Universidad Zaragoza

Academic Year/course: 2021/22

68753 - Statistical techniques, experimental design and modelling

Syllabus Information

Academic Year: 2021/22
Subject: 68753 - Statistical techniques, experimental design and modelling
Faculty / School: 105 - Facultad de Veterinaria
Degree: 631 -
ECTS: 6.0
Year: 1
Semester: First semester
Subject Type: Compulsory
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The subject is structured in **two sections**. The first one focuses on statistical techniques and the second one on the design of experiments and modeling. Each section consists of 6 lectures and 21 hours of practical activities in the computer room. Finally, an assignment developed in groups will be presented during a 5 hours face-to-face session. There will be a 1-hour session to explain in detail how the assignment should be done. The lectures will be held in the classrooms with audiovisual support. It is planned that the students have the necessary materials in advance (chapters of books, notes, etc.) that will be explained in each session, which will be available on the ADD (virtual platform). This will allow the teaching staff to focus on those aspects of the class that have the most difficulty understanding.

Students are expected to participate actively in the development of the class by asking questions about the doubts that may have arisen from the previous readings, or questions that will be formulated by the teaching staff.

The practice sessions are taught in the computer room. There, students will work with problems and cases, review the theoretical foundations on which the problems are based; solve them with appropriate software programs, and evaluate the obtained results.

The group assignment may consist of the preparation and presentation of the statistical conclusions resulting from the study of an experimental database or the analysis of a research article. In case it would be possible, both typologies can be combined. For the accomplishment of this work, students will have the support of the course Project elaboration, presentation and communication of results, which they are studying. Before doing the group assignment, it will be explained in detail how it should be addressed and how the oral presentation should be organized.

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures (12 hours). 6 hours per section. 21 hours of autonomous work.
- Practice sessions in the computer room (42 hours). 21 hours per section. 21 hours of autonomous work.
- Group assignment (1 hour). 20 hours of autonomous work. It is done in groups and may consist of the preparation and presentation of the statistical conclusions resulting from the study of an experimental database (section I) or the analysis of a research article (section II). In case it is possible, both typologies can be combined. In the case of

section I, a complete descriptive and inferential statistical analysis of a set of experimental data will be carried out, presenting the conclusions about the population that are extracted from the analysis performed in the sample. In the case of section II, a published research article chosen by the students or suggested by the lecturer will be analyzed and theoretically reproduced. Students will have to evaluate the experimental design used by the authors, analyze and model the data presented in the results section and discuss the conclusions obtained from the analysis performed.

- Oral presentation (5 hours). Oral presentation of the group assignment in which both its presentation and its defense of it will be evaluated. The relevance of the content of the presentation, the critical analysis of the results and their critical comparison with those made by the author of the scientific article and the clarity and precision of the presentation will be evaluated.

4.3. Syllabus

The course will address the following topics:

Section I. Statistical techniques.

Topic 1: Kind of variables and measurement scales. Quantitative and qualitative variables. Discrete and continuous variables. Appropriate measures.

Topic 2: Probability distributions. Probability. Random variable: types and classification. Probability distribution of a random variable. Discrete and continuous distributions in the field of food science and technology. Other fundamental distributions for statistical inference.

Topic 3: Conditional probability. Definition of independent random variables. Bayes Theorem.

Topic 4: Frequency. Frequency Tables. Frequency tables for grouped and ungrouped data. Graphical Representation of Frequency Distribution.

Topic 5: Descriptive statistics. Descriptive measures for a sample data. Moments measures (central tendency, variability and shape), and position measures (percentiles).

Topic 6: Sampling. Basic concepts of sampling. Characteristics of the sample. Factors to consider: sampling method and sample size. Types of sampling errors. Production mechanisms of slant and sampling errors. Sampling methods: probability and non-probability methods. Factors influencing sample size. Calculation of sample size (to detect disease, to estimate the mean, to estimate percentage and percentage differences).

Topic 7: Statistical Inference I: confidence intervals. Definition of statistical inference. Sampling distribution of a given statistic based on a random sample. Obtaining a probability interval from the sampling distribution. Confidence intervals. Calculation of the confidence intervals most representative or used in the food industry.

Topic 8: Statistical Inference II: statistical hypothesis test. Definition of hypothesis test. Basic elements in a Test. Types of errors. The significance level. P-value concept.

Topic 9: Statistical Inference III: selection of the statistical test. Types of hypothesis testing. Parametric and nonparametric tests. The most commonly used hypothesis tests in statistical inference with application to the food industry.

Section II. Design of experiments and modeling.

Topic 10. Experimental design. Introduction. Definitions and objectives of the experiment desing. Drawbacks of the traditional methods of experimentation. Statistical design of experiments. Factorial design. Response Surface Design: Box-Berken design, central composite design, Doehlert design.

Topic 11. Analysis of experimental data. Objectives. Analysis of systematic and accidental errors. Accuracy and precision. Graphical methods to show variability.

Topic 12. Modelling. Definitions. Terminology. Linear and nonlinear regression. Evaluation of the goodness of fit. Comparing models. Validation. Predictive Microbiology: primary, secondary and tertiary models.

Topic 13. Experimental design. Software management for statistical experimental design: Design-Expert. Exercises. Topic 14. Data analysis. Software management for data analysis: Prism, Excel. Exercises.

Topic 15. Modelling. Software management for data modeling: Prism, Excel. Development of primary, secondary and tertiary models. Models of interest in Food Science and Technology (growth and microbial inactivation, sorption isotherm, dehydration curve, enzyme kinetics). Software management and Web sites related to predictive microbiology: PMP (Pathogen Modeling Program), Combase, Seafood Spoilage Predictor Software, Growth Predictor.

4.4. Course planning and calendar

The calendar of the lectures and practice sessions of the course will appear throughout the month of September on the website of the Faculty of Veterinary http://veterinaria.unizar.es/

4.5. Bibliography and recommended resources

The literature of the academic year is kept updated and is consulted on the Library website (biblioteca.unizar.es / recommended bibliography).