main continuous probability distributions: normal, exponential.
4. Introduction to statistical inference.	Point estimation: properties of estimators. Confidence intervals: construction. Hypothesis testing: main concepts. Types of error. Critical level or p-value.
5. Comparison of means	Comparison of two means: dependent and independent samples. Non-parametric tests. Comparison of more than two means: analysis of variance (ANOVA) of one factor. Non-parametric tests.
6. Regression and correlation	Simple linear regression model. The regression line. Goodness of fit and residual analysis. Hypothesis tests for the simple linear regression model Non-linear regression: logarithmic and exponential models.
7. Qualitative data analysis	Contingency tables. Measures of association. Chi-square goodness-of-fit test and Chi-square test of independence.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	33	55	88
Problem solving	7	0	7
Autonomous problem solving	0	21	21
Practices through ICT	15	15	30
Objective questions exam	2	0	2
Essay questions exam	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

	Description
Lecturing	The theoretical contents of the course will be presented in a lecture session and practical exercises will be solved.
Problem solving	Resolution of practical exercises of the course
Autonomous problem solving	Autonomous resolution of practical exercises of the course.
Practices through ICT	Data processing and statistical analyses using the free software R and RStudio.

Personalized assistance

Methodologies	Description
Problem solving	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Lecturing	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Autonomous problem solving	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Practices through ICT	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Assessment

	Description	Qualification	Training and Learning Results		
Practices through ICT	Throughout the course, students will carry out four practical case studies of data analysis using R software. Each case study will account for 7.5% of the final grade. The evaluation will be carried out by means of a test through the Moovi platform and the delivery of the code (script) necessary for its resolution.	30	A2 A3 A4 A5	B2 B4	D1 D2
Objective questions exam	Tests throughout the course. Two mid-term exams (multiple-choice test). Each exam will account for 15% of the final grade.	30	A2 A3 A4 A5	C2	D1
Essay questions exam	Final exam on the contents of the course. The exam will consist of solving problems and exercises. A qualification higher than 3.5 points (out of 10) must be obtained in order to pass the course.	40	A2 A3 A4	C2	D1

Other comments on the Evaluation

Continuous evaluation: The student's work throughout the course will be evaluated. In the final qualification, the evaluations/tests carried out throughout the course (practicals and mid-term tests) will represent 60% and the final exam (to be made on the official date) 40%. To pass the subject, it will be compulsory to attend the final exam and to obtain a qualification higher than 3.5 points (out of 10). In case of not obtaining in the final test the minimum qualification to pass the subject, the grade to appear in the official record will be the minimum between 4.9 and the final qualification (weighted).

Second opportunity: In the second opportunity the same scale will be applied as in the continuous evaluation, with the evaluations/tests carried out throughout the course accounting for 60% and the final exam for 40%. In this case, the qualifications of the evaluations/tests carried out throughout the course will be maintained and only the final exam will be repeated, in which a qualification higher than 3.5 points (out of 10) must be obtained in order to pass the subject. In case of not obtaining in the final test the minimum qualification to pass the subject, the grade to appear in the official record will be the minimum between 4.9 and the final qualification (weighted).

Global evaluation: As an alternative to the continuous evaluation system, students may choose to be evaluated with a final exam that will represent 100% of the qualification. In this case, it will be necessary to obtain a qualification higher than 5 points (out of 10) in order to pass the subject. The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published before the academic start.

The date, time and place of the final exams will be published on the official website of the Faculty of Marine Sciences.

http://mar.uvigo.es/alumnado/examenes/

Students are strongly requested to fulfill a honest and responsible behavior. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher□s proposed work. Fraudulent behavior may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

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**, 1, Servizo de Publicacións da Universidade de Vigo, 2018
Susan Milton J., **Estadística para la biología y las ciencias de la salud**, 3, McGraw-Hill Interamericana, 2007
Whitlock, M.C. e Schluter, D., **The Analysis of Biological Data**, 3, WH Freeman, 2020

Complementary Bibliography

Fowler F., Cohen L., Jarvis P., **Practical Statistics for Field Biology**, 2, John Wiley and Sons, 2013
Miller J.N., Miller, J.C., **Estadística y Quimiometría para Química Analítica**, 4, Prentice Hall, 2002
Çetinkaya-Rundel, M. e Hardin, J., **Introduction to Modern Statistics**, OpenIntro, 2021

Recommendations