Course guide
330217 - ES - Statistics

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Unit in charge:	Manresa School of Engineering
Teaching unit:	749 - MAT - Department of Mathematics.

Degree:	BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023   **ECTS Credits:** 6.0   **Languages:** Catalan

LECTURER

Coordinating lecturer:	Rubió Massegú, Josep
Others:	Alsina Aubach, Montserrat
	Badia Orive, Esteve
	Bastardas Ferrer, Gemma
	Cors Iglesias, Josep M.
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	Domenech Blazquez, Margarita
	Freixas Bosch, Josep
	Gilibets Palau, Inmaculada
	Gimenez Pradales, Jose Miguel
	Puente Del Campo, Maria Albina
	Rossell Garriga, Josep Maria
	Samaniego Vidal, Daniel
	Sanchis Ferri, Francisco Miguel
	Tobias Rossell, Ester
	Ventura Capell, Enric

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE1: Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial differential equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
3. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
4. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

TEACHING METHODOLOGY

In the content exposition sessions, the teacher will introduce the theoretical bases of the subject, concepts, methods and results and will illustrate them with suitable examples to facilitate understanding.

The students will have to study independently to assimilate the concepts, solve the proposed exercises either by hand or with the help of the computer.

Small group face-to-face sessions where the teacher will solve the doubts that the students have after their autonomous study, and/or there will be practices.

Activities A1 and A2 are part of the small group face-to-face sessions while tests E1 and E2 are part of the large group face-to-face sessions.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the Statistics course, the student must be able to:
- Solve problems related to probability and statistics fluently.
- Use with good criteria the appropriate statistical tools for modeling and problem solving.
- Manipulate data, apply suitable theoretical methods and draw conclusions from the obtained results.
- Use appropriate software to solve statistical problems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

1. DESCRIPTIVE STATISTICS

Description:
Sample and population. Type of data. Frequency distributions. Graphical representation of data. Central and dispersion measures. Symmetry measures. Linear and polynomial regression. Linear transformable model. Correlation coefficient.

Related activities:
Test E1 and Activity A1

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

2. PROBABILITY AND RANDOM VARIABLES

Description:
Notion of probability, conditional probability, total probability and Bayes formula: applications. Probability, density and distribution functions. Reliability of a system. Expected value and variance of a random variable.

Related activities:
Test E1 and Activity A1

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

3. NOTABLE DISTRIBUTIONS

Description:
Discrete distributions: uniform, binomial, geometric and Poisson. Continuous distributions: uniform, normal and exponential. Distributions associated with the normal: khi-squared, Student's t and Fischer-Snedecor's F. Normal approximation of binomial and Poisson distributions.

Related activities:
Test E2 and Activity A2

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 6h
Self study : 18h

4. FUNDAMENTALS OF STATISTICAL INFERENCE

Description:
Random sample and displayed distributions. Estimation problem. Punctual estimators. Confidence intervals. Statistical decision: hypothesis test. Randomness, independence and normality test.

Related activities:
Test E2 and Activity A2

Full-or-part-time: 40h
Theory classes: 8h
Laboratory classes: 8h
Self study : 24h

5. QUALITY CONTROL AND MAIN COMPONENTS

Description:
Variable manufacturing control. Control graphs for median and standard deviation. Manufacturing control for attributes. Detection of main components.

Related activities:
Test E2 and Activity A2

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study : 12h

ACTIVITIES

A1: DESCRIPTIVE STATISTICS AND RANDOM VARIABLES

Description:
Activity to be done in the computer class individually.

Specific objectives:
At the end of the activity the student must be able to:
1. Use a statistical package to descriptively analyze a data set.
2. Organize and graphically represent a collection of data to interpret it correctly.
3. Compute and interpret the numerical descriptive measures of a data set.
4. Investigate the relationship between two variables.
5. Use a statistical package to simulate random variables.

Material:
Software available in the computer class.
Practice scripts, problem lists and miscellaneous material available at ATENEA.

