

Course guide

340354 - ESTA-C3O43 - Statistics

Last modified: 03/04/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2018). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Simo Mezquita, Ester

Others: Aguiló Gost, Francesc
Batlle Arnau, Carles

PRIOR SKILLS

Ability to apply the basic tools of differential and integral calculus in one real variable.

REQUIREMENTS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

Transversal:

2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

3. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

TEACHING METHODOLOGY

In the lectures the instructor presents some motivating ideas, the fundamental concepts and some relevant developments, intermingled with key examples and the resolution of representative problems.

In the lab classes the students learn how to solve some statistical questions, using R-STUDIO. In the last sessions, several short exercises, to be solved in the lab, will be assigned and graded afterwards.

LEARNING OBJECTIVES OF THE SUBJECT

- Be able to use the basic techniques to extract statistical information from a database.
- Be able to use the basic theory of probability
- Be able to use the distribution models that govern random behavior.
- Be able to use the techniques of statistical inference to find, from an observation of the population, certain characteristics of the population as a whole.
- Be able to use the regression techniques to make predictions.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	15,0	10.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

1.Descriptive statistics

Description:

- 1.1 Variables. Types.
- 1.2 Graphical and statistical tools for analyzing one-dimensional variables.
- 1.3 Graphic and statistical tools for analyzing two-dimensional variables.

Specific objectives:

Ability to use the basic techniques to extract statistical information from a database.

Related activities:

Activity 1

Related competencies :

- . CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.
- 07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
- 06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Full-or-part-time: 15h

Laboratory classes: 6h

Self study : 9h

2: Probability

Description:

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Specific objectives:

Related activities:

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Full-or-part-time: 15h

Theory classes: 6h

Self study : 9h

3: Random variables

Description:

3.1 Definition and types of random variables.

3.2 Density function and distribution function of random variables.

3.3 Expectation and variance of a random variable.

3.4 Distribution models: Binomial, Poisson, Exponential and Normal.

Specific objectives:

Understand distribution models that govern random behavior.

Related activities:

Activity 3

Activity 5

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

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06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Full-or-part-time: 32h

Theory classes: 12h

Laboratory classes: 2h

Self study : 18h

4. Inference

Description:

- 4.1 Sampling.
- 4.2 Estimation of parameters.
- 4.3 Confidence intervals.
- 4.4 Hypothesis tests.

Specific objectives:

Ability to apply the statistical inference to find, from an observation of the population, certain characteristics of the population as a whole.

Related activities:

Activity 2
Activity 4
Activity 5

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Full-or-part-time: 27h

Theory classes: 10h

Laboratory classes: 2h

Self study : 15h

5. Regression

Description:

- 5.1 Simple linear regression model.
- 5.2 Validation of the model.
- 5.3 Transformation of variables.

Specific objectives:

Learn regression techniques to make predictions.

Related activities:

Activity 4
Activity 5

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

Full-or-part-time: 22h

Theory classes: 8h

Laboratory classes: 2h

Self study : 12h

ACTIVITIES

1. FIRST LAB TEST

Description:

The student will have to solve problems, with the help of R-STUDIO, using statistical descriptive techniques of content 1.

Specific objectives:

Confirm the domain of the descriptive statistical techniques using R-STUDIO

Material:

Statement of the test and class material.

Delivery:

The written solution of the problems proposed.

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h

Laboratory classes: 2h

2. SECOND LAB TEST

Description:

The student will have to perform an assignment, with the help of R.STUDIO, using the techniques of contents 4 and 5.

Specific objectives:

-Be able to use linear regression tools and statistical inference with R-STUDIO.

Material:

Statement of test and class material.

Delivery:

The work must be delivered a week after the task was assigned.

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 5h

Self study: 5h

3. FIRST THEORETICAL EXAM

Description:

The student will have to solve, in person and in writing, problems on the contents 2 and 3 of probability and random variables.

Specific objectives:

- Be able to use basic probability theory.
- Be able to use distribution models of aleatory variables.
- Be able to use central limit theorem.

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed exercises

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h

Theory classes: 2h

4: SECOND THEORETICAL EXAM

Description:

The student will have to solve, in person and in writing, problems on contents 4 and 5.

Specific objectives:

- Be able to use statistical inference tools.
- Be able to use linear regression tools.

Material:

Statement of the test and summary table of theory.

Delivery:

The written solution of the proposed problems.

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

5: FINAL EXAM

Description:

The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

Specific objectives:

Be able to use the basic techniques of the subject.

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed problems.

Related competencies :

. CE1. Ability to solve arithmetic problems related to engineering. Aptitude to apply knowledge concerning: linear algebra, geometry, differential geometry, differential and integral calculus, differential and partial equations, numerical methods, numerical algorithms, statistics and optimization.

06 URI N1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 1. Identifying information needs. Using collections, premises and services that are available for designing and executing simple searches that are suited to the topic.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

6. REEVALUATION TEST

Description:

The student will have to solve, in person and in writing, problems about contents 2, 3, 4 and 5.

Specific objectives:

Be able to use the basic techniques of the subject.

Material:

Statement of test and summary table of theory

Delivery:

The written solution of the proposed problems.

Full-or-part-time: 2h 15m

Theory classes: 2h 15m

GRADING SYSTEM

A1=laboratory exam with R-STUDIO

A2=assignment with R-STUDIO

A3=first partial exam

A4=second partial exam

A5=final exam

A6=reassessment exam

FINAL GRADE = MAX (0.1*A1+0.1*A2+0.35*A3+0.45*A4, 0.1*A1+0.1*A2+0.8*A5)

REASSESSMENT GRADE = 0.1*A1+0.1*A2+0.8*A6

(all partial scores on a 0-10 scale)

EXAMINATION RULES.

- The conditions for conducting the individual written tests will be announced with sufficient time.
- Attendance at laboratory sessions and activities A1 and A2 are compulsory.
- Activities 4 and 5 will be done on the same day and, therefore, only one can be done.
- Only activity 5 can be reevaluated.

BIBLIOGRAPHY

Basic:

- Forsyth, David. Probability and statistics for computer science [on line]. 1st ed. Cham: Springer International Publishing, 2018 [Consultation: 14/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=6314295>. ISBN 9783319644103.
- Devore, Jay L. Probabilidad y estadística para ingeniería y ciencias. 9a ed. México [etc.]: Cengage Learning, 2016. ISBN 9786075228280.
- Peña, Daniel. Fundamentos de estadística. 2a ed. Madrid: Alianza Editorial, 2008. ISBN 9788420683805.

Complementary:

- Ras Sabidó, Antoni. Estadística aplicada per a enginyeria [on line]. Barcelona: Edicions UPC, 1993 [Consultation: 01/07/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36689>. ISBN 8476532849.