Universitat Autònoma de Barcelona

2022/2023

Mathematics

Code: 101968
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	FB	1	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Kevin Martinez

Prerequisites

The ones of access to the degree

Objectives and Contextualisation

In the context of Genetic studies, solid training is required in Mathematics, understood as the language of Science and in particular the genetic basis of biological processes. First of all it is important that the student master the calculation of functions of one variable, essential in many applications and especially in the growth models of populations, organisms or cells. On the other hand, the language of probability and the basic statistical techniques are essential to analyze genetic and genomic data from the description of natural phenomena, experiments or simulation of genetic processes. The general objective of the course is to provide the student with these mathematical tools, focusing especially on their correct use and on the interpretation of the results.

The specific objectives of the subject are:

1. Understanding the fundamentals of mathematical calculation in one variable and the representation of functions.

2. Study of the growth of functions with application to the dynamics of populations. Exponential growth and logistical growth.

3. Understanding the basic principles of probability and the notion of random variable. Study of distributions of greatest interest in Biology and Genetics.

4. To understand the notions about interpretation of data, application of contrast tests of hypotheses and calculation of confidence intervals.

5. Use of computer tools for the statistical processing of data.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply knowledge of theory to practice.
- Be able to analyse and synthesise.
- Develop creativity.
- Know, apply and interpret the basic procedures of mathematical calculation, statistical analysis and IT, the use of which is indispensable in genetics and genomics.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Reason critically.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Apply knowledge of theory to practice.
3. Apply the basic elements of the calculation of functions and statistical analysis to genetic and biological examples.
4. Be able to analyse and synthesise.
5. Develop creativity.
6. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
7. Reason critically.
8. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
9. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Content

1. Concept of function. The most important functions. Polynomial functions and rational functions. The exponential function. The logarithm function.

2. Notion and calculation of derivatives. The derivative as rate of growth. Representation of functions of one variable.

3. Integration. Applications of integral.

4. Differential equations of separate variables. Exponential growth and decline. Logistic growth.

5. Descriptive statistics. Descriptive study of a variable: mean, standard deviation, bar diagrams. Descriptive study of two variables: contingency and regression tables.

6. Fundamentals of probability. Independence and conditional probability. Bayes' Theorem.

7. Random variables and more frequent distributions. Expectation and variance.

8. Introduction to statistical inference. Confidence intervals and hypothesis tests.

Methodology

The teaching methodology includes three types of main activities (theoretical classes, classes of problems and practices in the computer room) and one of complementary (individual tutorials).

Theory classes (31 hours): they provide the student with the basic conceptual elements and information so that they can then develop autonomous learning. In addition to the essential theoretical body, the most illustrative examples of the subject will be presented to students and the main applications to Genetics will be discussed.

Problem classes (13 hours): in these classes, which will be carried out in smaller groups, well-selected exercises will be solved that help students to reason critically and to put into practice the theoretical knowledge of the subject. Periodically, exercises will be proposed to the students. A representative selection of these will be resolved in class, while the rest of the exercises will be left for self-study or group work outside class hours.

Practices in the computer classroom (8 hours): 4 sessions of two hours will be held in the computer room in which the student will learn the use of specific software for mathematical and statistical calculus (Maple type, statistical package d 'Excel, Spss).

Tutorials: Individual tutorials are recommended, or for small groups of students who wish it in the professor's office.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems classes	11	0.44	3, 2, 5, 7, 4
Theory classes	31	1.24	3, 7, 4
Type: Supervised			
Computer practises	8	0.32	3, 2, 5, 7, 4
Type: Autonomous			
Personal study	57	2.28	3, 7, 4
Solving exercises	32	1.28	3, 2, 5, 7, 4

Assessment

The competences of this subject will be evaluated by means of continuous evaluation, which will include written tests and the realization of a test of practices.
The evaluation system is organized in 2 modules, each of which will have a specific weight assigned in the final grade:

• Practices test module: this module will evaluate the performance of the computer practices and the presentation of memories and / or exercises related to them. This module will have a global weight of 20% (2 points of the final qualification).

• Written test module: this module will have an overall weight of 80%. It will consist of two partial tests at the

end of the two parts in which the subject is divided (Themes 1-4 and Topics 5-8). The final qualification of this module (about 8 points) will be calculated by calculating the arithmetic mean of the partial proof notes.

To pass the subject it is essential to have completed the two partial exams. The subject will be considered surpassed if at least a total of five points are obtained between the two modules.

Students who have a final grade of less than 5 (and therefore have not passed the subject) may take a recovery exam of the written test module. If an student pass after this exam (regardless of the grade equal to or greater than 5), the final qualification of the subjects will be 5.

To be eligible in the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

There will not be any other trial.(Improvement of grade or similar).

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practice exam	0,2	3	0.12	1, 9, 8, 3, 2, 5, 6, 7, 4
Recovery exam	0,8	4	0.16	1, 9, 8, 3, 2, 5, 6, 7, 4
partial exams	0,8	4	0.16	1, 9, 8, 3, 2, 5, 6, 7, 4

Bibliography

- Newhauser, C. Matemáticas para Ciencias, Prentice Hall, Madrid- Batschelet, E., Matemáticas básicas para biocientíficos, Dossat, Madrid

- Bardina, X., Farré, M., Estadística : un curs introductori per a estudiants de ciències socials i humanes Col·lecció Materials, Universitat Autònoma de Barcelona

- Delgado de la Torre, R. Apuntes de probabilidad y estadística. Colecció Materials, Universitat Autònoma de Barcelona

- Maynard Smith, J. Mathematical ideas in Biology, Cambridge U.P.

- Newby, J.C. Mathematics for the Biological Sciences, Clarendon Press

Software

The following software:

Sagemath

Rstudio