

Approval date: 20/06/2022

COURSE GUIDE

**Computational Statistics in
Pharmacy (20411A7)**

Grado (Bachelor's Degree)	Grado en Farmacia	Branch	Health Sciences				
Module	Complementos de Formación	Subject	Estadística Computacional en Farmacia				
Year of study	3 ^o	Semester	1 ^o	ECTS Credits	6	Course type	Elective course

PREREQUISITES AND RECOMMENDATIONS

It is recommended to have studied the subject BIOMETRICS from the first year of the Degree in Pharmacy or to have studied Descriptive Statistics and Calculus.

BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)

1. Methods of statistical inference
2. Design of experiments I: Analysis of variance
3. Design of experiments II: Regression
4. Non-parametric statistics
5. Sampling in finite population
6. Qualitative data

SKILLS**GENERAL SKILLS**

- CG03 - Saber aplicar el método científico y adquirir habilidades en el manejo de la legislación, fuentes de información, bibliografía, elaboración de protocolos y demás aspectos que se consideran necesarios para el diseño y evaluación crítica de ensayos preclínicos y clínicos.

SUBJECT-SPECIFIC SKILLS

- CE12 - Aplicar los conocimientos de Física y Matemáticas a las ciencias farmacéuticas.
- CE13 - Aplicar técnicas computacionales y de procesamiento de datos, en relación con la información referente a datos físicos, químicos y biológicos.
- CE14 - Diseñar experimentos en base a criterios estadísticos.



- CE15 - Evaluar datos científicos relacionados con los medicamentos y productos sanitarios.
- CE16 - Utilizar el análisis estadístico aplicado a las ciencias farmacéuticas.

TRANSFERABLE SKILLS

- CT02 - Capacidad de utilizar con desenvoltura las TICs

LEARNING OUTCOMES

As a consequence of the learning process, the student should be able to:

- formulate, solve and interpret a hypothesis test
- formulate, estimate and interpret a linear on non-linear regression model
- use the proper sampling method, calculate the corresponding simple size
- use contingency tables for categorical data.

PLANNED LEARNING ACTIVITIES

THEORY SYLLABUS

- Unit 1: Distribution function.
 - Discrete and continuous probability distributions. Expected value and variance. Distributions in sampling: t-Student, Pearson χ^2 and Fisher-Snedecor distribution.
- Unit 2 : Random variables: Statistical inference by estimation
 - Concept and properties of an estimator. Estimation methods: maximum likelihood, mean squares, Bayes, etc. Estimation with Gaussian variables: Fisher's theorem. Estimation by means of confidence intervals. Calculation of the sample size.
- Unit 3: Statistical inference by test of hypothesis
 - Basis concepts in statistical tests. Test with the Gaussian distribution. Test with two Gaussian variables. Interpretation of the p-value.
- Unit 4: Statistical design of a experiment I: Analysis of variance
 - Linear decomposition of the variance. One factor designs: the ANOVA I model. Two factor designs: the ANOVA II model. Balanced designs with multiple observations: Interaction analysis. Designs by means of latin squares and greco-latin squares.
- Unit 5: Statistical design of a experiment I: Regression
 - Introduction. Linear simple regression model. Linear multiple regression model. Non-linear regression. Logistic and Poisson regressions.
- Unit 6: Non-parametric statistics
 - Introduction. Tests for paired variables: signs test and Rank-signs Wilcoxon test. Tests for independent variables: Mann-Withney, Kolmogorov-Smirnov and Kruskal-Wallis tests. Friedman test. Spearman's rank-correlation. Dixon and Grubbs tests for anomalous data.
- Unit 7: Treatment of qualitative data
 - Goodness adjust asymptotic test. Test of Independence for qualitative variables. Diagnostic agreement. Analysis of 2x2 contingency tables. Epidemiological



- applications. Area under ROC curve.
- Unit 8: Sampling on finite populations
 - Probabilistic versus intentional sampling. Simple random sampling. Stratified random sampling. Sampling by means of conglomerates. Systematic sampling.

PRACTICAL SYLLABUS

The practices will be developed in the computer room and will consist in studying the solution of case studies by means of statistics using a statistical program. The statistical knowledge to solve the cases is the theoretical content of the subject.

RECOMMENDED READING

ESSENTIAL READING

- Biostatistics, Open Learning Textbook, University of Florida, <https://bolt.mph.ufl.edu/6050-6052/>
- B. Rosner, Fundamentals of Biostatistics, 8th Edition, Harvard University (2015). Electronic version at <http://galaxy.ustc.edu.cn:30803/zhangwen/Biostatistics/Fundamentals+of+Biostatistics+8th+edition.pdf>
- E. Cobo, P. Muñoz y J.A. González: Bioestadística para no Estadísticos. Elsevier, Barcelona (2007).
- C.M. Cuadras: Problemas de Probabilidades y Estadística (2 vols.). EUB, Barcelona (1999).
- V. Quesada, A. Isidoro y L.A. López: Curso y Ejercicios de Estadística. Alhambra, Madrid (2000).
- F. Rius y F.J. Barón: Bioestadística. Thomson-Paraninfo, Madrid (2008).
- S.M. Ross: Introducción a la Estadística. Reverté, Barcelona (2007).
- M.L. Samuels, J.A. Witmer y A. Schaffner: Fundamentos de Estadística para las Ciencias de la Vida. Pearson, Madrid (2012).

COMPLEMENTARY READING

- D. S. Shafer, Beginning Statistics, Zhiyi Zhang Publisher: lardbucket.org (2014). Electronic version at <https://2012books.lardbucket.org/pdfs/beginning-statistics.pdf>
- J.S. Milton: Estadística para Biología y Ciencias de la Salud. McGraw-Hill, Madrid (2001).
- A. Martín-Andrés y J.D. Luna del Castillo: Bioestadística para Ciencias de la Salud. Norma, Madrid (2005).
- C. Pérez: Estadística Práctica con Statgraphics®. Prencite Hall, Madrid (2002).

RECOMMENDED LEARNING RESOURCES/TOOLS

- The webpage of the subject in PRADO
- <https://bolt.mph.ufl.edu/6050-6052/>
- <http://galaxy.ustc.edu.cn:30803/zhangwen/Biostatistics/Fundamentals+of+Biostatistics+8th+edition.pdf>
- <https://2012books.lardbucket.org/pdfs/beginning-statistics.pdf>



TEACHING METHODS

- MD01 - Lección magistral/expositiva
- MD02 - Sesiones de discusión y debate
- MD03 - Resolución de problemas y estudio de casos prácticos
- MD06 - Prácticas en sala de informática
- MD10 - Realización de trabajos individuales
- MD12 - Tutorías
- MD13 - Participación en plataformas docentes

ASSESSMENT METHODS (Instruments, criteria and percentages)

ORDINARY EXAMINATION DIET

The assessment consists of four different parts:

1. Exams with theory and problems: 5 points
2. Attendance and exam of the practical classes: 3 points
3. Class work: 2 points.

EXTRAORDINARY EXAMINATION DIET

The assessment consists of three different parts:

1. An exam with problems: 5 points
2. Exam of the practical classes: 3 points
3. Final exam (short or multiple choice questions on concepts): 2 points.

SINGLE FINAL ASSESSMENT (evaluación única final)

It would consist on two parts:

1. An exam with problems and short or multiple choice questions on concepts): 7 points
2. Assessment of practical content: 3 points. This part would be discussed and arranged with the teacher in order to consider the possibilities (technical and of timetable) of the student.

