

## MA2822 Advanced Statistics

**Professor:** Département de mathématiques

**Language of instruction:** French – **Number of hours:** 36 – **ECTS:** 3

**Prerequisites:** MA1300 or equivalent.

**Period:** S6 Elective 01 February to April IN16DE1, SEP6DE1  
S8 Elective 08 February to April IN28IE1, SEP8IE1

### Course Objectives

This course puts in practice the notions introduced in MA1300 (Statistics). The goal is to face models and methods with their respective limitations. Theoretical and practical elements on nonparametric statistics, multivariate analysis and statistics under dependence are proposed. Applications from various domains illustrate the ubiquity of those methods. This course provides complementary technical grounds for subsequent studies on Machine Learning or Data Mining.

### On completion of the course, students should be able to

- ◇ use random modeling and nonparametric statistical techniques
- ◇ use the R software
- ◇ propose, implement and tune a prediction model
- ◇ validate and understand the limits of a statistical model

### Course Contents

- ◇ Multivariate linear regression, model selection
- ◇ Nonparametric regression, nonparametric density estimation, bandwidth selection
- ◇ Markov modelling, estimation of a Markov chain
- ◇ Monte-Carlo methods, resampling methods (bootstrap)
- ◇ Cross-validation of a model
- ◇ Complexity of a statistical model

### Course Organization

Lectures: 20 hr, Tutorials: 6 hr, Labwork: 7 hr, Exam: 3 hr

### Teaching Material and Textbooks

- ◇ Course reader, exercise booklet. Slides available on-line.

### Resources

Lab and tutorial classes by researchers and PhD students from MAS laboratory.

### Evaluation

2-hr written final exam, closed notes, closed books, no computer