

Math 372 S - Combinatorics

Online: MWF 10:05 - 10:55

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Course Description: Full course for one semester. Emphasis is on enumerative combinatorics including such topics as the principle of inclusion-exclusion, formal power series and generating functions, and permutation groups and Pólya theory. Selected other topics such as Ramsey theory, inversion formulae, the theory of graphs, and the theory of designs will be treated as time permits. Prerequisite: Mathematics 113 and 201. Lecture-conference.

Learning Outcomes: After completing the course students will:

- Be able to read and write rigorous combinatorial proofs using a variety of techniques, such as inclusion-exclusion.
- Understand the theory and applications of random walks.
- Develop experience working with group actions and enumeration under group action.
- Be familiar with the proof and applications of Polya's theorem.
- Be able to find and work with generating functions.

Distribution Requirements: This course can be used towards your Group III, "Natural, Mathematical, and Psychological Science," requirement. It accomplishes the following goals for the group:

- Use and evaluate quantitative data or modeling, or use logical/mathematical reasoning to evaluate, test, or prove statements.
- Given a problem or question, formulate a hypothesis or conjecture, and design an experiment, collect data or use mathematical reasoning to test or validate it.

This course *does not* satisfy the "primary data collection and analysis" requirement.

Course Design:

- **Class Sessions:** Class time will be spent primarily on lecture and discussion of the course material. Students are strongly encouraged to actively participate in the lecture. Periodically there will be opportunities for in-class work related to the lecture material.
- **Homework:** I will assign a weekly homework assignment that will be due via Gradescope weekly on Wednesday before the start of class. The homework will usually consist of a few computational problems and a few more involved problems.

Some more general thoughts on the reasoning for teaching this course in this way can be found on my webpage.

Course Text: We will use the free textbook *Algebraic Combinatorics: Walks, Trees, Tableaux, and More* by Richard Stanley. A pdf can be found [here](#). We may pivot to a second textbook (maybe *Generating-functionology* by Herbert Wilf or maybe *Combinatorial Commutative Algebra* by Ezra Miller and Bernd Sturmfels) depending on interests.

Course Moodle: I will use Moodle to host most information about the course. In particular you will be able to find the lecture videos, lecture notes and homework assignments there. A link to the Moodle page will be sent during the first week of class.

Office Hours: Office hours will be held on our class Zoom call. We will pick a time together during the first week of class. I am happy to meet with you outside of these times schedule permitting. Office hours can be used to ask questions, get additional help with homework or understanding parts of the lecture, or to explore a topic more deeply. Office hours are one of the most valuable part of a Reed education (in my opinion) and you are strongly encouraged to take advantage of them. If you are struggling with any of the material, I cannot emphasize the importance of office hours enough.

Additional Support: The math department hosts drop-in tutoring on Zoom Sunday-Thursday from 7-9pm. Junior and senior math major tutors will be available to help answer questions and work with you on homework questions. In addition, every Reed student is entitled to one hour of free individual tutoring per week. Use the tutoring section in IRIS to arrange a meeting with a student tutor.

Additional Additional Support: It is genuinely important to me that you feel supported. If there is ever anything you feel could help you be more successful in the course please do not hesitate to ask. I am happy to work with you to make sure you are able to get as much out of the course as possible.

Exams: There are no exams planned for this course at this time.

Submitted Work: All work will be submitted through Gradescope. You will receive a link to Gradescope along with information about using it during the first week of class. All work that you submit you should satisfy the following:

- Your work must be neatly written or typeset.
- Your solution should be thorough, showing every part of your thought process. This is, of course, a somewhat ambiguous statement but the general standard should be that another student in the course could read your solution and not have to wonder how you got from one step to the next.
- For problems that are not simply computations, your solutions should be presented in complete sentences.

Collaboration: You are strongly encouraged to collaborate with other students on the assigned homework. You must write up your solutions independently. Duplicated solutions will not be accepted and, in my opinion, constitute a violation of the Honor Principle.

Attendance: *If you are going to miss more than a few days of class for any reason please communicate with me.*

Learning In the Time of Covid-19: See some thoughts on my webpage.

Communication: In light of everything, I wanted to take a minute to emphasize how important communication is going to be this semester. If problems arise throughout the semester, Covid related or otherwise, I will be in a much better position to support you if you can talk to me early on.

Grading: Your grade will be primarily based on the homework you submit and your participation in class discussions.

Important Dates: Coming Soon.

Academic accommodations: If you have a documented disability requiring academic accommodation, please have Disability & Accessibility Resources (DAR) provide a letter during the first week of classes. I will then contact you to schedule a meeting during which we can discuss your accommodations. If you believe you have an undocumented disability and that accommodations would ensure equal access to your Reed education, I would be happy to help you contact DAR.