

## Mathematics 824, Spring 2015 (Section #66459) Algebraic Combinatorics (3 credits)

**Lectures:** MWF 11:00 – 11:50 AM, 564 Snow Hall

**Instructor:** Prof. Jeremy Martin (you can call me “Jeremy”)

E-mail: [jlmartin@ku.edu](mailto:jlmartin@ku.edu) (the best way to contact me)

Office: 623 Snow Hall, (785) 864-7114

Office hours: Tuesday and Wednesday, 2:00 – 3:00 PM, or by appointment

**Course website:** <http://www.math.ku.edu/~jmartin/math824/>.

**Course description:** Math 824 will cover fundamentals of algebraic and geometric combinatorics, including some or all of the following: partially ordered sets, lattices, matroids and oriented matroids, simplicial complexes, polytopes, combinatorial optimization, hyperplane arrangements, symmetric functions, and the representation theory of the symmetric group.

**E-mail:** I will periodically send class information (announcements, homework hints, etc.) to all students’ KU e-mail accounts. You are responsible for checking your e-mail regularly so as to receive this information.

**Prerequisites:** Math 724 (Enumerative Combinatorics), or permission of the instructor. In particular, you should be very comfortable with reading and writing proofs, basic counting techniques, and reasonably comfortable working with generating functions. Math 790 (Linear Algebra) is not an official requirement but is strongly encouraged.

**Textbooks:** The main text is my lecture notes, which are available on the course website (and which I am constantly updating). Several other books may be useful; all of these can be perused in my office. You should definitely obtain the free downloads #1, #4 and #5.

- (1) R.P. Stanley, *Enumerative Combinatorics, vol. I*. Cambridge Univ. Press, 2011. [Free version available online](#). (Enumeration; posets and lattices; generating functions; lots of exercises)
- (2) R.P. Stanley, *Enumerative Combinatorics, vol. II*. Cambridge Univ. Press (Cambridge Stud. Adv. Math., 62), 1999. (Exponential generating functions; symmetric functions)
- (3) M. Aigner, *Combinatorial Theory*. Springer (Classics in Mathematics), 1997 (reprint of 1979 original). (Enumeration; posets, lattices, and matroids)
- (4) R.P. Stanley, *Hyperplane arrangements*. [Free version available online](#).
- (5) A. Schrijver, *Combinatorial optimization*. [Free version available online](#).
- (6) T. Brylawski and J. Oxley, *The Tutte polynomial and its applications*. Chapter 6 of *Matroid applications*, N. White, ed., Cambridge Univ. Press (Encyc. Math. Appl., 40), 1992.
- (7) B. Sagan, *The Symmetric Group*, 2nd edn. Springer (Graduate Texts in Mathematics, 203), 2001. Contains material on symmetric functions.

**Coursework** will consist of problem sets and a final project.

- There will be  $6 \pm 1$  *problem sets*, due approximately biweekly. I’ll post the assignments at least a week in advance. You are encouraged to collaborate with other students, but you must write up the problems by yourself and acknowledge all collaborators. *You must submit typed solutions using LaTeX*. It is OK to draw figures by hand, but it is preferable to use software such as [TikZ](#), [Ipe](#), or [xfig](#). Homework is worth 50% of your final grade.
- The *final project* will consist of reading a research paper or papers, writing a brief summary, giving a short presentation to the rest of the class, and reviewing another student’s project. I will assist students individually with selecting appropriate papers to read. The project is worth 50% of your grade.

**Blatant shill:** Please attend the Combinatorics Seminar, which meets Fridays from 3–4 in Snow 408. Please also volunteer to give a talk.

**Computers:** It is *very* helpful for a combinatorialist to know how to program. I recommend that you learn how to use a computer algebra package; my preference is the free, open-source Sage ([www.sagemath.org](http://www.sagemath.org)).

**Makeup work:** If, for some legitimate and unavoidable reason, you are unable to turn in a homework assignment on its due date, you must notify me *in advance* to make appropriate arrangements.

**Incompletes:** A grade of I is a rare occurrence and is reserved for cases in which a student has completed most of the course work at an acceptable level, but is prevented from completing the course due to extraordinary nonacademic circumstances. If you think an incomplete may be warranted, you must talk to me *before* the final exam.

**Academic honesty and collaboration:** You are required to abide by all KU policies on academic integrity. Cheating, plagiarism or other academic misconduct will result in formal disciplinary charges and sanctions.

You are encouraged to collaborate with other students on the homework assignments. However, *each student must write up his or her own solutions and acknowledge all collaborators*. Copying someone else's homework, allowing someone else to copy yours, and copying the solutions from the Internet are all considered forms of cheating.

Official KU policies on academic misconduct can be found at <https://documents.ku.edu/policies/governance/USRR.htm#art2sect6>.

**Disability accommodations:** The KU Office of Disability Resources (22 Strong Hall; 785-864-2620 V/TTY; <http://www.disability.ku.edu>) coordinates accommodations and services for all students who are eligible. If you have a disability for which you wish to request accommodations, please contact Disability Resources as soon as possible. Please also contact me privately in regard to your needs in this course.

**Religious accommodations:** If you know that a scheduled assignment will conflict with a mandated religious observance, please contact me in advance to make appropriate arrangements.

**Intellectual property:** Course materials prepared by the instructor, together with the content of all lectures and review sessions, are the intellectual property of the instructor. Video and audio recording of lectures and review sessions without the consent of the instructor is prohibited. Upon reasonable request, the instructor will usually grant permission to record lectures, on the condition that such recording is used only as a study aid by the student making the recording, and is not modified or distributed in any way. Course materials posted online are intended for the personal use of students in the class and must not be redistributed without the instructor's consent.