



Universidad
de Alcalá

TEACHING GUIDE

Statistics

Degree in
Information System Engineering (GISI)
Computer Engineering (GIC)
Computer Science Engineering (GII)

Universidad de Alcalá

Academic Year 2022/2023

1st Year - 1st Semester (GISI+GIC+GII)

TEACHING GUIDE

Course Name:	Statistics
Code:	780004 (GISI+GIC+GII)
Degree in:	Information System Engineering (GISI) Computer Engineering (GIC) Computer Science Engineering (GII)
Department and area:	Ciencias de la Computación Computer Science and Artificial Intelligence
Type:	Basic (GISI+GIC+GII)
ECTS Credits:	6.0
Year and semester:	1st Year - 1st Semester (GISI+GIC+GII)
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	Spanish/English Friendly

1. COURSE SUMMARY

In the officially approved study plans, for the three grades including in this teaching guide, the matter Statistics is framed within the area of Mathematical Fundamentals of the block of Mandatory Basic Training. The inclusion of Statistics in said block derives from its importance as a basic instrumental science for data analysis. This importance is not only applicable to undergraduate studies in this teaching guide, but Statistics is a discipline that is included in practically all of the undergraduate study plans, with the exception of the humanities, both in Spain as abroad. Each matter in the study plan corresponds to one or more subjects, in the case of Statistics, there is only one subject with the same name, Statistics.

In the statistics subject, the basic statistics concepts and methods are studied, both descriptive as well as inferential, and consequently will also be studied the concepts of probability necessary to understand and apply the later. Said study will be carried out both in a theoretically and practically, for which a computer environment for statistical data analysis will be used.

Prerequisites and Recommendations

Prior to the teaching the subject of Statistics, the skills/knowledge obtained in the Mathematics subjects of Baccalaureate are needed. During the teaching of the subject, they will be usefulness the skills/knowledge that are acquired in the subject of Mathematics and Programming. After passing the subject, the skills/knowledge acquired in the same will be useful in various subjects of the degree, and especially for the subject Fundamentals of Data Science.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills:

en_CG8 - Knowledge of the basic subjects and technologies, which enable them to learn and develop new methods and technologies, as well as those that provide them with great versatility to adapt to new situations.

en_CG9 - Ability to solve problems with initiative, decision making, autonomy and creativity. Ability to know how to communicate and transmit the knowledge, skills and abilities of the profession of Computer Engineering Engineer.

en_CG10 - Knowledge to perform measurements, calculations, assessments, appraisals, appraisals, studies, reports, task planning and other similar computer work, in accordance with the knowledge acquired as set out in section 5, annex 2, of BOE resolution -A-2009-12977.

en_CB1 - That students have demonstrated to possess and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

en_CB2 - That the students know how to apply their knowledge to their work or vocation in a professional manner and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

en_CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

en_CB4 - That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized public.

en_CB5 - That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Specific Skills

This course contributes to acquire the following professional skills:

en_CIB1 - Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra; differential and integral calculation; numerical methods; numerical algorithms; Statistics and optimization.

Learning Outcomes

After succeeding in this subject the students will be able to:

RA1: Differentiate between probability and statistics. Differentiate between discrete and continuous probability. Understand the importance of estimation and the concepts of correlation and regression.

RA2: Calculate probabilities and expectations of random variables. Differentiate between dependent and independent events. Recognize situations in which it is appropriate to consider the relevance of normal and / or exponential distributions.

RA3: Calculate the expectation of functions of more than one variable. Recognize situations in which different sampling methods are relevant and apply them.

RA4: Know the role of hypothesis tests. Apply regression and correlation techniques to establish relationships between variables.

RA5: Become familiar with the concepts and tools to handle stochastic processes. Distinguish types of stochastic processes depending on the moments of observation and the results observed. To know the basic properties of Markov chains in discrete time. Classification of the states of Markov chains.

RA6: Know the most relevant properties and characteristics of the Poisson Process and other processes in continuous time. Correctly model waiting queue situations under Poissonian models. Know some non-Poissonian models, networks and series of queues, and the usefulness of simulation in Queuing Theory.

RA7: Know how to design and analyze experiments and studies using statistical tools.

RA8: Know how to use statistical data processing packages.

3. CONTENTS

Contents Blocks	Total number of hours
Lesson 1. Introduction to Statistics	4 h
Lesson 2. Descriptive Statistics: Description of one variable	8 h
Lesson 3. Descriptive Statistics: Joint description of several variables	8 h
Lesson 4. Probability	8 h
Lesson 5. Random variables and probability distribution models	8 h
Lesson 6. Statistical Inference: Estimation	8 h
Lesson 7. Statistical Inference: Hypothesis contrast	8 h

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (50 hours on-site +8 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Sessions of large group in the classroom in combination with practices in the laboratory:

Lessons in person will be held in the classroom and laboratory. It will be two kind of lessons:

- Lessons in the classroom: the theoretical concepts of the subject will be presented through the use of presentational tools and in the blackboard. Moreover, practical exercises will be solved in the blackboard complementing the theoretical contents.
- Lessons in the laboratory: It will be solved, thorough the use of the software statistical environment used in the subject, questions based on the contents of the lessons taught in the classroom. Moreover, practical exercises will be solved in the blackboard complementing the theoretical contents.

