Math 465
Introduction to Lie Groups and Lie Algebras
Rice University, Fall 2004

- **Instructor:** Theron J. Hitchman (TJ)
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  office hours: 2-3pm daily
- **Texts:** *Theory of Lie Groups I*, Claude Chevalley, Princeton University Press and *Lie Groups Beyond an Introduction*, Anthony Knapp, Birkhauser
- **Assessments:** No exams or quizzes. All grading will be done on homework.

Homework Policy: We have approximately 40 class meetings, you are required to do 40 homework problems this semester. These may be chosen from any of the problems in Knapp's book at the end of the introduction or chapters one or two (or from another book on Lie groups with my permission). To avoid problems piling up at the end of the semester, we will have four due dates. 10 problems due by September 24. 10 problems due by October 29. 10 problems due by November 22. Final 10 problems due by December 10.

Rough outline of topics to be covered: First we need a quick refresher course on differential topology, probably only two or three lectures.

Second, we shall cover the basics on Lie groups and algebras. Key words: definitions, examples, exponential map, subgroups (open and closed), quotients, covers, homomorphisms, adjoint representation, automorphisms, solvable, nilpotent and semisimple groups, the Theorems of Lie, Engel and Cartan, semidirect products, polar decomposition and topology of different types.

Third, we shall cover the theory of semisimple Lie algebras of the complex numbers with a view toward a complete classification. This includes a good study of $\mathfrak{sl}(2,\mathbb{C})$ and its representations, roots and root spaces, Cartan matrices, Dynkin diagrams and the Isomorphism and Existence Theorems.