MATH-467 **Probabilistic methods**

Cursus	Sem.	Type
Computer science	MA2	Opt.
Ing.-math	MA2, MA4	Opt.
Mathematics for teaching	MA2, MA4	Opt.
Mathématicien	MA2, MA4	Opt.
SC master EPFL	MA2, MA4	Opt.

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

Remark

pas donné en 2017-18

Summary

We systematically explore the exciting fact that randomness (i.e., coin flipping) can be used profitably to construct various mathematical structures with unexpected and often paradoxical properties, and to efficiently solve otherwise hopelessly difficult computational tasks.

Content

- Linearity of expectation
- Applications in combinatorics and number theory
- Randomized algorithms (sorting, convex hull, linear programming)
- The second moment method
- Random graphs

Keywords

random variable, expected value, probabilistic method, random graph, coloring

Learning Prerequisites

Required courses

Probability theory

Recommended courses

Discrete Mathematics or Graph Theory

Important concepts to start the course

Graph, random variable, expectation, variance, binomial coefficients, asymptotics

Learning Outcomes

By the end of the course, the student must be able to:

- Define and explain basic concepts in probability and discrete mathematics
- Define threshold functions, and analyze their asymptotic behavior

- Prove explain, and apply the first and second moment methods
- Prove explain, and apply the Local Lemma
- Solve exercises, design randomized algorithms
- Describe and explain the evolution of random graphs

Transversal skills

- Summarize an article or a technical report.
- Demonstrate the capacity for critical thinking
- Assess progress against the plan, and adapt the plan as appropriate.

Teaching methods

Lectures and exercises

Expected student activities

Attending the lectures, solving the exercises, reading sections from the textbook

Assessment methods

Exam written

Resources

Bibliography

Noga Alon-Joel Spencer: The Probabilistic Method (Wiley)
Stasys Jukna: Extremal Combinatorics (Springer)