

COMPUTATIONAL STATISTICS

Gaia Bertarelli
.....

Module 1: **R and Simulation** (15h)

Syllabus

R fundamentals and programming (4 hours): RStudio as a useful IDE - Basic commands - Statistical tools - Hints and tips for simulations with R (memory issues, object sizes, efficient handling of complex data structures, integration with other languages, ...) - Writing R functions

LaTeX and RStudio (2 hours): Sweave/knitr integration in RStudio - Generation of reports and scientific papers within RStudio

Pseudo-random numbers and variates generation (5 hours): Historical remarks on use of simulation methods in Statistics and Random Numbers Generation - Generating from a Uniform distribution: linear congruential generators - Goodness of Pseudo-RNG algorithms - empirical evaluation and statistical testing - Generating from arbitrary distributions: Inverse Transform, Mixture Representation, Accept-Reject Algorithm, ad-hoc methods

Monte Carlo methods for numerical integration (2 hours): Historical remarks - Classic Monte Carlo Integration - Importance Sampling and other Variance Reduction methods

Special Topics (2 hours or so): Outlier Robust Finite Population Estimation.