

Undergraduate Seminar: Combinatorics

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Spring 2022

1 Logistics

TA: Emily Saunders

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Office Hours: I will not have a standing office hours appointment for this course, but students should feel welcome to schedule a meeting with me if they ever need assistance preparing their talk, or if they simply want to discuss topics covered in the seminar.

Time: Thursday 4-6PM

Location: TBD

Grading: Grades will be assigned based on both talks and attendance according to the following expectations:

Talks

- If presenting virtually, students should have some sort of visual aid to accompany the talk if they do not have access to a tablet that they can hand-write on (for instance, slides or notes). Equations in slides should be LaTeXed so that they are readable.
- The talk should roughly fill the 2 hour block, with time for question and answer (this can be tricky so there will be some leeway, but try to prepare some additional examples in case the talk is much shorter than expected).
- The talk should be well-organized and clear. Examples will be appreciated.

Attendance

- Attendance is a crucial part of your participation in the seminar. You will spend more time as an audience member than giving your own talks. Therefore it is very important that you actually attend other students' talks, not just to keep up with the material, but also out of respect for your fellow students.
- Students are expected to attend all meetings and, in the event of a virtual meeting, they are expected to have their cameras on.
- Absences must be excused in advance (barring exceptional circumstances).

2 Topic

The topic of this seminar is combinatorics. Each week we will explore problems and applications in combinatorics. We will primarily focus on enumerative combinatorics, a branch of combinatorics concerned with counting the number of ways patterns can be formed, although students are welcome to challenge themselves with projects in algebraic or analytic combinatorics.

2.1 Resources

All references are hyperlinked.

Primary resource:

- *A Combinatorial Miscellany* by Anders Björner and Richard P. Stanley This is the most approachable reference, and the one I expect us to work through primarily.

Secondary resources:

- *Algebraic Combinatorics* by Richard P. Stanley This is an excellent reference, but requires more background in abstract algebra (linear algebra, finite fields, and group theory). Students who have seen this material before, or would like to learn it, are encouraged to give this a try!
- *A Course in Enumeration* by Martin Aigner I don't know much about this book, but it came highly recommended from Professor Bayer.
- *The Probabilistic Method* by Noga Alon and Joel H. Spencer This book uses probability in some very interesting ways to solve problems in combinatorics (many of which are related to graph theory). The methods in this book would be considered "analytic combinatorics". It gets challenging quickly, but the early chapters are very approachable and very fun.
- *Graph Theory with Applications* by J. A. Bondy and U. S. R. Murty Graph theory is closely related to combinatorics and very interesting.

I am happy to provide further resources if needed.

3 Talk Schedule

TBD