Group and collaborative work

The practical teaching, through the solution of questions, exercises and practices will have a fundamental role, as methodological strategy, in the teaching of the subject. In consequence will be asked to the students a high degree and participation in the solution of questions and exercises, individually, but also in group, specially in he realization of the practices or laboratory exams, that could

be solved in group. Moreover, as a part of that work, oral presentations could be made by the students groups about the work made, to the rest of students in the course, about the work done.

Personal work and study

Inside personal work and study the following activities must be performed:

- Study of the theoretical concepts imparted.
- Resolution of exercises. This will be the fundamental activity that the student must realize as personal work and study. It will be very important that the student dedicates enough time to personal work and study because of this dedication will depend the use of the lessons in person.
- Resolution of questions/exercises/practices with the software for statistic used in the subject.
- Realization of textual summaries and schemes about the concepts imparted.
- Consultation of bibliography sources and resources, physical and electronic.

Both the lessons and the autonomous work will be supported by tutorials, in official schedules hours established for the subject, that will be held individually or in group.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the [Learning Assesment Guidelines](#) as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

Continous Assessment:

The continuous assessment process will use different strategies and will collect, during the term, evidences related with all the teaching-learning process during the teaching of the subject. These evidences will consist in the following assessment exams:

- Two continuous assessment exams, PEC1 and PEC2, that will consist in the solution of written exercises based on the contents of the studied lessons.
- Three laboratory exams, PL1, PL2, PL3, that will consist in the solution of exercises or practices that can be solved with the use of the software for statistics used in the subject or as written exercises.

Assessment through final exam:

In the case of evaluation by means of a final exam, that will be only applied to the students that had asked to the direction of the studies for this possibility following the approved process and that has obtained its approbation, the exam will consist in the realization of one or more written theoretical practical exercises and/or laboratory practices, about the lessons imparted in the subject. The exam will be held in the date officially approved by the direction of the studies.

Extraordinary Call.

The extraordinary call will have the same format and duration as the final assessment exam and it will take place in the date officially set by the direction of the studies.

5.2. EVALUATION

EVALUATION CRITERIA

Evaluation criteria that will be applied to the subject Statistics are linked with the Learning Outcomes defined for it in section 2 and they will be oriented to collect both the level of understanding of the contents and the capacity to apply the acquired knowledges to problems resolution, with and without the use of software tools. Moreover, it will be taken into account the positive and collaborative attitude in the realization of the tasks, both individually and in group, and the degree of interest shown in the realization and accomplishment of the classroom and laboratory activities and in the autonomous and collaborative work, so it will be essential to deliver in time and with the correct format all the practices and activities:

It will be used the following percentages for each one of the criteria of assessment for the subject, related with the learning outcomes:

CE1. Knowledge and applications of the contents: 60%

CE2. Solution using software of practical problems: 36%

CE3. Interest and behavior in the subject: 4%

GRADING TOOLS

This section summarizes the assessment tools that will be applied in each one of the evaluation criteria:

1. **CE1.** PEC1 and PEC2
2. **CE2.** PL1, PL2 and PL3
3. **CE3.** Interest and behavior in the lessons in the classroom and in the laboratory

GRADING CRITERIA

In the ordinary call-continuous assessment the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE1, CE2, CE3	PEC1	30%
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE1, CE2, CE3	PEC2	30%
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE2, CE3	PL1	12%
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE2, CE3	PL2	12%
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE2, CE3	PL3	12%
		CE3	Interest and behavior	4%

In the ordinary call-final evaluation, the relationship between the competences, learning outcomes, criteria and evaluation instruments is as follows.

Skill	Learning Outcomes	Evaluation criteria	Grading Tool	Contribution to the final mark
en_CG8-en_CG10, en_CIB1	RA1-RA8	CE1, CE2, CE3	PEF	100%

Extraordinary call

In the case of the extraordinary call, the same percentages that have been established in the case of the evaluation by means of a final exam will be maintained.

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Peña, D. Fundamentos de Estadística. Alianza Editorial, 2008. ISBN: 9788420683805
- Spiegel, M. y Stephens, L. Estadística. McGraw-Hill, 2010. ISBN: 9701068874
- Johnson, R y Kuby, P. Just the Essential of Elementary Statistics. Duxbury-Thomson Learning, 2009. ISBN: 053499945X
- Dodge, Y. The Oxford Dictionary of Statistical Terms. Oxford University Press, 2010. ISBN: 9780199206131

6.2. Additional Bibliography

- De Burgos, J. Estadística, definiciones, teoremas y resultados. García Maroto Editores, 2011. ISBN: 9788415214632.
- Olarrea, J, y Cordero, M. Probabilidad y Variable Aleatoria: 25 problemas útiles. García Maroto Editores, 2007. ISBN: 9788493527198.
- Olarrea, J, y Cordero, M. Inferencia Estadística: 20 problemas útiles. García Maroto Editores, 2007. ISBN: 9788493527181.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.