Faculty of Science
Department of Mathematics

MA4198 PROJECT PROPOSAL (PROJECT CUM SEMINAR GROUP)

SUPERVISOR'S INFO

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PROJECT ID: PS2410-08

TITLE

Linear algebraic methods in Combinatorics and Discrete Geometry

BRIEF DESCRIPTION OF PROJECT

Linear algebraic techniques were proven to be an extremely powerful tool in Extremal Combinatorics. For instance, one strategy to bound the size of a family of discrete objects satisfying specific properties is to map these objects to linearly independent polynomials and show that these polynomials lie in a low-dimensional space. In this group project, we will explore together the various applications of linear algebra ideas. Over the semester, open problems will be regularly mentioned and interested students will be encouraged to actively work on them and branch out to different specific subtopics along the way.

EXPECTATION/S

The participants are expected to read and understand the book by Jiri Matousek (see below) together. Each participant will present a number of topics from the book, and work on related open research problems on an individual basis.

PREREQUISITE/S (at level 3000 or below, with at most one course at level 3000)

MA3233, as well as basic knowledge in calculus and linear algebra.

READING REFERENCE/S

The main reference will be the following book by Jiri Matousek: *Thirty-three Miniatures: Mathematical and Algorithmic Applications of Linear Algebra*, available at https://kam.mff.cuni.cz/~matousek/stml-53-matousek-1.pdf
We may also regularly use the Babai-Frankl book *Linear Algebra Methods in Combinatorics*, available at https://people.cs.uchicago.edu/~laci/babai-frankl-book2022.pdf