

MATH 8710 LIE ALGEBRA

Fall 2024

Instructor: Kang Lu	Time: MW 14:00 – 15:15
Email: Kang.Lu@Virginia.edu	Place: New Cabell Hall 068

Office Hours: Mondays 3:30-4:45PM and Tuesdays 4-5PM, or by appointment @ Kerchof 229.

Textbook We will mostly follow the classical *Introduction to Lie Algebras and Representation Theory* by James Humphreys, GTM 9, Springer.

Reference Another classical supplement is *Lie Algebras of Finite and Affine Type* by Roger Carter, Cambridge University Press.

Both textbooks should be freely available for downloading when you are on Grounds (or virtually via VPN).

Prerequisites: Abstract Algebra I and II. It helps if you know representation theory of finite groups, but the course will be mostly independent of finite group representation theory.

Objectives: Our basic goal is to have a basic understanding of the important subject of Lie algebras and their representation theory. We will cover

- Why Lie algebras?
- Nilpotent and Solvable Lie algebras
- Representation theory of \mathfrak{sl}_2
- Semisimple Lie algebras
- Root systems, Weyl groups, Dynkin diagrams, classification of semisimple Lie algebras
- Highest weight representations of semisimple Lie algebras
- Classifications of finite-dimensional irreducible representations
- Weyl character formulas and applications.

Assignments: There will be 4 homeworks assigned and due two weeks after. No late homeworks will be accepted. Discussing the problems with other students is encouraged, but each student must write solutions on his/her own. As another general principle in math, *practice makes perfect*.

Grading: Your final grade will be based on homework assignments and the final presentation. Remember, exercises are an integral part of your learning.

Homeworks (50%) and Final Presentation (50%).