UniversidadeVigo

IDENTIFYING DATA
Statistics: Biostatistics

Subject	Statistics: Biostatistics
Code	V02G031V01107
Study programme	Grado en Biología

Descriptors	ECTS Credits		Choose	Year	Quadmester
	6		Basic education	1st	2nd

Teaching language	#EnglishFriendly Spanish 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: 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

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 A3	B4 B6	C12	
Use statistical techniques to perform biological analysis.	A2 A4	B4 B6	C1 C12	D4

Apply knowledge and technology related to statistics to design models of biological processes.	A3 A4	B4 B6	C1	D5
Obtain information, develop experiments and interpret the results.	A2 A3	B2 B6	C1 C12	D4 D5
To understand the social projection of Biostatistics and its repercussion in the professional practice of the biologist.	A2 A3 A4		C12	D4 D5
To know and handle the concepts, terminology and scientific-technical instrumentation related to statistical techniques.			C1 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. Binomial and multinomial models. Other discrete models: hypergeometric, Poisson, negative binomial. 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. Frequency tables. Goodness-of-fit tests. Proportions, chi-square test. 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 topics 4, 5 and 6	30	A2 A3 A4	B2 B4 B6	C1	D4 D5
Laboratory practical	Data analysis with the statistical program R	30	A2 A3 A4	B2 B4 B6	C12	D5
Essay questions exam	Exam with exercises and questions on topics 1, 2 and 3.	40	A2 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 40% (Test of essay questions), 30% (Seminar Test) and 30% (Laboratory Test).

- AC qualification =0.4 Developmental questions test +0.3 Seminar test +0.3 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 =max{Final Exam, 0.5 Final Exam +0.5 Laboratory test}.

Continuous Assessment System (AC second opportunity):

- AC second opportunity qualification =max{Final Exam, 0.5 Final Exam +0.5 Laboratory 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 Secretaria 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 Universidade 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:

http://bioloxia.uvigo.es/es/docencia/horarios/