Syllabus

Subject

Subject / Group	20305 - Mathematics III - Statistics / 95
Degree	Degree in Automation and Industrial Electronic Engineering - First year Degree in Computer Engineering (2010 syllabus) - First year Degree in Computer Engineering (2014 syllabus) - First year
Credits	6
Period	2nd semester
Language of instruction	English

Professors

Lecturers	**Office hours for students**					
	Starting time	**Finishing time**	**Day**	**Start date**	**End date**	**Office / Building**
Margarita María Lourdes Miró Julià *Responsible* margaret.miro@uib.es	You need to book a date with the professor in order to attend a tutoring session.					

Context

The course *20305 Mathematics III - Statistics* is a basic course taught in the second semester of the freshman year. This course provides an introduction to probabilistic and statistical thinking, and its technical content is considered as a basic level to introductory probability and statistics. This course aims to provide mathematical training and an improvement in the reasoning ability of the student, enhancing their capacity for abstraction. This course is focused on the development of a set of skills and learning strategies that will enable the student to analyze a problem, search and find a mathematical model to describe it, solve it and interpret the solution obtained.

In the Computer Engineering Degree and the Industrial Engineering Degree 20305 Mathematics III - Statistics is part of the Basic Training Module.

Requirements

Since this is an introductory course, there are no requirements other than those needed for university access.

A good command of English is advisable for those students registered in group 95.

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Recommended

It is highly recommended to have completed successfully High School Mathematics (*Mathematics I* and *Mathematics II*). Knowledge in these subjects is expected and will not be part of the curriculum.

Skills

Specific

* To develop the capacity for the resolution of the mathematical problems that arise in engineering and the ability for applying statistical knowledge (GEIN: CBF01; GEEI: E1)

Generic

* To develop skills in analysis and synthesis (GEIN: CTR01; GEEI: T1)
* To have the ability to acquire new knowledge autonomously (GEIN CTR03; GEEI T5)
* To convey the ability to work with multidisciplinary and multilingual teams. (GEIN CTR05; GEEI T7)

Basic

* You may consult the basic competencies students will have to achieve by the end of the degree at the following address: http://www.uib.eu/study/grau/Basic-Competences-In-Bachelors-Degree-Studies/

Content

The major areas of Statistics are covered in this course. Descriptive statistics is the discipline of quantitatively describing the main features of a collection of information. The aim of descriptive statistics is to summarize the data either quantitatively or with a graph. Univariate analysis involves describing the distribution of a single variable, whereas multivariate analysis describes relationships between many variables. Probability theory is the analysis of random phenomena and the mathematical foundation for statistics. It is essential in the quantitative analysis of large sets of data. The central ideas behind probability theory are random variables and probability distributions. Through them patterns exhibited by the data can be studied and predicted. Statistical inference makes propositions about a population, using data drawn from the population via some form of sampling. With inferential statistics, you are trying to draw conclusions that extend beyond the immediate data.

Range of topics

1. Univariate Statistics. Multivariate Statistics
    * Frequency distribution tables
    * Graphs
    * Central tendency measures
    * Statistical dispersion measures
    * Contingency tables
2. Probability Theory
    * Basic definitions and operations
    * Probability. Properties
    * Bayes theorem
3. Random Variables and their Distributions

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* Discrete random variables. Probability function. Espected value and variance. Binomial distribution, Poisson distribution, geometric distribution, ...
* Continuous random variables. Density function. Expected value and variance. unifofrm distribution, normal distribution, exponential distribution, ...
* Introduction to random vectors. Multidimensional distribution functions.

4. Introduction to Inferential Statistics
   * Populaton and sample. Simple random sample
   * Sampling distributions
   * Confidence intervals
   * Hypothesis testing for one and two samples
   * Goodness of fit test. Independent variable test
5. Applications

   Application of statistical techniques and methods to practical cases using specific software. Such as:

   * Analysis of variance (ANOVA). Linear regression
   * Quality control
   * Introduction to statistical learning

Teaching methodology

Following below are the different types of activities to be performed by the students, both in the classroom and autonomously (at home, library, group-study, ...).

With the purpose of making easier the student's personal work, it has been requested that the course be part of the Aula Digital project that allows for flexibility in distance teaching and learning. Through this platform students will have at their disposal online communication with the teachers, a calendar with news of interest, electronic documents, proposed problems or assignments for both individual and group work, as well as a suitable environment for submitting assignments and access to their grades.

