TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

FACULTY OF MATHEMATICS

Handout 1 Winter 2026–27
General Information Igal Sason

Probabilistic Methods in Combinatorics (1060921)

Instructor: Prof. Igal Sason. Meyer 652. E-mail: `sason@ee.technion.ac.il`.

Time and Place: Mondays 09:30-12:30, Ullman building 102.

Credit Points: 3.0 academic points. A joint undergraduate-graduate course.

Prerequisites: Elementary (undergraduate) courses in calculus, combinatorics, and probability.

Language: English.

Grading Policy: The grades will be determined by an exam in class. Homework assignments are not for submission but are very recommended.

Exams: Final A (3 February, 2027), and Final B (4 March, 2027).

Course outline (Tentative) [3 hours per week, 13 weeks]:

1. Basic method and examples.
2. Linearity of expectation. Existence results.
3. First moment method.
4. Alterations.
5. Dependent random choice.
6. Second moment method.
7. Threshold functions for random graphs.
8. Lovász local lemma and applications.
9. Chernoff, martingales, and concentration.
10. Shannon entropy and applications.

References

[1] N. Alon and J. Spencer, *The Probabilistic Method*, 4th edition, Wiley, 2016.

[2] M. Aigner and G. M. Ziegler, *Proofs from the Book*, Springer, 6th edition, 2018.

[3] S. Jukna, *Extremal Combinatorics with Applications in Computer Science*, 2nd edition, Springer, 2011.

[4] M. Molly and B. Reed, *Graph Colouring and the Probabilistic Method*, Springer, 2002.

[5] I. Sason, "The Lovász local lemma: foundations and applications," *AIMS Math.*, vol. 11, no. 7: 19659–19715, 2026. `https://www.aimspress.com/article/doi/10.3934/math.2026798`