

## STATISTICS AND APPLICATIONS USING COMPUTATIONAL TECHNIQUES (m63102p)

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Core Course, 1<sup>st</sup> semester, 5 ECTS units

Course level: Graduate (MSc)

Language: Greek

### Course Description

The course provides concise coverage of the fundamentals of inference for parametric statistical models, including both theory and practical numerical computation. The course focuses on frequentist maximum likelihood estimation while also considering alternative general methods applicable to a wide range of models and emphasizing the common questions addressed by each of the approaches. The material serves as a lively introduction to the theory and tools that a beginning graduate student needs in order to make the transition to serious statistical analysis: inference; modelling; computation, including optimisation; simulation methods; and the R language. The course will deepen understanding of why and when methods work and explain how they are suitably applied in practice.

### Prerequisites

Probability.

### Target Learning Outcomes

After completing the course, the students ideally should be able to:

- Implement the standard methods from the classical mathematical statistics theory to derive estimates for unknown parameters of a population with known otherwise distribution.
- Assess and compare the derived estimates with respect to standard statistical criteria.
- Construct a confidence interval for the unknown parameters based on a sample.
- Construct a test for a statistical hypothesis involving unknown parameters of the population under study.
- Implement relevant computational methodologies and simulation techniques when an analytic approach is not feasible.
- Take advantage of the statistical programming language R for computer age statistical inference.

### Recommended Bibliography

- Simon Wood. Core Statistics, Cambridge University Press, 2015.
- Bradley Efron and Trevor Hastie. Computer Age Statistical Inference: Algorithms, Evidence, and Data Science, Cambridge University Press, 2016.
- John Verzani. Using R for Introductory Statistics, Second Edition, Chapman & Hall/CRC: The R Series 2005.
- Michael J. Crawley. Statistics, An Introduction Using R, John Wiley & Sons 2015.

- Leonhard Held and Daniel Sabanés Bové. Applied Statistical Inference Likelihood and Bayes, Springer 2014.
- Dennis D Boos and L. A Stefanski Essential Statistical Inference: Theory and Methods, Springer 2013.

**Teaching and Learning Activities**

Face to face teaching covering theory and practice. The practicals are implemented with R.

**Assessment and Grading Methods**

Project.