

OM 380: Optimization 1
Spring 2010
Unique No. 03930

Professor Anant Balakrishnan

Classroom:	CBA 4.338	Office:	CBA 6.486
Class time:	Tues. 2:00 to 5:00 p.m.	Hours:	Tuesdays, 1 to 2 p.m.
e-mail:	ananb@mail.utexas.edu		or by appointment

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All reading materials, assignments, and announcements will be distributed via *Blackboard*.

Course Description and Goals

Optimization, using mathematical programming, is one of the cornerstones of management science research and practice. Mathematical programming refers to a broad array of mathematical models and underlying optimization methodologies that have applications in remarkably diverse contexts, ranging from management, engineering, and science to public policy and healthcare. Operations research provides a structured and systematic approach to defining and solving practical problems. Further, understanding the structure of each problem class and developing new and effective solution methodologies is a very important aspect of the field.

The development of linear programming, the core model of constrained optimization, some fifty years ago heralded the modern era of constrained optimization. Much of mathematical programming builds upon the basic concepts of linear optimization and linear programming solution methodologies. Accordingly, a major portion of this course will be devoted to linear optimization, including linear programming, network optimization, and integer programming. We will also discuss some of the basic concepts and methods for nonlinear programming.

Optimization 1, a foundation course for graduate students who expect to study and apply optimization models and methods, seeks to provide a grounding in the underlying theory and methodologies while also introduce students to modeling, algorithmic development, interpretation, and applications. The course will attempt to cover the following topics:

- basic optimization concepts and model formulations;
- solution methods for linear programming, including the Simplex method and its variants;
- duality theory and sensitivity analysis;
- decomposition methods to exploit special structure in large-scale optimization problems; and,
- principles of network optimization, integer programming, and nonlinear programming.

Course materials

The course will rely largely on the following materials:

- Draft chapters from a preprint of a book on Optimization by Professor Thomas L. Magnanti, MIT.
- Chapters from the book "*Applied Mathematical Programming*" by Bradley, Hax, and Magnanti (originally published by Addison-Wesley).

Relevant chapters from both books will be distributed electronically, via Blackboard. These chapters will be supplemented as needed by other notes.

The following books are recommended as introductory or advanced/reference texts. Highly recommended books are shown in bold.

Introductory texts

- W. L. Winston. *Operations Research: Applications and Algorithms*, Thomson Brooks/Cole, 4th edition, 2004
- V. Chvatal. *Linear Programming*, W. H. Freeman & Company, 1983
- F. Hillier and G. J. Lieberman, *Introduction to Operations Research*, McGraw Hill, 9th edition, 2010

Reference texts

- D. Bertsimas and J. N. Tsitsiklis. *Introduction to Linear Optimization*, Athena Scientific, 1997
- M. S. Bazaraa, J. J. Jarvis, and H. D. Sherali. *Linear Programming and Network Flows*, Wiley, 1990

Course preparation and student evaluation

Students are expected to read, before each class, relevant book sections and chapters shown in the course schedule. Active class participation—responding to questions, offering explanations and insights, raising interesting issues, and contributing to better understanding the material—is strongly encouraged. The course requirements include regular homework assignments, a mid-term examination, and a final examination.

Homework assignments, approximately one per week, must be turned in at the beginning of class on the day they are due. Unless specified otherwise, homework assignments are *individual* (not group) assignments. You are permitted to discuss the broad approach and seek clarifications from other students (if so, provide the names of people you consulted), but must work out the details (e.g., proofs, algorithms) and write up the assignment on your own. **Do NOT copy** from other students' homework or use other sources (e.g., past years' solutions, web sites). Students must answer all the questions in each assignment, although only a selected subset of problems will be graded. Homework grades will be based on clarity of the work (including specifying assumptions and providing explanations) as well as completeness and correctness.

The course **exams** may include both in-class and/or take-home components. Typically, you are permitted to bring one 8.5 x 11 inch sheet (two-sided) of handwritten notes for the in-class exams. Take-home exams must be completed individually, without *any* discussions or help from other individuals and without consulting materials other than the textbook and class notes.

Grades for the course will be based on homework assignments (25%), class participation (10%), mid-term examination (30%), and final examination (35%).

Academic Integrity

By enrolling in this class, you agree to abide by the Honor System. In particular, **you must not use any materials (handouts, solutions, etc.) from other instructors or universities or from students who have previously studied this material.** If the application of the Honor System to this course is unclear in any way, it is your responsibility to ask the instructor for clarification.

Feedback

Your feedback is valuable, and facilitates continuous course improvement. Please do not hesitate to let me know, throughout the semester, how to improve the course and the learning experience it provides.

The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. If you have a condition (e.g. learning disability, chronic medical condition, etc.) or event that needs accommodation, please see me early in the semester so that we can take appropriate steps. For additional information about the University's policies, contact the Office of the Dean of Students at 471-6259 or 471-4641.