26302 - ME2 - STATISTICAL METHODS 2

Coordinating unit: 200 - FME - Faculty of Mathematics and Statistics
Teaching unit: 715 - EIO - Department of Statistics and Operations Research
1004 - UB - (ENG)Universitat de Barcelona

Academic year: 2009

Degree: DEGREE IN STATISTICAL SCIENCES AND TECHNIQUES, PLAN 99 (Syllabus 1999). (Teaching unit Compulsory)
INTER-UNIVERSITY MASTER'S DEGREE IN STATISTICS AND OPERATIONS RESEARCH UPC-UB (Syllabus 2006). (Teaching unit Optative)
DOCTORATE IN STATISTICS AND OPERATIONAL RESEARCH (Syllabus 2007). (Teaching unit Optative)
MASTER IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2006). (Teaching unit Optative)

Credits: 6

Teaching languages: Catalan

Lecturers

Coordinator: RIBA CIVIL, ALEXANDRE
Others: RUIZ DE VILLA JUBANY, M. DEL CARME

Teaching methodology

Course lecture sessions are held in a lecture hall and in a computer lab.
* Theoretical sessions: 2-hour sessions in which course topics are introduced and discussed with the aid of transparencies. The lecturer will present the statistical techniques of experimental design and analysis using practical examples and real data (all the files used by the lecturer are freely available on the course intranet).
* Problem-solving sessions: Weekly 2-hour sessions held in the PC lab. The first hour is devoted to introducing the instructions of the software package required for solving problems of analysis that are posed on the course intranet before the start of the class. During the second hour, students solve these problems with the assistance of the lecturer. Before the end of the session, the lecturer will post the files containing the correct implementation of the problems set on the course intranet.
* Practicals: There are two practical assignments that must be completed individually. They consist of solving an experimental result analysis problem. Each practical assignment must be completed in students' own time and will count toward the final practical result. Assignment reports must be handed in two weeks after the corresponding script is made known.

There is also a course project based on a topic chosen by students themselves, who should present a proposal to that effect to the lecturer, who in turn must approve it by a specified date. Before the end of the course, students are required to hand in a project report. A file containing many examples of experiments that can be performed, as well as specific guidelines for the work, can be found on the course intranet.

Learning objectives of the subject

The Statistical Methods 2 course is of a highly applied nature. Its basic aim is for students to acquire the knowledge and skills required for solving practical problems of experimental design and analysis, as well as techniques for the statistical control of processes that may arise during professional practice. The strategy for attaining this basic aim revolves around six fundamental objectives:
1- Data gathering and analysis: the first objective is for students to understand the need for good data gathering from which to extract the relevant information.
2- Experimental design: a second aim is for students to become familiarized with the main types of problems requiring a planned data-gathering design and an appropriate experimental design for a broad range of cases.
3- Experimental design and factor types: students will recognize crossed designs from nested designs and the fixed from
random factors, and will be able to evaluate which design should be used in each problem.
4- Analysis: once the experiment and data-gathering have been designed, it is then necessary to analyse the results.
   Students will analyse the experimental results with the aid of a software package.
5- Solution analysis: students should learn how to interpret correctly the results provided by the software application and carry out an analysis of the information provided by the programme in order to draw the most useful conclusions.
6- Knowledge of statistical techniques: students will learn the basic aspects of the analysis of variance and of the linear models required for understanding correctly the function of the software application employed in solving problems.
Content

INTRODUCTION TO EXPERIMENTAL DESIGN

Description:
Experimental design vs Data gathering analysis. Concepts of randomization, replication and blocking.

FIXED EFFECTS MODEL. ONE FACTOR DESIGN

Description:
- One Factor Designs
- Hypothesis checking
- Power of a factor
- Comparison of one factor’s levels by Orthogonal Contrasts, Analysis of tendencies and Multiple Comparisons
- Design with one factor and one concomitant variable: ANCOVA
- Non parametric analysis: Test of Kruskal-Wallis

FIXED EFFECTS MODE. RESTRICTIONS IN RANDOMIZATION: BLOCKING

Description:
- Randomized Block Design
- Latin Squares

FACTORIAL DESIGNS

Description:
- Two fixed factors design. Interactions.
- Design with two factors and a concomitant variable: ANCOVA
- Non parametric analysis: Test of Friedman
- Complete and fractional Factorial designs 2^k
- Robust Designs
The basis will be the continuous evaluation. However, there will be a final exam in case a student could not follow it. The evaluation activities could be:
- a test at the end of a chapter;
- solution and (possibly) exposition of assignments, which could be problems, open questions, little computing programs or conduct a data analysis;
- oral expositions.
- 1st midterm exam
- 2on midterm exam
In case a final exam is required, it will consist in the solution of problems and answering questions.
Prior skills

* Basic skills in matrix algebra: knowledge of how to calculate the rank and determinant of a matrix, how to invert matrices and how to perform operations with matrices.
* Basic statistical skills: knowledge of the main probability distributions and of statistical sample distributions, as well as possessing basic knowledge on inference.
* Know the linear regression model: know multiple linear regression; know how to adjust regression models to data; know inference with regression coefficients, and know the variance-covariance matrices.
* Basic skills in the use of the MINITAB software package: know how to make graphics, adjust linear models, interpret them from a given list and know their menus.

Bibliography

**Basic:**


**Complementary:**