14722.0099 Lattices and Quadratic Forms Summer 2024

Instructor: Caner Nazaroglu
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Lectures: MoTh 8-9.30 in Seminarraum 3 Mathematik (Room 314)
Exercise Sessions: Tu 12-13.30 in Seminarraum 1 Mathematik (Raum 005)
Will Craig (wcraig@uni-koeln.de)
First Session: April 16
Office Hour: Wed 11-12

Final Exam: The final exam will be an oral exam, to qualify for it you need 50% in homeworks.
Homeworks: Homeworks will be assigned on Thursdays and will be due on next Thursday in class (with a few exceptions due to holidays).

Course Outline and Textbook

We do not have an official textbook, but the following books roughly contain the topics we will cover.

1. J.H. Conway and N.J.A. Sloane, Sphere Packings, Lattices and Groups (Third Edition), Springer 1999.
2. W. Ebeling, Lattices and Codes: A Course Partially Based on Lectures by Friedrich Hirzebruch (Third Edition), Springer Spektrum 2012.
3. J-P. Serre, A Course in Arithmetic, Springer-Verlag 1973.

Tentative Outline:

- Introduction to Lattices
- Root Lattices
- Theta Functions and Modular Forms
- Codes and Code Lattices
- Positive Definite Even Unimodular Lattices
- Quadratic Reciprocity and p-adic Numbers
- Quadratic Forms over $\mathbb{Q}_p$ and $\mathbb{Q}$
- Unimodular Integral Quadratic Forms
- Leech Lattice and the $\mathrm{II}_{25,1}$ Lattice
- Sphere Packing