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Fall 9-1-2020

M 363.B01: Linear Optimization Laboratory

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**Courses:** M 362 Sec. 01 (CRN 74668) 3 cr.

Linear Optimization

TΘ 11:00am–12:20pm in MATH 103

& on Zoom (meeting ID: 943 2431 6583

M 363 Sec. B01 (CRN 74993) 1 cr., Autumn 2020

Linear Optimization Lab

T 1:00–1:50pm in MATH 103 & by arrangement

passcode: 598116 for both courses)

Instructor: Mark Kayll**Econtact:** mark.kayll@umontana.edu

umontana.zoom.us/j/6948539958 (for Office Hours)

hs.UMT.edu/math/people/default.php?s=Kayll

Office: MATH 209
406.243.2403**Hours:** T 3:00–3:50pm, Θ 2:00–2:50pm & by appointment
(tentative) (open for all course matters, including DSS 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 is 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: last day to add w/o instructor consent	Thursday, 27 August (5pm);
Labor Day Holiday	Monday, 7 September;
last day to drop	
or select Audit grade option	Wednesday, 9 September (5pm);
last day to drop via Add/Δ/Drop	
link and avoid 'WP' or 'WF'	Wednesday, 21 October (5pm);
Election Day Holiday	Tuesday, 3 November;
Veterans' Day Holiday	Wednesday, 11 November;
last day to add/drop by petition	Wednesday, 18 November (5pm);
last class meeting (during finals)	Friday, 20 November 10:10am–12:10pm.

Description: Linear optimization is concerned with optimizing a linear function subject to linear inequality constraints. This pair of courses will focus 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: matrix games, transportation and assignment problems, network-flow problems.

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 Disability Services for Students. If you have a disability that adversely affects your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. The instructor will work with you and Disability Services to provide an appropriate modification.

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](https://www.gradescope.com), either in PDF or JPG format from your device. The course number is **156755**, with Entry Code **MKV2RG**. 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.

<i>Tentative grading schedule</i>	Item	Date(s)	Weight
362	Homework	19 August — 17 November	20%
	Test # 1	Thursday, 17 September	20%
	Test # 2	Thursday, 22 October	20%
	Final exam	Friday, 20 November 10:10am–12:10pm	40%
363	Weekly Computer Projects & Writing Assignments		100%

Teaching modality: This is a *hyflex* course; i.e., some students attend face-to-face while others join synchronously via Zoom. Class meetings will be recorded on Zoom so that all students can revisit desired segments.

Moodle pages: These are located at moodle.umd.edu/course/view.php?id=33442. 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: Attendance will be recorded to support contact tracing. All students must follow UM's face covering policy; see www.umd.edu/policies/browse/facilities-security/covid-19-face-covering-policy. With mask use required in the classroom, consuming food or beverages is not allowed because these require mask removal.

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

