

Degree programme	Type	Course
Biology	FB	1

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

Although there are no official prerequisites, it is advisable for the student to review:

- 1) Combinatorics and Newton's binomial.
- 2) The probability and the statistics that have been studied in secondary school.
- 3) Elementary functions (exponential, logarithm) and series.

Objectives

Contextualization:

This is a basic, instrumental type course that introduces probabilistic tools and basic statistics in Biology studies in order to analyze biological data from the description of natural phenomena or experiments. These tools will be used for other subjects of the degree and are essential for the future graduate in Biology training both for the pursuit of their profession and for research. Along with Mathematics, this is characterized by the fact that in addition to its own content, it helps the student to develop scientific rigor and logical thinking.

Training objectives of the subject: It is intended for the student to...

1. Be able to use fluently the language of the probability and the statistics used in Biology.
2. Learn how to explore descriptive methods with various sets of data, resulting from the observation of biological phenomena or experimentation.
3. Be able to raise the most suitable probabilistic models in different situations, and know how to use the probability rules to calculate the probability of the events of interest.

4. Know and understand the concept of random variable, know classical examples of random variables and in what situations are used for modeling.
5. Learn how to use the methods of statistical inference (confidence intervals and hypothesis tests) to reach conclusions on one or more populations based on partial information contained in random samples.
6. Know computer tools (R software and RStudio user graphical interface) for the statistical treatment of data.
7. Apply common sense and develop a critical spirit in dealing with the problems that will have to be solved, both at the time of its resolution and resolution, as well as at the time of drawing conclusions and making decisions.

Learning outcomes

- CM06 (Work in experimental design and data analysis in compliance with the ethical aspects inherent to biological studies of different types.) Work in experimental design and data analysis in compliance with the ethical aspects inherent to biological studies of different types.
- CM08 (Plan projects and data analysis using biostatistics, genomics, transcriptomics and proteomics tools, with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values, and in accordance with the Sustainable Development Goals.) Plan projects and data analysis using biostatistics, genomics, transcriptomics and proteomics tools, with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values, and in accordance with the Sustainable Development Goals.
- KM12 (Describe the content of databases of interest for biosciences and the methodologies for extracting relevant information in the field of biology.) Describe the content of databases of interest for biosciences and the methodologies for extracting relevant information in the field of biology.
- SM07 (Select the statistical tests and computer resources appropriate to each situation and set of biological data.) Select the statistical tests and computer resources appropriate to each situation and set of biological data.
- SM09 (Interpret the results of statistical tests applied to the resolution of biological problems in different fields, expressing them appropriately.) Interpret the results of statistical tests applied to the resolution of biological problems in different fields, expressing them appropriately.

Contents

1. Descriptive statistics.

- Data and random error. Measurement scales.
- Descriptive analysis of data from a single variable: frequency distributions, graphic representations, numerical summaries (position, dispersion and shape measurements).
- Descriptive analysis of data from two variables: correlation and regression line, tables of contingency.

2. Probability.

- Basic properties of probability. Conditional probability. Formula of total probabilities. Bayes Formula. Independence of events.
- Expectation and variance of a random variable.

- Discrete random variables. Bernoulli, Binomial and Hypergeometric distributions.
- Continuous random variables. Normal distribution. Approximation of the Binomial by the Normal distribution.
- Independence of random variables.

3. Statistical inference.

- Introduction to Statistics: population and sample, parameters and estimators.
- Distribution of the mean sample in the normal case with known variance: Z-statistic. Confidence interval for the mean of a normal population with known variance.
- Student's distribution. The case of the unknown variance: the T-statistic and the confidence interval for the mean of a normal population with unknown variance.
- Hypothesis test concept. Test for the mean and for the variance of a Normal population. Test for the proportion.
- Introduction to hypothesis tests. Hypothesis test for the mean of the normal with known variance and with unknown variance. Tests for the population proportion.
- Test of comparison of means and variances for two Normal populations. Test of comparison of proportions.
- The Shapiro-Wilk test of normality. Non-parametric tests for the comparison of means.
- Chi-square test for the goodness of fit and the independence.

