

University of Toronto
COURSE INFORMATION
APM461 – Additive Combinatorics

Course homepage:

<http://www.math.toronto.edu/lgoldmak/APM461/>

Instructor: Leo Goldmakher

Office: 2142 Earth Sciences Centre

Phone: (416) 978-6742

email: lgoldmak@math.toronto.edu

Office hours: By appointment on Mondays, Wednesdays, and Fridays.

Lectures: Fridays 3–6, in MP 137. (MP is the McLennan Physics building, 255 Huron St)

Textbook: None required. *Additive Combinatorics* by T. Tao and V. Vu is one of the only textbooks written on the subject, and it is an excellent resource. There are also many lecture notes freely available online; a few I've found particularly useful are those by A. Granville, B. Green, S. Lovett, I. Ruzsa, and K. Soundararajan.

Prerequisites: The most important prerequisite is mathematical maturity and curiosity. I will also assume familiarity with linear algebra, elementary number theory, elementary group theory, and elementary analysis. Other subjects will play a role in our discussions (notably graph theory and Fourier analysis), but I will explain all the required notations and results from those areas when they come up.

Syllabus: Lying at the interface of combinatorics, ergodic theory, harmonic analysis, number theory, and probability, Additive Combinatorics is an exciting field which has experienced tremendous growth in recent years. Very roughly, it is an attempt to classify subsets of a given field which behave nicely with respect to some binary operation. We will discuss a variety of topics, including sum-product theorems, the structure of sets of small doubling (e.g. the Freiman-Ruzsa theorem), structured subsets of sumsets, and applications to computer science (e.g. to pseudorandomness). Depending on time and interest, we may also discuss higher-order Fourier analysis, the polynomial method, and ergodic approaches to the subject.

Marking scheme:

There will be no exams in this course. Instead, your mark will be calculated based on problem sets (worth 70%) and a final project (worth 30%). The nature of the final project will be announced later in the term.