Fall 9-1-2021

M 363.01: Linear Optimization Laboratory

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UNIVERSITY OF MONTANA

Department of Mathematical Sciences

M 362, 363
Linear Optimization

Courses: M 362 Sec. 01 (CRN 73797) 3 cr. Linear Optimization TΘ 11:00am–12:20pm in MATH 311
M 363 Sec. 01 (CRN 74047) 1 cr., Autumn 2021 Linear Optimization Lab T 1:00–1:50pm in MATH 306 & by arrangement

Instructor: Mark Kayll
Econtact: mark.kayll@umontana.edu
umontana.zoom.us/j/6948539958 (in case of remote OH)
hs.umt.edu/math/people/default.php?s=Kayll
Office: MATH 209
406.243.2403
Hours: T 3:00–3:45pm, Θ 2:00–2:50pm & by appointment (*tentative*) (open for all course matters, including ODE accomm.)

Prerequisites: one of M 162 (Applied Calculus), M 172 (Calculus II), or M 182 (Honors Calculus II); M 221 (Intro Linear Algebra) is also recommended; or consent of instructor.
Students should have background appropriate for junior-level mathematical studies. Though we shall begin from first principles, it's extremely helpful if students have—or can learn quickly—basic knowledge of elementary linear algebra.

Texts: James K. Strayer, *Linear Programming and Its Applications*, Springer-Verlag, 1989 [ISBN-13 978-1-4612-1009-2]
LINDO and *LINGO User's Manuals*, LINDO Systems Inc., 2003, 2018, available at www.lindo.com

Important Dates:

Labor Day Holiday	Monday, 6 September;
last day to add w/o instructor consent	Wednesday, 8 September (5pm);
last day to drop or select Audit grade option	Monday, 20 September (5pm);
last day to drop via Add/Δ/Drop link and avoid 'WP' or 'WF'	Monday, 1 November (5pm);
Veterans' Day Holiday	Thursday, 11 November;
Thanksgiving Break	24–26 November;
last day to add/drop by petition	Friday, 10 December (5pm);
last class meeting (during finals)	Thursday, 16 December 10:10am–12:10pm.

Description: Linear optimization concerns optimizing a linear function subject to linear inequality constraints. This pair of courses focuses on modeling real-world problems as linear programs (LPs) and solving the resulting LPs using various techniques, including via computer. Strayer's text will be our guide; the plan is to cover much (most?) of this book. The simplex algorithm and duality are of principal importance. In addition, topics from the following list will be considered as time permits: transportation and assignment problems, network-flow problems, matrix games.

Learning outcomes: The 'official' outcomes below are reflected in the description above.

- Demonstrate the techniques of linear optimization and their applications;
- Formulate a linear program for an appropriate 'real-world' problem;
- Solve linear programs using appropriate software packages;
- Explain the beautiful theoretical underpinnings of linear programming.

Accommodation: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity (ODE). If you anticipate or experience barriers based on disability, please contact the ODE at 406.243.2243, ode@umontana.edu, or visit www.umt.edu/disability for more information. Retroactive accommodation requests will not be honored, so please do not delay. The instructor will work with you and the ODE to implement an effective accommodation, and you're welcome to contact the instructor privately if you wish.

Assessment: M 362 course grades are based on homework assignments, two term tests, and a final exam. M 363 grades are based exclusively on weekly computer projects and associated writing assignments. In both courses, traditional letter grades will be assigned using the +/− system (see *UM catalog* at catalog.umt.edu/academics/policies-procedures). UM's policy on Incomplete grades will be followed (see *UM catalog*).

(over)

Homework Assignments are set regularly, roughly every two weeks. A (possibly improper) subset of the assigned problems will be graded. Homework is submitted electronically on `gradescope.com`, either in PDF or JPG format from your device. The course number is **298288**, with Entry Code **86ZK4K**. You'll receive an email invite at your official UM email address; follow the instructions to link to `Gradescope` and get started. Students are responsible for compiling their own 'solution sets', comprised of their own submissions, augmented by notes from meetings with other students and with the instructor.

I urge students from the outset to get into the habit of staying on schedule with reading and homework. This helps to maximize the material absorbed in class, meaning less effort in preparing for tests.

***Tentative* grading schedule**	Item	Date(s)	Weight
362	Homework	31 August — 9 December	20%
	Test # 1	Tuesday, 28 September	20%
	Test # 2	Tuesday, 2 November	20%
	Final exam	Thursday, 16 December 10:10am–12:10pm	40%
363	Weekly Computer Projects & Writing Assignments		100%

Teaching modality: This course is face-to-face. The instructor is prepared to shift to Zoom should the need arise, as dictated by the pandemic status.

Moodle pages: These are located at `moodle.umt.edu/course/view.php?id=46361`. Students should check the Moodle site regularly to stay in tune with the course flow (announcements, homework, grade book, etc.).

General Remarks

On homework: Please use complete sentences, proofread, and polish your work prior to submission. You're encouraged to type homework solutions unless your handwriting is clear. You may work with others on homework problems, and you're encouraged to do so.

Solutions should be written down privately in your own words.

If you use an important idea of someone else, then please acknowledge that person by giving an appropriate citation in your write-up. This professional courtesy will not affect your grade.

On exams: As noted above, there are two in-class tests and a final exam. The latter will be cumulative with a slight emphasis on the material not covered by the in-class tests.

On make-ups: Make-ups for tests will *not* be given unless there is a valid excuse cleared with the instructor *prior* to the test. At least your most detrimental assignment will be dropped; thus, there are no homework make-ups.

On deadlines: Any stated deadlines are firm; please don't ask for extensions.

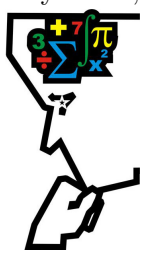
On electronic devices: Cell phones must be silenced during class meetings and office hours. Use of a cell phone during a test for any purpose other than as a calculator is grounds for earning a zero score on that test.

On coronavirus: Masks are required in the classroom & during office hours; students feeling sick or exhibiting COVID-19 symptoms shouldn't attend class and instead contact Curry (CHC: 406.243.4330). UM recommends obtaining a vaccine; please visit the CHC. Students required to isolate or quarantine will receive support for continued academic progress. Specific seating arrangements are in place; attendance/seating is recorded photographically to support contact tracing. Consuming food or beverages is discouraged in the classroom.

On conduct: All students need to be familiar with the Student Conduct Code; it can be found in the 'A to Z Index' on the UM home page. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the university.

Additional References

1. B. Guenin, J. Könemann, L. Tunçel, *A Gentle Introduction to Optimization*, Cambridge University Press, New York, 2014
2. G. Hurlbert, *Linear Optimization: The Simplex Workbook*, Springer-Verlag, New York, 2010



Combinatorics is the most fundamental, and hence the most important, branch of mathematics, since it deals with FINITE structures, and the world is finite.
Doron Zeilberger, *Board of Governors Professor of Mathematics*
Rutgers University