Syllabus

TITLE OF THE COURSE UNIT:

Probability and Statictics

Learning outcomes

Knowledge: (Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research. Critical awareness of knowledge issues in a field and at the interface between different fields)

- Exploratory data analysis
- Sample design
- Basic concepts of probability and random variables
- Sampling distribution of a statistic and behavior of sample mean
- Statistical inference involving confidence intervals and hypothesis testing
- Statistical modeling of data in the context of regression analysis

Skills: (specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields)

- Ability to use statistical methods in collecting data, summarizing data and drawing inferences and conclusions on the basis of data
- Ability to apply fundamental concepts in exploratory data analysis
- Ability to design studies for obtaining data whilst avoiding common design flows
- Ability to use appropriate software tool for data analysis
- Ability to use statistical models to represent the reality

ECTS (academic hours):

Lectures: 20 hours	**Practical** 20 hours	**Laboratory** 20 hours

Languages used in class:

English

CRITERIA FOR ASSESSMENT:

Final score for the course will be computed as a weighted average of class participation, ten homework assignments, one midterm exam and one final exam:

	Weight
Class participation	5%
Homework	20%
Midterm	30%
Final Exam	45%

SPECIFIC SOFTWARE:

Statistical software package R is used in a class. *R* is available to download for free for both Macs and PCs (and on Unix) here: http://cran.us.r-project.org/.

COURSE OVERVIEW:

1. ***Descriptive statistics***: frequency distribution; mean, median and mode; percentiles; variance and standard deviation; introduction to regression.
2. ***Probability:*** definition and basic properties of random variables; probability distributions; expected value and variance; transformations of random variables; normal distribution.
3. ***Sampling and Estimation***: random sampling; polls; types of samples; distribution of sample estimates; central limit theorem; point estimates; accuracy and precision; bias; constructing confidence intervals; hypothesis tests, p-values.
4. ***Regression analysis:*** simple linear regression; estimation of parameters and significance testing; correlation coefficient; interpreting the regression output; multiple linear regression; dummy variables; model selection; examples of non-linear regression; applications.

LEARNING OUTCOMES

The students will learn the fundamentals of probability and statistics from a mathematical point of view, and learn logic and methods useful for the treatment and modeling of uncertainty and variability.

BIBLIOGRAPHY:

Lecture slides and a set of notes will be provided in class and they are the most important source of information for this course. There is no single book used in the course, but all references and sources used in a lecture will be provided in handouts in class.

http://online.stanford.edu/course/probability-and-statistics-self-paced