

North Carolina State University Department of Mathematics
MA 792 Special Topics-Lie Algebras and Symmetric Functions Fall 2017

Instructor: Dr. N. Jing, Office: SAS 3142, 3-3584. email: jing@ncsu.edu

Lectures: TH, 10:15–11:30, DAN 216

Office Hours: TH, 3:15–4:15

Course description:

Lie algebras and symmetric functions are closely related in many ways. The special topics course aims to discuss the basic materials of symmetric functions with applications to classical Lie algebras. We plan to cover the celebrated Schur-Weyl duality and the related applications.

Symmetric functions are a classical chapter in modern algebraic combinatorics and have many applications in algebraic geometry, invariant theory, representation theory, Lie groups and algebras, PDE (KdV and KP hierarchy equations), statistical mechanics, random matrix models, to name a few. In this introductory course I will try to cover the basic materials in symmetric polynomials and some generalizations. We then survey the recent approach of vertex operators to symmetric functions and Schur-Weyl duality.

Students with maturity in linear algebra will have sufficient background. The course is beneficial to anyone working in algebra, combinatorics, computer algebra, statistics etc. I will try to cover the materials from scratch and present the course in a down-to-earth fashion.

Schedule:

CHAPTERS	TOPICS	No. of Lectures
1	Symmetric groups	3
2	Frobenius theory of S_n	3
3	Lie algebraic approach	4
4	Vertex operators	3
5	Boson-Fermion correspondence	4
6	Representations of $GL_n(\mathbb{C})$	2
7	Schur-Weyl duality	2

Grading Policy Your grades will be determined by attendance and presentation of selected topics.

References:

1. R. Stanley, Enumerative combinatorics, II
2. Fulton and Harris, Representation Theory, a first course, Springer-Verlag, 1991
3. I. G. Macdonald, Symmetric functions and Hall polynomials, 1995
4. I. Frenkel, J. Lepowsky, A. Meurman, Vertex operator algebras and the Monster, 1988

Course Evaluations: Online class evaluations will be available for students to complete during the last two weeks of class. Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructors.