



The Hebrew University of Jerusalem

Syllabus

Intersection problems for finite sets - 80815

Last update 30-08-2022

HU Credits: 2

Degree/Cycle: 2nd degree (Master)

Responsible Department: Mathematics

Academic year: 0

Semester: 1st Semester

Teaching Languages: Hebrew

Campus: E. Safra

Course/Module Coordinator: Noam Lifshitz

Coordinator Email: noamlifshitz@gmail.com

Coordinator Office Hours: The hour right after class

Teaching Staff:

Dr. Noam Lifshitz

Course/Module description:

In the course we will learn a variety of tools from different fields in order to solve problems that are very easy to state. These are called intersection problems for finite sets. They take the form: How large can a family of $n/2$ -sized subsets of $\{1, \dots, n\}$ be if the intersection of each two sets in the family is not of size $n/4$.

Course/Module aims:

The student will be able to use the recently developed tools in extremal combinatorics and attempt to solve open problems in the area using them.

Learning outcomes - On successful completion of this module, students should be able to:

The students will be able to use analytic and algebraic methods and then be able to attempt to solve the open problems presented in the course.

Attendance requirements(%):

Teaching arrangement and method of instruction:

Course/Module Content:

- 1) The EKR theorem and Katona's circle method
- 2) Shifting method
- 3) Spectral method/ Hoffman's bound
- 4) Sharp threshold results
- 5) Regularity method
- 6) The junta method
- 7) Ranks of matrices and tensors: the polynomial method
- 8) Huang's spectral dimension method
- 9) Methods from algebraic topology
- 10) Hyprcontractivity for global functions
- 11) The Frankl-Rodl theorem
- 12) Sunflower problem

Required Reading:

I'll send you notes with exercises that you are expected to go over and send me corrections

Additional Reading Material:

Course/Module evaluation:

End of year written/oral examination 80 %

Presentation 0 %

Participation in Tutorials 0 %

Project work 0 %

Assignments 20 %

Reports 0 %

Research project 0 %

Quizzes 0 %

Other 0 %

Additional information:

Good control of probability and linear algebra.