

Computational Statistics (61102)

Instructors: D.KARLIS

Core Course, 1st semester, 7.5 ECTS units

Course level: Graduate (MSc)

Language: Greek/English

Course Description

The aim of the course is to teach how computers can be used and facilitate statistical inference. The students learn the basic principles of simulations and its usage in modern statistical analyses. They also learn how to make statistical inference using the computer and how to apply numerical methods to solve statistical problems like, estimation, calculation of quantities that it is not possible otherwise, the EM algorithm etc. The basic contents of the course are:

- R programming,
- Simulation techniques,
- Monte Carlo methods,
- Markov Chain Monte Carlo Methods,
- Bootstrap and its use for inference,
- Numerical methods for statistics,
- Numerical optimization and the EM algorithm.

Prerequisites

The course implies a good prior knowledge of statistics. Basic knowledge of programming in R is required.

Target Learning Outcomes

Upon completion of the course the students will be able

- To use the computer for statistical inference
- To simulate various phenomena and stochastic models based on different distributions
- To solve statistical problems that involve numerical methods with the use of computer
- To write R code for all the above

Recommended Bibliography

- Venables, W.N., Ripley, B.D. (2002). Modern Applied Statistics with S (4th edn). Springer
- Crawley, M.J. (2002). Statistical Computing: An introduction to data analysis using S-Plus. Wiley
- Robert, C.P. and Casella, G. (2010). Introducing Monte Carlo Methods with R, Springer.
- Efron, B. and Tibshirani, R.J. (1993). An Introduction to the Bootstrap, Chapman & Hall.

- Davison, A.C. and Hinkley, D.V. (1997) Bootstrap Methods and Their Applications. Cambridge University Press, Cambridge.
- Gilks, W.R., Richardson, S. and D.J. Spiegelhalter, (1996) Markov Chain Monte Carlo in Practice, Chapman & Hall, NY

Teaching and Learning Activities

Course lasts 12 3-hours lectures (one each week). Every week there will be exercises as homework (some to be submitted).

Assessment and Grading Methods

The final grade is the weighted average of the final examination grade (weight 70%) and the three assignment/projects (weight 30%).