

## LINEAR PROGRAMMING

PROFESSOR: J. F. Bard

OFFICE: ETC 5.126, 471-3076

OFFICE HOURS: 3:30 - 5:00 pm TTH or by appointment

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PREREQUISITES: *An Introduction to Operations Research* course such as ME 366M (OR Methods), ME 366L (OR Models) or equivalent; an understanding of linear algebra; a working knowledge of at least one computer programming language (e.g., C++, VBA, Java).

TEXTS Required: Dimitris Bertsimas and John N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, Belmont, MA, 1997.  
<http://www.athenasc.com/linoptbook.html>

Recommended: Chapter 2, *Linear Programming*, from *Practical Bilevel Programming*, by J. F. Bard, Kluwer Academic Press, Boston, 1999

Excel Add-Ins: <http://www.ormm.net> Follow instructions for loading and using.

OBJECTIVES: To develop a thorough and complete understanding of linear programming in order to be able to undertake more advanced work in optimization. This will be achieved by a detailed presentation of theory, a discussion of applications, and the development of related software.

### GENERAL COURSE POLICIES

HOMEWORK: Homework and computer assignments can be done in teams of 2 or 3 students. Dates will be posted to indicate when these assignments are due.

SOLUTIONS: All solutions to the homework assignments and exams will be posted on the web.

EXAMS: All exams are open book and open notes. All students must take the exams when scheduled, including the final — no exceptions (dates on exams 1 and 2 are subject to minor changes). There will be **NO** make-up exams and there will be **NO** incompletes in the course; every student will get a grade. If you would like to review your final exam, please do so no later than one week after the next semester begins (fall, spring, or summer). After that time, all exams and other unreturned class material will be discarded.

GRADING:	Homework		8%
	Programs		7%
	First Exam	Thursday, October 8	20%
	Second Exam	Tuesday, November 3	25%
	Final Exam	Saturday, December 12; 7 - 10 pm	40%

Arithmetic errors on exams and homework are usually penalized a few points. Conceptual errors or errors in logic are penalized more severely. On exams, always show your computations and logic that led to your solution, label the solution, and cross out any work that you do not want graded. If your exam contains erroneous information or computations, even if you have the correct solution, you will still be penalized.

Necessary (but not sufficient) conditions for receiving a grade of **A** in the course are either an **A** on the first two examines or an **A** on the final and at least a high **B** on the first two exams. An **A** on the two midterms and a **C** on the final will likely result in a **B** in the course. Analogous requirements exist for receiving a grade of **B** and so on. Grades on the homeworks and programs are used to evaluate borderline students. All students **must** take the **final** on the scheduled date.

RE-GRADING: If you feel that you weren't graded fairly on an exam question, **first** look at the solution, **then** write a note to me explaining how your answer compares to the posted solution and why you think that you deserve more credit. Hand in your note and exam to me no later than 2 weeks after the exam is returned.

EXTRA CREDIT: There will be **NO** extra assignments for those wishing to try to improve their overall grade.

DISHONESTY: University policies for academic dishonesty will be strictly followed. Students found cheating on any exam will receive a grade of "F" in the course. Homework and other assignments turned in that do not represent the student's original work will receive a grade of zero.

DISABILITIES: The University of Texas provides upon request academic adjustments for students with documented disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4241.

### General References

1. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, *Linear Programming and Network Flows*, Third Edition, John Wiley & Sons, New York, 2005.
2. A. Brooke, D. Kendrick, and A. Meeraus, *GAMS: A User's Guide*, The Scientific Press, South San Francisco, 1988. <http://www.gams.com/>

3. G.B. Dantzig and M.N. Thapa, *Linear Programming 1: Introduction*, Springer-Verlag, New York, 1997.
4. G.B. Dantzig and M.N. Thapa, *Linear Programming 2: Theory and Extensions*, Springer-Verlag, New York, 2003.
5. S. Gass, *Linear Programming*, Fourth Edition, McGraw Hill, New York, 1975.
6. G. Hadley, *Linear Algebra*, Addison-Wesley, Reading, MA, 1973.
7. Katta F. Murty, *Linear Programming*, John Wiley & Sons, New York, 1983.
8. G. Strand, *Linear Algebra and its Applications*, Third Edition, Harcourt Brace Jovanovich, San Diego, CA, 1988.
9. Robert J. Vanderbei, *Linear Programming: Foundations and Extensions*, Third Edition, Springer-Verlag, New York, 2008.

#### **Reference List for Interior Point Methods**

9. I. Adler, N. Karmarkar, M. G. Resende and G. Veiga, "Data Structures and Programming Techniques for the Implementation of Karmarkar's Algorithm," *ORSA Journal on Computing*, Vol. 1 No. 2, pp. 84-106 (1989).
10. I. C. Chow, C. L. Monma, and D. F. Shanno, "Further Development of a Primal-Dual Interior Point Method," *ORSA Journal on Computing*, Vol. 2 No. 4, pp. 304-311 (1990).
11. J. N. Hooker, "Karmarkar's Linear Programming Algorithm," *Interfaces*, Vol. 16, No. 4, pp. 75-90 (1986).
12. I. J. Lustig, R. E. Marsten and D. F. Shanno, "Computational Experience with a Primal-Dual Interior Point Method," *Linear Algebra and its Applications*, Vol. 152, pp. 191-222 (1991).
13. R. E. Marsten, M. J. Saltzman, D. F. Shanno, G. S. Pierce, and J. F. Ballintijn, "Implementation of a Dual Affine Interior Point Algorithm for Linear Programming," *ORSA Journal on Computing*, Vol. 1 No. 4, pp. 287-297 (1989).
14. R. E. Marsten, R. Subramanian, M. Saltzman, I. Lustig, and D. Shanno, "Interior Point Methods for Linear Programming: Just Call Newton, Lagrange, and Fiacco and McCormick," *Interfaces*, Vol. 20, No. 4, pp. 105-116 (1990).
15. K. A. McShane, C. L. Monma, and D. Shanno, "An Implementation of a Primal-Dual Interior Point Method for Linear Programming," *ORSA Journal on Computing*, Vol. 1 No. 2, pp. 70-83 (1989).

16. S. Mehrotra. "Implementations of affine scaling methods: Approximate solutions of systems of linear equations using preconditioned conjugate gradient method," *ORSA Journal on Computing*, Vol. 4, No. 2, pp. 102-118 (1992).
17. T. Terlaky, "Twenty-Five Years of Interior Point Methods," *Tutorials in Operations Research*, Chapter 1, pp. 1-33, INFORMS (2009).