

MATH-337

**Number theory I.c - Combinatorial number theory**

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Cursus	Sem.	Type
Mathematics	BA5	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

This is an introductory course to combinatorial number theory. The main objective of this course is to learn how to use combinatorial, topological, and analytic methods to solve problems in number theory.

**Content**

Combinatorics is the study of discrete structures, and number theory the study of arithmetic. At the interface of these domains we encounter the fascinating field of combinatorial number theory (sometimes also called arithmetic combinatorics), which concentrates on the study of arithmetic structures. Two of the key areas that we will focus on during this course are Ramsey theory, encompassing Schur's Theorem, van der Waerden's Theorem, and the Erdos-Szekeres Theorem, and additive combinatorics, featuring Hindman's Theorem and Roth's Theorem. This course will help foster both your combinatorial and analytic intuition in mathematics and will allow you to visualize the natural numbers in new and complex ways. We will also discover connections to subjects that you have seen before, such as number theory, analysis, group theory and set theory.

**Keywords**

Combinatorial number theory, additive combinatorics, arithmetic combinatorics, additive number theory, Ramsey theory, discrete mathematics

**Learning Prerequisites****Required courses**

First year math courses

**Learning Outcomes**

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

- Apply tools from combinatorics, probability theory, and discrete harmonic analysis to solve problems in number theory
- Prove results in additive combinatorics and Ramsey theory
- Transpose ideas from analysis and number theory

**Transversal skills**

- Use a work methodology appropriate to the task.
- Demonstrate a capacity for creativity.
- Demonstrate the capacity for critical thinking
- Continue to work through difficulties or initial failure to find optimal solutions.

### Teaching methods

Weekly lectures, weekly exercises classes, weekly homework assignments

### Expected student activities

Participation in lectures and exercise classes

### Assessment methods

25% written homework assignments, 75% written final exam

### Supervision

Office hours	No
Assistants	Yes
Forum	Yes

### Resources

#### Notes/Handbook

Lecture notes will be provided

#### Moodle Link

- <https://go.epfl.ch/MATH-337>