Large-Scale Systems Optimization – Course Syllabus

OM 380.8 -Unique # 04215 –ORI 391Q.9-Unique # 19320

MW 2:00-3:30, GSB 5.154

Instructor and Teaching Assistant

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Course Materials

Text: Optimization Theory for Large Systems, L.S. Lasdon, Dover, 2002 (paperback), or the original version in hardcover, published by MacMillan, 1970. Both are out of print, but are available online. As of 8/20/11 there were 6 copies of the hardback for $45 and 3 used copies of the paperbackfor $150 available on Amazon.com. There are also 11 copies available on abebooks.com, most under $75.

Readings: Posted on the class website. All articles from INFORMS journals are copyrighted by INFORMS, which reserves all publication rights. These articles appear for educational use only by permission of the Institute for Operations Research and the Management Sciences (INFORMS).

Course web site: http://courses.utexas.edu. This is on the UT intranet, called Blackboard. It contains class plans, course readings, and this syllabus, and will be updated as the semester progresses. Class plans will be posted prior to the class. This website will also contain announcements, calendar events, and perhaps a bulletin board for online class discussions.

Instructional Methods

The basic approach is to learn by doing using an active learning approach. This means that you spend some time in class in small groups discussing ideas and solving problems. Research shows that this leads to much greater understanding and retention than merely listening passively to a lecture. Hence we will organize small learning groups, who work together to solve problems and discuss topics in class. These problems are stated on the plan for each class. Last years plans are on the course website, and are a reasonable guide to those used in the current year. They will be updated prior to each class. After the group work, we discuss the problem solutions as a class. This is interspersed with lecture segments when needed. There will also be occasional outside speakers, who will explain how they use course topics in their work.

Class Schedule: Students should read the indicated material prior to the class that includes it. Numbered items refer to text sections. Items in quotes refer to files on the class website under “course readings” with the same names.

Session	Topic	Text Chapters	Readings
1	Course Description; Dantzig-Wolfe Decomposition	2.1-2.6, 3.1-3.5	"Deriving the DW decomposition algorithm.ppt"
2-4	Dantzig-Wolfe – Extensions, Applications, gams implementations	3.6-3.10	"Dantzig-Wolfe decomposition with gams.pdf", "dw.gms" "Dantzig Wolfe decomposition example_Luis.doc"
5-8	Column Generation - Cutting Stock, multi-item scheduling, Multicommodity Flows, gams implementations	4.1, 4.2	"A Suggested Computation for Maximal Multicommodity Network Flows," "Interactive Vessel Scheduling," "Notes on Multi-Item Scheduling"
9-10	Airline Crew Scheduling and Pilot planning and training models		"A Crew Scheduling Problem," "Recent Advances in Crew-Pairing Optimization at American Airlines," "Optimizing Pilot Planning and Training for Continental Airlines"
11-15	Branch and Bound algorithms for mixed integer programming. Dynamic programming		"Mixed-Integer Programming", "SBB.pdf", "Deterministic Dynamic Programming"
16	In-class midterm exam		
17-18	Benders Decomposition	2.8, 7.3	Benders Decomposition with GAMS, class handout
19-21	Distribution System Design Using Benders		"Multicommodity Distribution Systems Design," "Twenty Years of Strategic Distribution System Design"
22	Lagrangian Relaxation	1.3.3, 8.1-8.4	"An Applications Oriented Guide to Lagrangian Relaxation"
23-25	Data Envelopment Analysis		"Solving Real-World Linear Programs," "Analysis of Mathematical Programming Problems Prior to Applying the Simplex Algorithm"

26-28	Scenario-based Stochastic Programming and Financial Optimization		"Stochastic Network Programming," "Multiperiod Portfolio Models," "Towers Perrin Global Cap," "Stochastic Optimization of the Highland Lakes System," "Psychology of Preferences"

Grading: homework 1/3; midterm 1/3; term paper & class participation 1/3.

Homework: homework assignments, approximately one per week, must be turned in at the start of the class when they are due. Homeworks may be done by teams of two students. Homework grades will be based on clarity of the solutions (including specifying assumptions and providing explanations) as well as completeness and correctness.

Exams: The course will have one exam, held around mid-semester, consisting of an in-class portion and possibly a take-home portion. The in-class portion will be open book and notes.

Term Paper: Term papers may be done individually or in teams of 2. Some may be presented during the last few sessions of the course. The topic and type of work needed for the term paper is quite flexible. For instance, students can conduct a literature survey—covering theory, algorithms, and/or applications—on a particular topic or model closely or loosely related to some course topic, explore the modeling and application of a practical problem, develop a new algorithm for an existing optimization problem, or implement and test a previously developed algorithm. The following example topics illustrate the range of term paper choices:

- Survey of models and algorithms for the cutting stock problem;
- Applications of column generation algorithms;
- Implementation and testing of a Dantzig-Wolfe or Benders decomposition algorithm;
- Study of disruption management applications; or
- Compare the GAMS global optimizers on a set of test problems.

These topics are only representative examples; students can choose any course-related topic (subject to the instructor's approval) that best fits their interests. By the end of **October**, students must select their term paper topic (in consultation with the instructor, if desired), and submit a brief ***proposal*** describing the topic, the focus of the paper, the nature of work to be done, and a timeline. The instructor might suggest modifications, and must approve the proposal. The final term paper should be no more than 20 pages long, and is due during the last week of class. Grades on the term paper will be based on clarity of exposition, thoroughness of literature review, and novelty (e.g., frameworks or ideas).

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259.

By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Policy on Academic Integrity:
Students who violate University rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on academic dishonesty will be strictly enforced. For further information please visit the Student Judicial Services Web site:
http://deanofstudents.utexas.edu/sjs