Mathematics 824, Fall 2018 (Section #27817)
Algebraic Combinatorics (3 credits)

Lectures: MWF 1:00–1:50 PM, 456 Snow Hall

Instructor: Prof. Jeremy Martin (you can call me "Jeremy")
  Contact info: `jlmartin@ku.edu` (preferred) or (785) 864-7114
  Office: 618 Snow Hall
  Office hours: Thu 1–3pm or by appointment

Website: Most course material will be at http://jlmartin.faculty.ku.edu/math824. There is also a Blackboard site for materials that are not to be distributed publicly (such as solution sets).

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

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) and Math 791 (Abstract Algebra) are not official requirements, but I strongly recommend some prior proof-based experience with these subjects.

Textbooks: The main text is my combinatorics lecture notes which I am constantly updating. The notes are licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License: in short, use them freely for any academic purpose, but do not sell them or anything derived from them. Also, do not print out the full 200-page document on the department MFD!

Several other books may be useful; all of these can be perused in my office. #1 and #2 are considered the standard references for the field. All the free downloads are worth owning.

(1) R.P. Stanley, *Enumerative Combinatorics, vol. I*. Cambridge U. Press, 2011. Free download.
(2) R.P. Stanley, *Enumerative Combinatorics, vol. II*. Cambridge U. Press, 1999.
(3) M. Aigner, *Combinatorial Theory*, Springer, 1997 [reprint of 1979 original].
(4) R.P. Stanley, *Hyperplane Arrangements*. Free download.
(5) A. Schrijver, *Combinatorial Optimization*. Free download.
(6) M. Beck and R. Sanyal, *Combinatorial Reciprocity Theorems*. Free download.
(7) B. Sagan, *The Symmetric Group*, 2nd edn. Springer, 2001.
(8) F. Ardila, *Algebraic and Geometric Methods in Enumerative Combinatorics*. Free download.

Problem sets: Problem sets will comprise 50% of your grade. There will be 6 or 7 problem sets, due approximately biweekly, starting on **Friday, August 31**. I will post the assignments on the course website 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. **Solutions must be typeset using LaTeX**. The website contains numerous LaTeX resources. Computer use may be helpful or even required on some problems. I primarily use the open-source language Sage and its cloud-based version CoCalc; more about this later.

Final Project: A final project will comprise the other 50% of your grade. The project will consist of reading a research paper, 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 in selecting appropriate papers to read. Some presentations will take place during the scheduled exam time (Tuesday, December 11, 10:30am–1:00pm).

Blatant shill: Please attend the Combinatorics Seminar (Fridays, 4–5pm, Snow 408). Please also volunteer to give a talk.

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 forms of cheating. Refer to the official KU policies on academic misconduct for more information.

Disability accommodations: Student Access Services (22 Strong Hall; `access.ku.edu`; 785-864-2620 V/TTY) coordinates accommodations and services for all students who are eligible. If you have a disability for which you wish to request accommodations, please contact SAS 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.

Commercial note-taking ventures: Pursuant to KU's Policy on Commercial Note-Taking Ventures, commercial note-taking is not permitted in Math 824. Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy. Note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is *not* the same as commercial note-taking and is not covered under this policy.

Weapons policy: Individuals who choose to carry concealed handguns are solely responsible for doing so in a safe and secure manner and in strict conformity with state and federal laws and KU weapons policy. Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the carrier's custody and control.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position
- Must have the safety on, and have no round in the chamber.

Updated Tue 8/14/18