FSF3634 Probalistic number theory 7.5 credits

Probabilistisk talteori

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FSF3634, valid from Spring 2023 (S-2023-0036 KS 3.2.2). Date for decision 2023-01-31

Grading scale

P, F

Education cycle

Third cycle

Additional regulations

Course literature: [1] E. Kowalski. An Introduction to Probabilistic Number Theory (Cambridge Studies

in Advanced Mathematics). Cambridge University Press, Cambridge, 2021.

doi:10.1017/9781108888226

Specific prerequisites

No specific prerequisites beyond what is needed to start a PhD in mathematics.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

This course is aimed at a general PhD level audience and should be accessible and of interest to doctoral students from different directions, including combinatorial, analytic as well as algebraic or geometric directions.

Probabilistic methods and heuristics play an increasingly important role in many areas of mathematics with striking applications in proofs of deterministic results.

This course aims at developing a basic tool box of probabilistic methods based on applications within number theory. The course will start out from Emmanuel Kowalski's recent book [1] on this subject, but may include ad-ditional material in form of current research papers.

A background in number theory is not required for this course as we will follow Kowalski's approach and keep the number theoretic input at a minimum while focussing on the probabilistic tools.

Intended learning outcome: To understand and be able to apply probabilistic techniques to analyse the asymptotic behaviour of arithmetically defined probability measures. In other words, to gain a basic tool box of probabilistic tools.

Course contents

This course is an introduction to applications of probabilistic methods within number theory. We will discuss a selection of the topics presented in [1], starting out from the Erdős-Kac theorem about the distribution of number of distinct prime factors of a typical integer of size about N.

Possible topics include the distribution of values of the Riemann Zeta function, Chebychev bias (which concerns the question whether there are there more primes p Ξ 3 (mod 4) than primes p Ξ 1 (mod 4)) as well as connections between exponential sums and random walks.

Course structure: Lectures, homework, possibly presentations by course participants.

Examination

- ÖVN1 - Excercises, 7.5 credits, grading scale: P, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Homework and/or presentation

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.