

# Math 533

## Algebraic Combinatorics

3.0 Units, Spring 2019  
MWF 10:00-10:50am

**Location:** KAP 414

**Instructor:** Sami Assaf

**Office:** KAP 438-C

**Office Hrs:** M 12-12:50pm, F 11-11:50am

**Contact:** shassaf@usc.edu

### Course Description

This course looks in depth at topics in algebraic combinatorics, including generating functions, tree enumeration, symmetric functions, and tableaux combinatorics.

### Learning Objectives

Student will learn to count and develop mathematical maturity and proof writing as they learn advanced counting techniques. By the end of the course, students should be proficient with enumeration questions and combinatorial algorithms.

**Recommended Preparation:** Math 410 or 510

### Course Notes

Homework assignments, solutions, and lecture notes will be disseminated through Blackboard.

### Required Readings and Supplementary Materials

Required: *Enumerative combinatorics*, Volume 2, by Richard Stanley.

Recommended: *Enumerative combinatorics*, Volume 1, second edition, by Richard Stanley.

### Description and Assessment of Assignments

Students are expected to complete bi-weekly problem sets that reinforce and expand on topics covered in lecture. There will be a take home final exam due Monday May 6 by 10am.

### Grading Breakdown

Assignment	% of Grade
Homework (7 assignments)	77%
Final Exam (05/06)	23%
<b>TOTAL</b>	<b>100%</b>

### Assignment Submission Policy

Homework is due in class on alternating Wednesdays as indicated. Late homework will be penalized 10% per day.

## Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings	HW Due Dates
<b>Week 1</b>	Generating functions	EC2 5.1	
<b>Week 2</b>	Exponential generating functions	EC2 5.2	HW 1 (due 1/16)
<b>Week 3</b>	Enumeration of trees	EC2 5.3	
<b>Week 4</b>	Lagrange inversion	EC2 5.4	HW 2 (due 1/30)
<b>Week 5</b>	Matrix-Tree Theorem	EC2 5.6	
<b>Week 6</b>	De Bruijn sequences	EC2 5 Ex	HW 3 (due 2/13)
<b>Week 7</b>	Symmetric functions	EC2 7.1, 7.2	
<b>Week 8</b>	Classical bases	EC2 7.3, 7.4, 7.5	HW 4 (due 2/27)
<b>Week 9</b>	Hall scalar product	EC2 7.6, 7.8	
<b>Week 10</b>	Schur functions	EC2 7.10, 7.15	HW 5 (due 3/20)
<b>Week 11</b>	RSK correspondence	EC2 7.11, 7.12, 7.13	
<b>Week 12</b>	Jacobi-Trudi formulas	EC2 7.16, 7.17	HW 6 (due 4/03)
<b>Week 13</b>	Quasisymmetric functions	EC2 7.19	
<b>Week 14</b>	Dual equivalence	EC2 A.1.2	HW 7 (due 4/17)
<b>Week 15</b>	Littlewood–Richardson rules	EC2 A.1.3	
<b>Final</b>			Final (due 5/06)

## 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 Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community such as a friend, classmate, advisor, or faculty member can help initiate the report, or can initiate the report on behalf of another person. The *Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage [sarc@usc.edu](mailto:sarc@usc.edu) describes reporting options and other resources.

### Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. The *Office of Disability Services and Programs* [http://sait.usc.edu/academic-support/center-programs/dsp/home\\_index.html](http://sait.usc.edu/academic-support/center-programs/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.