MATH 184A: COURSE SYLLABUS

Subject: Combinatorics.

Prerequisites: Math 31CH or Math 109 with a grade of C or better.

Expectations: Students in Math 184A will be expected to spend considerable time and effort on self-directed study. This expectation is not arbitrarily imposed by the instructor; rather, it is demanded by the subject, which requires active engagement and extensive reflection. Ideally, this will be a rewarding process driven by curiosity. Mass-distributed study aids such as practice tests and review problems will not be provided by the instructor, who will instead work to support self-directed scholarship and genuine understanding. This course will focus on the communication and development of ideas, and place the job of being a student in the hands of the student.


Topics: We will aim to discuss the following topics in the following order.
(1) Infinitude of the primes (Chapter 1).
(2) Bertrand’s postulate (Chapter 2).
(3) Binomial coefficients (Chapter 3).
(4) Hadamard matrices (Chapter 7).
(5) Sylvester-Gallai theorem (Chapter 11).
(6) Euler’s formula (Chapter 13).
(7) Sets and functions (Chapter 19).
(8) Inequalities (Chapter 20).
(9) Dividing a square into triangles (Chapter 22).
(10) Littlewood-Offord Lemma (Chapter 24).
(11) Pigeonhole and double counting (Chapter 27).
(12) Three theorems on finite sets (Chapter 29).
(13) Lattice paths and determinants (Chapter 31).
(14) Cayley’s formula (Chapter 32).
(15) Identities vs. bijections (Chapter 33).
(16) The finite Kakeya problem (Chapter 34).
(17) Permanents and entropy (Chapter 37).
(18) Guarding a museum (Chapter 39).
(19) Turán’s theorem (Chapter 40).
(20) Probabilistic method (Chapter 44).
Professor: Jonathan Novak, jinovak@ucsd.edu, APM 7157.

Teaching Assistants: Jiaxi Nie (Sections A01,A02), jin019@ucsd.edu, APM 6414; Chengjie Huang (Sections A03,A04), chh164@ucsd.edu, APM 6436.

Piazza: We will use Piazza as the primary method of electronic communication. Please refrain from using email, and instead post your questions to Piazza so that we can discuss them as a class. If absolutely necessary, it is possible to send private messages to Instructors on Piazza. The Piazza signup link is: piazza.com/ucsd/winter2018/math184a.

Course Webpage: www.math.ucsd.edu/~jinovak, click on the “Math 184A” tab.

Lectures: MWF, 17:00-17:50, PCYNH 109.

Discussion Sections: Every student is assigned to one of the following:

Section A01: Tue. 14:00, APM 2301.
Section A02: Tue. 15:00, APM 2301.
Section A03: Tue. 16:00, APM 2301.
Section A04: Tue. 19:00, APM 2301.

Office Hours: The office hours for the Professor and the TAs will be posted to Piazza.

Grading Scheme: 40% Problem Sets, 15% Midterm 1, 15% Midterm 2, 30% Final.

Problem Sets: Due Fridays at 16:00 in APM basement dropbox. No late submissions accepted, lowest score dropped.

Midterm Exams: 01/29/2018 and 02/26/2018, both in class. No makeup tests; the weight of a missed midterm will be shifted to the Final Exam. Bring a blue book to each test.

Final Exam: 03/19/2018, 19:00-21:50, location TBA. No scheduling flexibility. If you cannot sit for the exam at the announced time, you should not enroll in the course. Bring a blue book to the final exam.

Letter Grade Conversion: Your final grade will be a number $x$ between 0 and 100, which will be converted to a letter grade $L(x)$ as follows:

$$L(x) = \begin{cases} 
A^+, & 90 \leq x \leq 100 \\
A, & 80 \leq x < 90 \\
B, & 70 \leq x < 80 \\
C, & 60 \leq x < 70 \\
D, & 50 \leq x < 60 \\
F, & 0 \leq x < 50
\end{cases}$$