Mathematics B.Sc. – Thesis topics 2024
University of Debrecen, Institute of Mathematics

<div align="center">DEPARTMENT OF ANALYSIS</div>

Basics of convex optimization

- **Name of subject leader:** Dr. Tibor Kiss
- **Language:** -
- **Remark:** -
- **Abstract:** The aim of the thesis is to discuss in detail the basic tools of convex optimization, with special emphasis on the Karush–Kuhn–Tucker Theorem, and then to apply them to real life examples. In our problems, the objective function is convex and the constraints are given by convex functions as well.

Monopoly and oligopoly strategies

- **Name of subject leader:** Dr. Zoltán Boros
- **Language:** -
- **Remark:** -
- **Abstract:** For markets with given (linear or some particular non-linear) demand functions, we investigate the optimal output or the optimal price for a monopoly. Equilibrium strategies for duopoly or oligopoly are investigated as well.

Properties of Takagi's function

- **Name of subject leader:** Dr. Zoltán Boros
- **Language:** -
- **Remark:** -
- **Abstract:** A celebrated example for a continuous, nowhere differentiable function is investigated. We consider its descriptions in terms of specific operators, as well as via functional equations. We use these tools to verify further properties of Takagi's function.

Numerical methods for eigenvalue problems

- **Name of subject leader:** Dr. Borbála Fazekas
- **Language:** -
- **Remark:** -
- **Abstract:** The aim of this work is to demonstrate numerical methods for eigenvalue problems for matrices. We are interested in methods which are not covered by the basic numerical analysis courses.

Numerical methods for nonlinear equations

- **Name of subject leader:** Dr. Borbála Fazekas
- **Language:** -
- **Remark:** -
- **Abstract:** The aim of this work is to demonstrate numerical methods for nonlinear equations. We are interested in methods which are not covered by the basic numerical analysis courses.

<div align="center">DEPARTMENT OF GEOMETRY</div>

The geometry of surfaces

- **Name of subject leader:** Dr. Zoltán Muzsnay
- **Language:** -
- **Remark:** -
- **Abstract:** -

Tomography

- **Name of subject leader:** Dr. Ábris Nagy
- **Language:** english
- **Remark:** -

- **Abstract:** Tomography is a discipline, where images of cross-sections of a body are produced in order to reveal the inner structure of the body. During a CT-scan, x-ray beams penetrate through the human body and the change of intensities of these beams are measured. Then the inner structure is revealed with the help of mathematical computations. However, tomographic examinations can be performed not just for the human body, but structures made of metal, or a piece of rock, or even the Earth's atmosphere. The mathematical problem is to reconstruct an unknown distribution of a physical quantity with the knowledge of the values of line integrals along straight lines. The discrete version of this problem is when we wish to find an unknown finite point set in the plane having only the number of elements contained by a finite set of lines. Discrete tomography deals with the solution of this problem, where methods of combinatorics and graph theory arise naturally. The reconstruction of binary matrices by their line and column sums is a special topic with several possible simple solutions. Several answers exist for this problem with easy and strightforward computations.