Part of the topics will be developed in practice classes with statistics software.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Individual Tutorials	8	0.32	CM06, CM08, KM12, SM07, SM09
Theory classes	30	1.2	CM06, CM08, SM07, SM09
Problem classes and practices	22	0.88	CM06, CM08, KM12, SM07
Study + work of problems and practices	83	3.32	CM06, CM08, KM12, SM07

The center of the learning process is the work of the student. The student learns working, being the mission of the teaching staff help him/her in this task by providing information or showing him/her the sources where one

can get it and directing your steps in a way that the learning process can be carried out effectively. In line with these ideas, and in accordance with the objectives of the subject, the course development is based on the following activities:

Theory classes:

The student acquires the scientific-technical knowledge of the subject assisting the theory classes, complementing them with self-study of the subjects explained in order to assimilate the concepts and the procedures, to detect doubts and to realize summaries and schematics of the subject. In the theory classes, the professor introduces the basic concepts of the subject, showing their application. The classes are taught with blackboard and the support of ICT.

Problems and practices:

Problems and practices are sessions with a smaller number of students where the scientific-technical knowledge presented in the theory classes is worked on to complete their understanding and deepen it by solving problems and practical cases, with the appropriate software. Students will work individually or in groups, under the supervision of the professor, solving the proposed problems. This will be done both in class and autonomously by the student.

In the computer practice sessions, the student will learn to use computer tools for descriptive analysis of data sets and statistical inference.

In this course, the use of Artificial Intelligence (AI) technologies is permitted as an integral part of the development of the work, provided that the final outcome reflects a significant contribution by the student in terms of analysis and personal reflection. The student must clearly identify which parts have been generated using this technology, specify the tools used, and include a critical reflection on how these tools have influenced the process and the final outcome of the activity. Lack of transparency in the use of AI will be considered a breach of academic honesty and may result in a penalty in the activity grade, or more serious sanctions in severe cases.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Recovery exam	70%	3	0.12	CM06, CM08, KM12, SM09
Practice works	30%	0	0	CM06, CM08, SM07, SM09
Partial exams	70%	4	0.16	CM06, CM08, KM12, SM09

Continued evaluation.

The evaluation of the subject consists of a part of continuous evaluation of the acquired competences: there will be two partial exams, each with a weight of 35%. These two partials will be the recoverable part of the

subject.

The evaluation of the practices will have a weight of 30% in the final evaluation of the subject. The mark of the practice part will be obtained from the delivery of some works.

To participate in the recovery examination, the students must have been previously evaluated in a series of activities whose weight equals a minimum of 2/3 of the total grade of the subject. Therefore, the students will obtain the "Non-evaluable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade.

Unique evaluation.

The unique evaluation consists of a single summary exam in which the contents of the entire theory program of the subject will be assessed. The grade obtained in this final exam will account for 70% of the final grade of the subject. The date of this exam will coincide with that fixed in the calendar for the last continued evaluation exam and the same recovery system will be applied as for the continued evaluation.

The evaluation of practice activities and the delivery of assignments will follow the same procedure as the continued evaluation. The grade obtained will have a weight of 30% in the final evaluation of the subject.

Minimum grades.

A minimum grade of 3.5 out of 10 is required for each exam (partial, final or recovery). A minimum grade of 4 out of 10 is also required for each delivery. If these minimum grades are achieved, the final grade is the weighted average. Otherwise, the final grade is calculated as the minimum between the weighted average and 4.5 (all rated out of 10).

Any irregularity committed during an assessment activity (academic misconduct, plagiarism, or improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant alteration of the grade will result in that activity being graded as 0. If the course syllabus stipulates that obtaining a minimum mark in this assessment is an essential requirement to pass the course, or if multiple irregularities occur in the assessment activities of the same course, the final grade for the course will be 0. Furthermore, disciplinary proceedings may be initiated against any student who incurs any of these irregularities.

Bibliography

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Devore, Jay L. *Probabilidad y Estadística para ingeniería y ciencias*. International Thomson Editores. 1998.
Milton, J. S. *Estadística para Biología y Ciencias de la Salud*. Interamericana de España, McGraw-Hill, 2007 (3a ed. ampliada).
Remington, R. D. Schork, M. A. *Estadística Biométrica y Sanitaria*. Prentice/Hall Internacional, 1974.

Software

In the computer practice sessions, the student will learn to use the free software R with the graphical user interface RStudio (or an equivalent graphical interface), in order to apply the statistical tools for the descriptive analysis of data sets and statistical inference.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	11	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	111	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	111	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	112	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	112	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	113	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	114	Catalan	second semester	morning-mixed