Math 417/487: Mathematical Programming (Fall 2017)

Times/Location:

1. **Lecture:** Tuesday and Thursday 8:35–9.55 am, BURN 1214.
2. **Tutorial:** Tuesday 5.35–6.55 pm, BURN 1205.

Instructor: Tim Hoheisel, Burnside Hall 1114, email: tim.hoheisel@macgill.ca
Office Hours: Tuesday 2.30–4 pm, and also by appointment.

Webpage: `https://www.mcgill.ca/mathstat/tim-hoheisel`

TA: Christopher Finlay, email: christopher.finlay@mail.mcgill.ca
Office Hours: Wednesday 2.30–3.30 pm, and also by appointment.

Marker: Aram Pooladian

Topics: The course focusses on theoretical and computational aspects of *Linear Programming*, its applications and extensions. The following topics are planned (topics marked with * are optional and depend on time limitations).

- Review of linear algebra
- Optimization terminology
- Convexity
- Theoretical properties of linear programs: geometrical aspects, solvabilty, duality theory
- Simplex method
- Sensitivity analysis
- Interior-point methods for linear programming: central-path conditions, Newton's method for nonlinear equations, Mehrotra's predictor-corrector method
- Ellipsoid method*

- Quadratic programming
- Applications: game theory etc.

Textbooks: The course does not follow a particular textbook. Lecture notes will be produced as the course goes and made available to the students. For the linear programming part of the lecture the book *Linear Optimization* by Bertsimas and Tsitsiklis (Athena Scientific) is a good complementary read. For the nonlinear optimization parts standard references are *Numerical Optimization* by Nocedal and Wright (Springer) and Nonlinear Programming by Bertsekas (Athena Scientific). For those who want to dig deeper into theoretical aspects of convex sets and functions I recommend *Fundamentals of Convex Analysis* by Hirriart-Urruty and Lemaréchal (Springer).

Prerequisites: For the first part of the lecture, the students have to know the basics concepts from Linear Algebra such as *linear independence, subspaces, bases, dimension, linear span, linear equations, and matrix calculus.*

Moreover, for the second part, a notion of differentiability of functions in several variables is necessary to understand Newton's method, which will be introduced in the course.

Grading (417/487): Students in 487 will write modified forms of each exam and may be assigned extra questions on assignments. The overall formula for both parties is as follows:

- Homework: 20%
- Midterm: 30%
- Final: 50 %

Policy on homework: You may (and are encouraged to) work with other students in the class on the assignments, however, the work you submit must be your own. You **must** also cite any materials you have used to complete your work. Since both the midterm and the final exam will, in part, be heavily based on the homework assignments, it is strongly recommended to take the homework seriously.

Statement: By direction of the Senate all course outlines have to include the following statements:

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information).

In accord with McGill Universitys Charter of Students Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This right applies to all written work that is to be graded, from one-word answers to dissertations.

In the event of extraordinary circumstances beyond the Universitys control, the content and/or evaluation scheme in this course is subject to change.