Delivery:
The solved practice must be given to the teacher. The realization of this test is necessary to pass the subject by course.
It represents a part of the continuous evaluation of laboratory teaching.

Full-or-part-time: 4h
Laboratory classes: 1h
Self study: 3h

A2: NOTABLE DISTRIBUTIONS, STATISTICAL INFERENCE AND QUALITY CONTROL

Description:
Activity to be done in the computer class individually.

Specific objectives:
At the end of the activity the student must be able to:
1. Calculate probabilities associated with notable distributions.
2. Approximate distributions using the Central Limit Theorem.
3. To estimate punctually and by interval the population parameters of the remarkable distributions.
4. Make decisions using hypothesis tests.
5. Identify situations for which quality improvement tools are useful.
6. Use a statistical package to achieve the objectives set out in the previous points.

Material:
Software available in the computer class.
Practice scripts, problem lists and miscellaneous material available at ATENEA.

Delivery:
The solved practice must be given to the teacher. The realization of this test is necessary to pass the subject by course.
It represents a part of the continuous evaluation of laboratory teaching.

Full-or-part-time: 4h
Laboratory classes: 1h
Self study: 3h

E1 AND E2: WRITTEN TESTS

Description:
Individual tests in class related to the learning objectives of the contents of the subject.

Specific objectives:
Evaluate the general assimilation of the objectives of contents 1, 2, 3, 4 and 5.

Material:
Test statements (delivered at the time of the test).

Delivery:
The solved test must be given to the teacher.
It represents a part of the continuous evaluation of the specific contents of the subject.

Full-or-part-time: 16h
Theory classes: 4h
Self study: 12h

GRADING SYSTEM

The qualification is obtained from the NE mark, corresponding to the E1 and E2 tests, and the NA mark corresponding to the activities A1 and A2.

The objectives of the subject will be considered achieved if the final grade of the continuous assessment: Nc=0.7*NE + 0.3*NA is greater than or equal to 5.

Students with a course grade (Nc) lower than 5 can take a comprehensive exam (grade:Ng). The student's final grade will be Nf=maximum (Nc, Ng).

EXAMINATION RULES.

All tests and activities are mandatory.
If any of the tests or activities of the subject is not carried out, it will be considered a grade with zero.

BIBLIOGRAPHY

Basic:
- Forcada, Santiago.; Rubió Massegú, Josep. Elements d'estadística [on line]. Barcelona: Edicions UPC, 2007 [Consultation: 06/11/2020]. Available on: http://hdl.handle.net/2099.3/36675. ISBN 9788483019269.
- Grima, P.; Marco, L.; Tort-Martorell, X. Estadística práctica con Minitab. Madrid: Pearson Educación, 2004. ISBN 8420543551.
- Ryan, B. F.; Joiner, B. L. Minitab handbook. 3rd ed. Belmont, CA: Duxbury Press, 1994. ISBN 0534212409.
- Walpole, R. E., i altres. Probabilidad y estadística para ingeniería y ciencias [on line]. 9ª ed. México: Pearson Educación, 2012 [Consultation: 07/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6766. ISBN 9786073214179.
- Devore, Jay L; García Hernández, Ana Elizabeth; Torres Flores, Jesús Miguel; León Cárdenas, Javier. Probabilidad y estadística para ingeniería y ciencias. 9ª ed. México: Cengage Learning, 2016. ISBN 9786075228280.

Complementary:
- Lipschutz, S.; Schiller, J. J. Introducción a la probabilidad y estadística. Madrid: McGraw-Hill/Interamericana de España, 2001. ISBN 8448125045.
- Mendenhall, W.; Scheaffer, R. L.; Wackerly, D. D. Estadística matemática con aplicaciones. México: Grupo Editorial Iberoamérica, 1986. ISBN 9687270179.
- Moore, D. S. Estadística aplicada básica [on line]. 2ª ed. Barcelona: Antoni Bosch, 2005 [Consultation: 29/07/2022]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=803821&site=eho

st-live&ebv=EB&ppid=pp_Cover. ISBN 8495348047.