EPFL

MATH-230	**Probability**
	Aru Juhan

Cursus	Sem.	Type
Mathematics	BA3	Obl.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course provides an introduction to probability theory - the mathematical study of randomness. The aim is to get to know the basic mathematical framework of probability theory, and to learn to think and argue in this framework.

Content

1. Basic framework of probability theory
We will start by discussing the notion of a probability space and events on a probability space. We learn doing basic manipulations with events, and meet interesting notions like independence and conditional probabilities.

2. Random variables
Random variables can be seen as a generalization of events. We will discuss different types of random variables and several examples like uniform, binomial, Gaussian, Poisson random variables.

There are different ways of describing random variables - distribution function, density function, expectation, variance, moments, characteristic functions. We will look into those.
We will also meet random vectors, and revisit the concept of independence, correlation and conditional laws in the realm of random variables.

3. Limit theorems
Sometimes when one considers combinations of many random variables certain interesting patterns and structures, certain laws start to emerge. We will study some of such phenomena, including what are called laws of large numbers and the Central limit theorem. This requires first understanding the notion of limits in the realm of probability theory.

4. Varia
Time permitting, we will discuss some interesting probabilistic models like branching random walks, or some applications to other fields of mathematics.

Keywords

Probability, independence, mathematical expectation, random variables, random vectors, limit theorems.

Learning Prerequisites

Required courses

- First year courses of the Mathematics section
- Swiss school program up to the high school degree "Maturité"

Important concepts to start the course

First year analysis and linear algebra of the Mathematics section.

Learning Outcomes

By the end of the course, the student must be able to:
- Demonstrate mastery of the course material
- Demonstrate mastery of the problems related to the exercices sessions
- Demonstrate the capability of using these notions in other contexts

Transversal skills

- Use a work methodology appropriate to the task.

Teaching methods

Ex cathedra lecture and exercises in the classroom

Expected student activities

Attend lecture regularly, solve the problems presented and write out the solutions, study the previous course material before the next course, go over the material before the exam.

Assessment methods

Written exam

Resources

Bibliography

Introduction à la théorie des probabilités, R. Dalang et D. Conus.
A first course in probability, S.M. Ross.

Ressources en bibliothèque

- The essentials of probability / Durrett
- Introduction à la théorie des probabilités / Dalang
- A first course in probability / Ross

Prerequisite for

Bachelor and Master-level courses in Probability and statistics