Important dates are available at the beginning of the semester through the UIB digital platform, these dates are tentative, except the dates of the final exam which is set by the Polytechnical School. The due dates of the proposed assignments will be notified to the students in class and by announcements through Aula Digital.

The distribution of on-site classroom work is illustrative and represents the planning made by the professors without taking into account any contingencies that might arise during the semester.

The distribution of out-of-class work, which is also illustrative, represents the ideal distribution planned by the professors. The different activities are planned so that for each hour of on-site classroom work, the student should work an additional hour and a half in an autonomous manner (individual study, problem solving, computer implementation, ...). Without an out-of-classroom work load of this magnitude it will be difficult to reach a sufficient level of knowledge and obtain the desired competencies.

Workload

The distribution of the proposed in-class work volume is illustrative and represents the planning made by the teachers, without taking into account all the contingencies that may arise during the course.
The distribution of out-of-class work, which is also illustrative, represents the ideal distribution planned by the teachers. The various activities of the course are planned so that for each hour of in-class work, the average

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student should work an hour and a half autonomously (individual study, problem solving, ...). Without an autonomous work of this magnitude it will be difficult to reach the desired level of knowledge and skills.

In-class work activities (2.4 credits, 60 hours)

Modality	Name	Typ. Grp.	Description	Hours
Theory classes	Lecture	Large group (G)	Concepts, procedures and their application to exercises and problems are introduced at master classes. The lecturer will describe the theoretical and practical foundations of the different topics covered in the course. The achievement of skill CBF01 is part of this activity.	41
Seminars and workshops	Continuous evaluation tasks	Medium group (M)	In order to assess the student's progress, different tasks will be proposed in the seminars/workshop sessions. The proposed assignements will be solved individually or in small groups with or without the support of the professor. * QUIZZES: throughout the course, in order to ensure the acquisition of knowledge and skills, students will complete quizzes or short tests. * WORKSHOPS: throughout the course, students will complete proposed assignments during class or autonomously, individually or in small groups, with or without the support of the professor. * APPLICATIONS: students will complete, individually or in small groups, a project that integrates the knowledge acquired throughout the semester, it will consist in the resolution of a problem using the R software environment for statistical computing and graphics * OTHER: the teachers may propose other activities to assess student's learning, scoring details will be explained in the proposal. The achievement of skills CBF01, CTR01 and CTR05 are part of this activity.	15
Assessment	Final exam	Large group (G)	The final comprehensive examof the entire course evaluates the acquisition of the topics and competencies of the course. The final exam may have questions on theoretical concepts and the resolution of problems and will always have a part consisting in the use and/or interpretation of statistical software. The achievement of skill CBF01 is part of this activity.	2
Assessment	Midterm	Large group (G)	A midterm exam will be taken as part of the continuous evaluation process. The midterm exam may have questions on theoretical concepts and will always have a part consisting in the resolution of problems. The achievement of skill CBF01 is part of this activity.	2

At the beginning of the semester a schedule of the subject will be made available to students through the UIBdigital platform. The schedule shall at least include the dates when the continuing assessment tests will

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be conducted and the hand-in dates for the assignments. In addition, the lecturer shall inform students as to whether the subject work plan will be carried out through the schedule or through another way included in the Aula Digital platform.

Distance education tasks (3.6 credits, 90 hours)

Modality	Name	Description	Hours
Individual self-study	Individual self-study	Individual self-study to assimilate the contents presented in the master classes or to review autonomously proposed assignments. The achievement of skills CTR01, CTR03 are part of this activity.	30
Group or individual self-study	Real-life applications	Individually or in small groups, the student will be required to complete assignments using specialized statistical software. The achievement of skills CBF01, CTR01, CTR03 and CTR05 are part of this activity.	30
Group or individual self-study	Problem solving	Individual or group study focused on consolidating what has been assimilated in the individual self-study through the resolution of exercises and problems, and exam preparation. The achievement of skills CBF01, CTR01 and CTR05 are part of this activity.	30

Specific risks and protective measures

The learning activities of this course do not entail specific health or safety risks for the students and therefore no special protective measures are needed.

