

COURSE SYLLABUS

Math 432: Applied Combinatoris

Section 39653, Fall 2024

BASIC INFORMATION

Lectures: MWF 1:00 – 1:50pm, KAP 147

Instructor: Yifeng Huang

Email: yifeng.huang@usc.edu

Office Location: KAP 438D

Office Hours: W 2:00pm–3:00pm, F 10:30am–11:30am or by appointment

Course Description: (4 units) This course surveys a variety of topics in combinatorics, beginning with basic counting techniques (e.g., Pigeonhole Principle) and elementary proof techniques (e.g., mathematical induction, counting in two ways). We apply these to enumeration of subsets, arrangements, and derangements. We develop advanced counting techniques of generating functions and solving recurrence relations. We study fundamentals of graph theory and algorithms on graphs, including graph colorings and matchings. We also explore advanced topics in probabilistic methods.

Learning Objectives: By the end of the course, students will develop proficiency for the following:

- compute examples from combinatorial descriptions;
- recognize common combinatorial objects, patterns, and recurrence relations;
- equate real world scenarios with graph-theoretic problems;
- develop proficiency applying combinatorial algorithms.

Prerequisites: Math 225 or 235 or 245.

Text: A Walk Through Combinatorics, by Miklós Bóna, 4th edition. (2nd or 3rd are also fine. **Warning:** Chapter orders from Chapter 17 on are different across editions.)

Math Center: The Math Center is open from 8am to 7pm Monday-Thursday, and 8am to 5pm on Friday. It is primarily run by math graduate students here at USC. The office hours of your TA will also be held in the Math Center, although you can go to the Math Center at any time it is open to ask for help.

ASSIGNMENTS

Homework:

Each week a number of homework problems will be assigned on Wednesday. The problems are due on the next Wednesday before the lecture and should be submitted through Gradescope. Solutions will be posted immediately after the due date, and so **late homework is not accepted**. Please submit partial solutions by the due date to receive partial credit. You can drop one homework at the end of the semester.

Any student found to plagiarize a homework problem or exam problem from any source will receive an F for this course and a report will be filed with the Office of Academic Integrity.

EXAMS AND GRADING

Exams: All exams will be held in person during the scheduled times. If you cannot be present, you must contact me BEFORE the exam date to make other arrangements. If you no-show for an exam and attempt to contact me afterward, do not expect to be allowed a make-up exam.

There are three exams in this course: two midterms and a final. The midterms will be held during normally scheduled class times. The final exam is cumulative and written by the Math Department. It is university policy that no student may take the final exam early, or be allowed to skip it.

- Exam 1: Wednesday October 2
- Exam 2: Monday November 4
- Final Exam: Wednesday Dec 18, 11:00am–1:00pm, Room TBD.

Grading: Your grade in the course is calculated as follows:

- Homework: 40%
- Midterms: 40% (20% each)
- Final Exam: 30%

OTHER POLICIES

Academic Integrity: The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university’s mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity’s website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Use of Generative AI: This course aims to develop creative, analytical, and critical thinking skills. Therefore, all assignments should be prepared by the student working individually or in groups. Students may not have another person or entity complete any substantive portion of the assignment. Developing strong competencies in these areas will prepare you for a competitive workplace. Therefore, **using AI-generated text, code, or other content is prohibited in this course, will be identified as plagiarism, and will be reported to the Office of Academic Integrity.**

COURSE CALENDAR (TENTATIVE)

Week 01: Counting Basics, Ch 1, 2.

Week 02: Orders and Choices, Ch 3. **Monday Labor Day.**

Week 03: Binomial Theorem, Ch 4.

Week 04: Partitions, Ch 5.

Week 05: Permutations, Ch 6.

Week 06: Sieve (a.k.a. Inclusion-Exclusion), Ch 7. **Exam 1 on Wednesday Oct 2.**

Week 07: Generating Functions, Ch 8. **Thursday and Friday Fall Recess. Friday Oct 11 is the last day to add classes, or to drop without a “W”.**

Week 08: Graph Theory, Ch 9.

Week 09: Trees, Ch 10.

Week 10: Graph Coloring, Ch 11.

Week 11: Ramsey Theory, Ch 13. **Exam 2 on Monday Nov 4.**

Week 12: Discrete Probability, Ch 15. **Monday Veterans Day. Friday Nov 15 is the last day to drop with a “W”.**

Week 13: Additional Topics.

Week 14: Additional Topics. **Wednesday to Friday Thanksgiving Break.**

Week 15: Additional Topics.

Finals Week: Final Exam.

Students and Disability Accommodations: USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Student Financial Aid and Satisfactory Academic Progress: To be eligible for certain kinds of financial aid, students are required to maintain Satisfactory Academic Progress (SAP) toward their degree objectives. Visit the Financial Aid Office webpage for undergraduate- and graduate-level SAP eligibility requirements and the appeals process.

Support Systems:

- Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
- 988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline consists of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.
- Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).
- Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.
- Reporting Incidents of Bias or Harassment - (213) 740-2500
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.
- The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

- USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.
- Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.
- USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.
- USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.
- Office of the Ombuds - (213) 821-9556 (UPC) / (323) 442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.
- Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.