

ACADEMIC MASTER PROBABILITY AND STATISTICS

**MATHEMATICS AND COMPUTER SCIENCE DOMAIN
MATHEMATICS STREAM**

Specialty: PROBABILITY AND STATISTICS

Presentation of the training

Statistics, which relies heavily on probabilities, is a science that proceeds to the methodical study based on mathematical models and methods of using and processing data. By its very nature, it is situated at the junction of two modes of thought, that of mathematics and that of empirical domains.

Probability and statistics touch every aspect of modern life. They underlie many decisions by public authorities, businesses and communities. They provide information on trends and forces that affect our lives. Many applications are implemented in finance, economics, social sciences and technology. They are powerful tools for public decision-making. In recent years, through stochastic calculus, probabilities have invested many spaces such as the financial industry and market risk management.

The teaching of these disciplines aims to provide each student with effective and well-identified technical and conceptual tools which should help him to clarify the questions of a problem, describe, process, analyze data, make the link between analytical reflection



on questions relating to the field of application, their formalization and their quantitative treatment and finally to read with a critical and distanced look, the conclusions of various statistical studies.

Educational goals

- The lessons are designed to acquire both mathematical tools and practical field techniques. A good statistician must have the rigor of analyzing phenomena and be a good observer
- Acquisition of the applied statistical methodology. All socio-economic sectors are covered and the main methods will be taught through their applied components.
- The objective is to provide the student with quality training covering the various high-performance areas of probability and statistics as they are taught today.

Prerequisites

The student must have acquired a bachelor's degree in mathematics or any other equivalent diploma.

Opportunities

- Acquisition of fundamental tools to integrate research teams. For example, the student can, at the end of his training, join a laboratory research team to prepare a doctorate.
- Student employability can also be seen in research and development. Therefore, at the end of this master's degree, the student can obtain an effective integration into a professional or university environment.
- Possibility of integrating a professional team in the pharmaceutical, financial, industrial field as a researcher.

Indeed, during his training, the student will be confronted with real business situations and field surveys. He will learn to interpret data to learn to decide.

Semester 1 Teaching Units

- Fundamental Subjects
- Advanced probabilities (credits: 3 coefficients: 6). The student will take up the basic notions of probability and deepen them to better establish his fundamental capacities.
- Measurement and integration: (credits: 2 coefficients: 4). Measurement and integration is taught with a useful and necessary probabilistic orientation to acquire scientific rigor.
- Parametric statistics: (credits: 2 coefficients: 4). It is a very important subject which covers the notions of mathematical modeling of classical statistics with processing of real data from biology, economics and finance, etc.
- Bayesian Statistics¹: (credits: 2 coefficients: 4). This subject is a second approach to statistics that will allow the training of a complete statistician. Thanks to its decision-making tool profile, it has grown in all fields such as medicine, biology, agronomy, management and governance. It teaches the student how to model the optimal decision in a situation of uncertainty and risk. Methodological Matters
- Simulation and IT (credits: 2 coefficients: 4). This subject allows the student to manipulate very powerful statistical computer languages such as R which is very popular in the scientific world today. The objective is to learn how to handle the computer tool effectively and efficiently.

- Data analysis1 (credits: 3 coefficients: 5). This is a branch of statistics which enables the implementation of data exploration methods. Its applications are numerous (telecommunications, airports, etc.) and it is strongly associated with the current development of Big Data. Transversal Subjects
- Basic English (credits: 2 coefficients: 2).. Through this subject, the student learns to read, write and speak English fluently, which is an essential language for scientists.
- Scientific communication (credits:1 coefficient:1). This subject allows the student to learn to communicate and debate in a scientific environment. It will be a question of proposing a range of themes that the student will study by writing a scientific report and exposing it to confront it with an audience.

Semester 2 Teaching Units

- Fundamental Subjects
- Markov chains (credits: 2 coefficients: 4). This course gives the fundamental results on Markov chains with the mathematical and probabilistic aspects as well as its practical applications.
- Stochastic Processes (credits: 3 coefficients: 6). Processes are one of the essential branches of probability and statistics. They model complex situations of the socio-economic sector which they rationalize to better understand them.
- Non-parametric statistics (credits: 3 coefficients 4). This subject is the continuation of the parametric methods of the first semester. It is an opportunity offered to the student to deepen the statistical techniques and to move on to much more powerful methods.
- Bayesian Statistics2 (credits:2 coefficients:4). This subject makes it possible to deepen and complete the course of the first semester and to assimilate the Bayesian approach. Methodological Matters
- Time series1 (credits: 3 coefficients: 5). The content of the curriculum for this subject covers the

time series also called chronological series which are phenomena that depend on time (financial, meteorological, economic, climatic, etc.)

- Data analysis2 (credits: 2 coefficients: 4). The opportunity will be given to the student to finalize his training on this powerful technique of exploratory data management. Transversal Subjects
- Philosophy of science (credits: 2 coefficients: 2). A student who is trained in areas as specialized as statistics and probability must learn to carry out the philosophical and intellectual reflections necessary for the formation of a rigorous and rational scientific mind.
- Scientific English (credits: 1 coefficients: 1). This subject is designed to teach the student how to write an article, a scientific report in English. The opportunity will be given to him to get used to the English used in mathematics, in general and in statistics and probability in particular.

Semester 3 Teaching Units

- Fundamental Subjects
- Regression models (credits: 2 coefficients: 4). Regression methods are the basis for modeling major econometric, biological and other questions. The goal is to explain variables by others as Keynes did in economics. The content consists of mathematical methods associated with applications on real data in the form of practical work.
- Waiting systems (credits: 3 coefficients: 6). This module focuses on waiting phenomena that model, among other things, telephone call centers, the operation of supermarkets, road traffic and car traffic. These powerful methods are well taught to give the student the ability to model these situations.
- Time series2 (credits: 2 coefficients: 4). This subject makes it possible to complete the teachings of master 1 by moving on to more elaborate models.
- Theory of extreme values (credits: 2coefficients 4).

- The field of extreme values concerns all sectors where there is risk and large investments such as insurance, finance, actuarial services, etc. The teaching focuses on the mathematical tools that make it possible to master this very efficient sector in developed countries.
- Methodological material Martingale theory (credits: 3 coefficients: 6). Martingale theory has the great advantage of being applicable to solutions of stochastic differential equations, whose Markovian properties play a crucial role in many applications. The content of this subject could evolve according to the real situation of the level of training of the students.
- Monte Carlo methods (credits: 2 coefficients: 3). When you have acquired mathematical methods, their implementation requires a good mastery of calculation techniques. Monte Carlo methods are an adequate response to this problem. This is the purpose of this teaching intended to provide the student with this necessary background. Transversal Subjects
- ICT and Management (credits: 2 coefficients: 2). This subject allows the student to acquire tools related to information and communication technologies and problems related to management. This allows him to understand the business world and the society organized in networks.
- Pedagogical engineering (credits: 1 coefficients: 1). A student who follows this training must also be able to teach in the educational and university world. This requires knowledge that we have provided in this subject to help him become a future teacher.

Semester 4

Semester 4 is devoted to an end-of-studies dissertation which is the culmination of the student's graduate training and an initiation to research with a view to preparing a doctorate. A seminar will be organized for the benefit of master's students to integrate them into a dynamic of scientific animation.