Student learning assessment

The assessment of the course will be carried out using the following elements: MIDTERM EXAM, COMPREHENSIVE EXAM and CONTINUING EVALUATION TASKS:

Comments:

* By default, all students will be evaluated using itinerary A. Those students who wish to be evaluated by itinerary B must request it at the beginning of the semester.
* The submission of assignments proposed through itinerary B will take place at a seminar where the students will discuss the work carried out.
* Make ups are not available for assessment elements marked as "non-retrievable" ("no recuperable"); all assessment elements will have submission deadlines that must be respected by the students. Assignments turned in late will be penalized.
* In order to pass the course it is necessary to obtain a minimum score of 4 (over 10) in the final exam. If the minimum score is not reached, the final grade will be the minimum between 4.5 and the weighted average of all assessment elements.
* In order to pass the course it is necessary to attend an 80% of the classes. If the minimum attendence is not satisfied, the final grade will be the minimum between 4.5 and the weighted average of all assessment elements.
* In the individual grade of group activities, the professor may take into account (to raise or lower the grade) the contribution of the student to the group's performance.

Statement on Academic Misconduct

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The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations.

For additional information, see https://seu.uib.cat/fou/acord/109/10959.html (In particular, *article 33 del Reglament Acadèmic de la UIB respecte al frau*.)

Frau en elements d'avaluació

In accordance with article 33 of Regulation of academic studies, "regardless of the disciplinary procedure that may be followed against the offending student, the demonstrably fraudulent performance of any of the evaluation elements included in the teaching guides of the subjects will lead, at the discretion of the teacher, a undervaluation in the qualification that may involve the qualification of "suspense 0" in the annual evaluation of the subject".

Continuous evaluation tasks

Modality	Seminars and workshops
Technique	Other methods **(non-recoverable)**
Description	In order to assess the student's progress, different tasks will be proposed in the seminars/workshop sessions. The proposed assignements will be solved individually or in small groups with or without the support of the professor. * QUIZZES: throughout the course, in order to ensure the acquisition of knowledge and skills, students will complete quizzes or short tests. * WORKSHOPS: throughout the course, students will complete proposed assignments during class or autonomously, individually or in small groups, with or without the support of the professor. * APPLICATIONS: students will complete, individually or in small groups, a project that integrates the knowledge acquired throughout the semester, it will consist in the resolution of a problem using the R software environment for statistical computing and graphics * OTHER: the teachers may propose other activities to assess student’s learning, scoring details will be explained in the proposal. The achievement of skills CBF01, CTR01 and CTR05 are part of this activity.
Assessment criteria	Correctness of the approach used, the justified mathematical solution of the problem, the clarity of the explanation and the rigor in the reasoning, the ability to express and defend concepts learned throughout the course. Assessed skills: CBF01, CTR01 and CTR05

Final grade percentage: 40% for pathway A
Final grade percentage: 50% for pathway B

Final exam

Modality	Assessment
Technique	Objective tests **(recoverable)**
Description	The final comprehensive examof the entire course evaluates the acquisition of the topics and competencies of the course. The final exam may have questions on theoretical concepts and the resolution of problems and will always have a part consisting in the use and/or interpretation of statistical software. The achievement of skill CBF01 is part of this activity.
Assessment criteria	Correctness of the approach used, the justified mathematical solution of the problem, the clarity of the explanation and the rigor in the reasoning, the ability to express and defend concepts learned throughout the course.

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Assessed skills: CBF01 and CTR01.

Final grade percentage: 40% for pathway Awith a minimum grade of 4
Final grade percentage: 50% for pathway Bwith a minimum grade of 4

Midterm

Modality	Assessment
Technique	Objective tests **(non-recoverable)**
Description	A midterm exam will be taken as part of the continuous evaluation process. The midterm exam may have questions on theoretical concepts and will always have a part consisting in the resolution of problems. The achievement of skill CBF01 is part of this activity.
Assessment criteria	Correctness of the approach used, the mathematical solution of the problem, the clarity of the explanation and the rigor in the reasoning. Assessed skills: CBF01.

Final grade percentage: 20% for pathway A
Final grade percentage: 0% for pathway B

Resources, bibliography and additional documentation

The books recommended in the basic bibliography are publically available to UIB students

Basic bibliography

Introductory Statistics (3rd Edition)
Sheldon M. Ross
Elsevier, 2010.
Introduction to Probability and Statistics for Engineers and Scientists (4th Edition)
Sheldon M. Ross
Elsevier, 2009.

Complementary bibliography

Using R for Introductory Statistics (2nd Edition)
John Verzani
CRC Press, 2014.
Coping with Hitchhikers and Couch Potatoes on Teams
Turning Student Groups into Effective Teams
B. Oakley, R.M. Felder, R. Brent y I. Elhajj
Journal of Student Centered Learning
Vol. 2, No. 1, 2004/9
McGraw Hill, 1996.

Other resources

Through the Aula Digital platform, students will have at their disposal academic resources prepared by the professors.

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