Math 417-487: Mathematical Programming (Fall 2015)

Times: Tuesday and Thursday 8:35 - 9:55, Burnside 1B39.

Instructor: Bruce Shepherd (Office: Burnside 1113, Email: bruce.shepherd@mcgill.ca)

Office Hours: Tuesday 1:30-3:00. And also by appointment.

`Webpage: www.math.mcgill.ca/~bshepherd`

TA: Richard Torres (Office Burnside Hall)

Office Hours: TBA Or by email appointment.

Topics:

The course gives a firm grounding in several core topics in **mathematical optimization** and provides brief introductions to several selected advanced topics. Core topics include *Linear Programming* (models, solution techniques, duality, sensitivity and parametric analysis), *Operation Research Models* (inventory management, lot-sizing, network design), *Integer Programming* (the branch and bound and Gomory methods, lift and project), *Polyhedral Combinatorics* (affine linear algebra and cutting plane theory).

Brief introductions will then be given for selected topics amongst the following: *Optimization with Uncertainty* (Robust, Stochastic and/or Chance-constrained programming), *Theory of Games*, *Approximation algorithms*, *Bi-level programming*, *Convex Optimization*, *Optimization with Excel spreadsheets.*

Textbooks:

There is no course textbook but the following are useful supporting references.

(1) Much of the core material (including modelling, LP and IP) can be learned from the out of print text: *Applied Mathematical Programming* by Bradley, Hax and Magnanti. It is available online at http://web.mit.edu/15.053/www/.
(2) For linear programming it is hard to beat the classic *Linear Programming* by V. Chvátal.
(3) And similarly for integer programming: *Integer Programming* by L. Wolsey.
(4) The most comprehensive handling of polyhedral combinatorics is *The theory of linear and integer programming*, by A. Schrijver. A more circumscribed introduction is *A course in convexity* by A. Barvinok.
(5) There are several commendable texts on stochastic programming including *Introduction to Stochastic Programming* by Birge and Louveaux; Stochastic Programming by Kall and Wallace (available at http://www.stoprog.org/).
(6) *Convex optimization* by Boyd and Vandenberghe.

Prerequisites:

Students should know the basics from Calculus and Linear Algebra.

Grading (417/487):

In-class Quiz: $5 \times 5\% = 25\%$

Homework: 35%

Final: 40 %

Students in 487 (and Math 699) will write modified forms of each exam and may be assigned extra questions on assignments.

Students in Math 699 will also be required to complete a project and have a different grading scheme.

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.

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.