

M 584 – The Probabilistic Method, Spring 2021

Contact information

- Instructor: Cory Palmer
- Office: Meeting on zoom only
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- Office hours: TBA

Course description

The probabilistic method is a powerful and widely applied technique in combinatorics and graph theory. In this course we will develop the fundamentals of this technique and use them to prove dozens of interesting and important theorems. Matousek and Vondrak give the following excellent description of this method:

The probabilistic method is a remarkable technique for proving the existence of combinatorial objects with specified properties. It is based on probability theory but, surprisingly, it can be used for proving theorems that have nothing to do with probability. The usual approach can be described as follows.

We would like to prove the existence of a combinatorial object with specified properties. Unfortunately, an explicit construction of such a “good” object does not seem feasible, and maybe we do not even need a specific example; we just want to prove that something “good” exists. Then we can consider a random object from a suitable probability space and calculate the probability that it satisfies our conditions. If we prove that this probability is strictly positive, then we conclude that a “good” object must exist; if all objects were “bad”, the probability would be zero.

Class schedule

MWF: 12:00-12:50 PM. Lectures will be broadcast synchronously via zoom (link in email) and will be recorded and posted to Moodle. Some of you may have quick turnaround between in-person and remote courses. The university has set up remote learning spaces on campus. More information should be posted here: https://www.umn.edu/umonline/keep_on_learning/default.php.

Here are some tips for taking an online course and making it a successful experience:

<https://www.northeastern.edu/graduate/blog/tips-for-taking-online-classes/>

Textbook

The Probabilistic Method by Alon and Spencer. The third or fourth edition is preferred.

Homework

I will be assigning a few mandatory problems as we progress through the chapters. You are encouraged to work in groups on the homework, but be sure to write up your own answers. Students are expected to solve additional book exercises as needed to keep up with the material.

Only complete solutions to problems should be submitted. Homework will be graded both on correctness and clearness of arguments. Work that is too difficult to follow may be marked off. Homework will be submitted online through: <https://gradescope.com> (entry code in email).

LaTeX

Written work must be typeset in LaTeX. I strongly recommend the free web-based LaTeX editor: <https://www.overleaf.com/>

Presentation

Each student will give an in-class presentation. Most of these will be based on the *The Probabilistic Lens* sections in the book. I will randomly assign the topics to students. These presentations will be given periodically throughout the semester and the final-exam slot. As part of this presentation students will be expected to prepare a 1-page summary of their topic/lecture complete with references. This summary should be submitted to me a week before the planned presentation.

Grading

Your grade will be composed of 50% homework and 50% from the in-class presentation. Letter grades and +/-s will be assigned according to the standard scale.

Class website

Homework will be submitted to gradescope and recorded lectures will be posted to Moodle.

Accommodations

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Academic honesty

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the [Student Conduct Code](http://www.umt.edu/safety/policies/) (<http://www.umt.edu/safety/policies/>).

Registration deadlines

Full registration deadlines can be found online on the [registrar calendar](http://www.umt.edu/registrar/calendar.php) (<http://www.umt.edu/registrar/calendar.php>).