Syllabus Math 513 (Lie theory)

Prof: C. Negron
Time and Location: MWF 1:00–1:50, DMC 259
Text: Humphreys *Introduction to Lie algebras and representation theory*
Office Hours: Fridays (but not both, on any given week)
Website: c-negron.github.io/513_F25

Prerequisites
Math 510A, 510B.

Course description
The course provides an introduction to the representation theory of semisimple Lie algebras over the complex numbers. Topics include the classification of semisimple Lie algebras via Dynkin diagrams and weight systems, descriptions of semisimple Lie algebras via their Cartan and Borel subalgebras, and the classification of representations for semisimple Lie algebras via dominant weights. Special attention will be given to $\mathrm{sl}_2(\mathbb{C})$ and $\mathrm{sl}_n(\mathbb{C})$, and we will discuss (affine) algebraic groups to some small extent.

Homework and Tests
Homework will be essentially biweekly, and turned in in class. Problems will appear on the course website, and will either be constructed by the professor or come out of Humphreys. There will be a "final" at the conclusion of the class. Students will complete a written project, or provide an oral presentation, for the final.

Grades
The final grade will be calculated as 90% homework and 10% final.

Outline
Representations of $\mathrm{sl}_2(\mathbb{C})$ [some # of weeks]
$\to$ Representations of $\mathrm{sl}_n(\mathbb{C})$ [some # of weeks]
$\to$ Algebraic groups and $\mathrm{SL}_n(\mathbb{C})$-reps [1.5 weeks?]
$\to$ Humphreys: solvable, nilpotent, Engel
$\to$ Humphreys: Cartan, the Killing form, and semisimplicity
$\to$ Humphreys: Root systems and classification
$\to$ Verma modules, dominant weights, and constructing all simple reps

Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

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The university is committed to the full accessibility of our campus, programs, and activities to individuals with disabilities. USC will make a good faith effort to provide reasonable accommodation for qualified visitors, prospective students, enrolled students, employment applicants, and employees with a disability

unless the accommodation requested would cause an undue hardship as defined by the ADA. In compliance with Section 504 of the Rehabilitation Act, the university provides academic adjustments and auxiliary aids for students with disabilities.

For the full text, including university disability services contact information see USC Disability Accommodations Policy at policy.usc.edu/disability-accommodations/. Contacts and basic information regarding accessibility services can be found USC's Office of Student Accessibility Services, osas.usc.edu/.