

# Math 263A: Lie Groups and Lie Algebras

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When you start listing topics you'd like to cover in a first course in Lie groups, you get greedy fairly quickly. Our solution to this problem is to stay greedy, allowing the range and number of topics to dictate the pace of the course and the degree to which we will delve into their proofs in class. We'll be following closely the new GTM by Dan Bump with the eponymous title, roughly planning to touch on most of the sections in part II. Before beginning the class, you may want to refresh your memory by reading through the first couple of chapters of the book, as we will begin at Chapter 5, the first in part II. Otherwise, a very basic acquaintance with manifolds and representations should be all that is required. The following is a list of topics in the approximate order they will be tackled in class:

1. Lie groups and subgroups
2. Tangent spaces, Lie algebras, exponential map
3. Universal enveloping algebras
4.  $\mathbb{R}$  vs.  $\mathbb{C}$ , Lie groups over different fields
5. Universal covers
6. A local Frobenius theorem
7. Tori
8. Cartan's Theorem
9. Weyl Integration Formula
10. Root Systems
11. Semisimple Lie groups
12. Highest weight vectors
13. Weyl Character Formula
14. Spin
15. Coxeter groups
16. Decomposition theorems
17. Relative root systems and embeddings of Lie groups