Tools for research in telematic engineering

Academic Year: (2021 / 2022) **Review date: 07-06-2021**

Department assigned to the subject:

Coordinating teacher: MUÑOZ MERINO, PEDRO JOSE

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students taking this course are expected to have prior knowledge on probability theory at the basic level (concept of probability, conditional probability, probability distribution function, probability density function, or usual probability distributions) In addition, they are expected to be fluent programmers.

OBJECTIVES

The competencies that are reinforced in this course are:
- Students acquire the learning abilities that enable them to continue studying in a self-regulated and autonomous learning way
- Ability to apply knowledge of mathematics, statistics and science to the problems of Telematics Engineering
- Ability to design and conduct experiments, and analyze and interpret data
- Students know how to use different techniques for the modelling and analysis of the temporal behavior of a telematics system
- Students master the analytical foundations of the performance analysis of networks and telematics applications

After finishing the course, students will be able to:
- Properly design experiments and apply the appropriate statistical methods in order to evaluate different research objectives they will face in their research career
- Apply concepts of graph theory in order to solve problems that require it, and program algorithms on graphs

DESCRIPTION OF CONTENTS: PROGRAMME

The contents of the course are divided into two separated parts. Each one of them is detailed next with their included topics.

1.- Applied statistics

- Design of experiments: Research objectives, data gathering, methodology.
- Descriptive statistics
- Confidence intervals
- Normality test, Levene test
- Statistical hypothesis testing
- Parametric tests such as t-test or ANOVA
- Non-parametric tests such as Kruskal-Wallis or Mann-Whitney.
- Correlation
- Prediction: regression, bayesian networks

2.- Introduction to graphs in telematic systems

- Definition of graph, properties, paths, loops, connectivity, types of graphs
- Shortest path algorithms

LEARNING ACTIVITIES AND METHODOLOGY

The course comprises theoretical and practical sessions. The theoretical part will include, in addition to the explanations of the different concepts, examples and case studies. The practical part about the applied statistical part will include the resolution of practical cases and the use of a statistical software. The practical part about graph theory will include programming at least one shortest path algorithm.

ASSESSMENT SYSTEM

The evaluation will assess the level of achievement of the learning objectives based on the students outcomes.

1) First opportunity evaluation:

The calculation of the grade will be obtainned in the following way for students who follow the continous evaluation:

- Final Exam (50% of the total grade)
- Submissions of the resolution of practical cases about statistical analysis, and practical assignment about programming graph algorithms (50% of the total grade)

For students who do not follow the continuous evaluation, the final exam will have a weight of 60%.

2) Second opportunity evaluation

For those students who fail the course in the first opportunity, they will have a second opportunity. If the student followed the continuous evaluation, the final course exam of the second opportunity will have the same percentage value of 50% as in the first opportunity, and the final course grade will consider the grade of the continuous evaluation and the grade obtained in the final exam. Therefore, students who follow the continuous evaluation have the same weight distribution of percentages of the different assessments in the first opportunity and the second opportunity.

If the student has not followed the continuous evaluation, the final course exam of the second opportunity will constitute 100 % of their grades. In any case, in the second opportunity, for students who have followed the process of continuous evaluation, the best grade will be considered between both ways of evaluation.

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Andy Field Discovering Statistics using R, SAGE, 2012

- John A. Dossey, Albert D. Otto, Lawrence E. Spence, Charles Vanden Eynden Discrete Mathematic, 4th ed., Addison Wesley, 2001

ADDITIONAL BIBLIOGRAPHY

- Deborah Rumsey Intermediate Statistics For Dummies, John Wiley & Sons, 2007

- Peter Dalgaard Introductory statistics with R, Springer, 2002

BASIC ELECTRONIC RESOURCES

- . R manuals: http://cran.r-project.org/manuals.html

- G.P. Quinn, M.J. Keough . Experimental Design and data analysis for biologists: http://bio.classes.ucsc.edu/bio286/MIcksBookPDFs/
- Ruth Rosenholtz . Statistical Methods in Brain and cognitive sciences: http://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-07-statistical-methods-in-brain-and-cognitive-science-spring-2004/