MATH-335 **Coxeter groups**

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Cursus	Sem.	Type
Mathematics	BA6	Opt.

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

Summary

Study groups generated by reflections

Content

- Orthogonal transformations in a real Euclidean space
- Groups generated by reflections. Coxeter groups, root systems. Crystallographic groups. Fundamental regions for Coxeter groups.
- Coxeter graphs. Root systems, simple and positive roots.
Classification of finite root systems. Classification of finite crystallographic Coxeter groups. Order and structure of irreducible Coxeter groups. Generators and relations of Coxeter groups.
- Applications and connections with other fields.

Keywords

Orthogonal transformations, reflection, regular polytop, root system, simple root, positive root, Coxeter group, Coxeter graph, crystallographic group, Weyl group, fundamental region, simply laced root system, the longest element of a Coxeter group, Coxeter element, Coxeter plane, Coxeter number, root lattice, highest root, finite Dynkin diagrams.

Learning Prerequisites

Required courses

Linear algebra I-II, Group theory

Recommended courses

Linear algebra I-II, Geometry I-Ii, Group theory, Lie algebras, Linear representations of finite groups

Learning Outcomes

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

- Apply concepts and ideas of the course
- Reason rigorously using the notions of the course
- Choose an appropriate method to solve problems
- Identify the concepts relevant to each problem
- Apply known methods to solve problems similar to the examples shown in the course and in the problem sets
- Solve new problems using the ideas of the course
- Implement appropriate methods to identify and study the groups generated by reflections

Teaching methods

Lectures and exercise sessions

Assessment methods

Take-home test 15%.
Final written exam 85%.
Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Bibliography

1. J. Humphreys, Reflection Groups and Coxeter Groups, Cambridge University Press, 1990.
2. C.T. Benson, L.C. Grove, Finite Reflection Groups. Second Edition, Springer, 2010.
3. A. Bjorner, F. Brenti, Combinatorics of Coxeter Groups. Springer, 2005.

Ressources en bibliothèque

- (electronic version)
- Reflection Groups and Coxeter Groups / Humphreys
- Finite Reflection Groups / Benson & Grove
- Combinatorics of coxeter groups / Björner & Brenti

Moodle Link

- https://go.epfl.ch/MATH-335