

Mathematics 824, Fall 2010 (Section #45169) Algebraic Combinatorics (3 credits)

Lectures: MWF 1:00 – 1:50 PM, 564 Snow Hall

Instructor: Prof. Jeremy Martin (you can call me “Jeremy”)
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Office: 623 Snow Hall, (785) 864-7114
Office hours: Wed 2:00–2:50, Thu 1:00–2:15, or by appointment

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

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

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 and with basic counting techniques, and reasonably comfortable working with generating functions.

Books. All of these can be perused in Jeremy’s office. The official textbook is #1 in the list below; however, you may want to substitute #3, whose material is a bit closer to what will be covered in the class. (All the homework assignments will be self-contained.) You should definitely obtain #4 and #5, which are free downloads. In addition, #1 is currently being made into a second edition; you can obtain the first two chapters for free from Stanley’s website.

- (1) R.P. Stanley, *Enumerative Combinatorics, vol. I*. Cambridge Univ. Press (Cambridge Stud. Adv. Math., 49), 1997. (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*. (Lecture notes, freely available online; link on webpage)
- (5) A. Schrijver, *Combinatorial optimization*. (Lecture notes, freely available online; link on webpage)
- (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.

- *Problem sets* will be due approximately biweekly. I’ll post problems on the website, typically 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*, preferably using LaTeX (it is OK to draw figures by hand). Homework is worth 50% of your final grade.
- The *final project* will consist of reading a research paper or papers, writing a brief summary, and giving a short talk (approximately 20 minutes). I will assist students individually with selecting appropriate papers to read. The talks will take place either during the last week of classes, or at the time scheduled for the final exam (Friday, December 17, 10:30–1:00). The project is worth 50% of your grade.

Blatant shill: Please attend the Combinatorics Seminar, which meets Wednesdays from 3–4 in Snow 408.

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 a failing grade on the assignment in question, notification of the student's dean, and usually further disciplinary sanctions, possibly including a failing grade in the course.

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, or allowing someone else to copy yours, is considered to be a form 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); achieve@ku.edu; <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.