ORI 397 - Logistics Analytics

Syllabus

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Office Hours
T Th, 10:45 a.m. – 11:30 a.m., (stop by anytime, I'll meet with you if I am not very busy, or send an e-mail to make an appointment)

Class Meetings
Times: T Th, 12:30 p.m. – 2:00 p.m., Room: ETC 2.140

Course Web Page
Canvas: http://canvas.utexas.edu

Course Description
Logistics deals with the planning and control of material flows and related information in organizations, both in the public and private sectors. Broadly speaking, its mission is to get the right materials to the right place at the right time, while optimizing a given performance measure (e.g., minimizing total operating costs) and satisfying a given set of constraints (e.g., a budget or a service level constraint). Logistics issues are encountered in firms producing and distributing physical goods. The key issue is to decide how and when raw materials, semi-finished, and finished goods should be acquired, moved and stored. Logistics problems also arise in firms and public organizations producing services. This is the case of garbage collection, mail delivery, public utilities, and after-sales service.

Effective and efficient management of logistics systems requires high quality decisions at multiple levels, strategic, tactical and operational. Since logistics systems are large and complex, with intricate and nontrivial relationships and tradeoffs among multiple segments of the logistics systems, even developing models that capture such complexities is challenging. Moreover, due to the large number of decision alternatives that need to be considered, solving the corresponding models and obtaining high quality decisions brings methodological challenges.

This course targets primarily doctoral and senior master students who are interested in research on supply chain and logistics engineering and optimization. We focus primarily on mathematical programming-based models for supply chain and logistics management. We start developing our

understanding of more complex systems by using classical "building block" models such as traveling salesman, vehicle routing, lot sizing, generalized assignment, and facility location problems. Classical logistics systems coverage will include manufacturing, distribution, transportation and service logistics systems. Several models will bring stochastic inventory and queueing/congestion considerations into deterministic optimization models, highlighting the newer, more comprehensive, ever-more interesting and challenging "hybrid" models. We then explore more recent logistics applications such as integrated and extended logistics systems, sustainable logistics network design, humanitarian logistics and disaster management, energy logistics, and healthcare logistics. The goal will not be to cover them all; we will customize this list depending on students' interests. Although our focus is on optimization models, we will highlight successful and time-tested heuristic techniques, especially emphasizing large scale, real life logistics systems applications of both optimization-based and heuristic techniques. Considering that some of the best models and algorithms are specialized/customized and exploit a particular problem structure or application domain, we emphasize understanding the problem structure, modeling choices and their effect on computational burden, and technical details of the reviewed models and methods. To this end, we test our understanding through computational exercises with various case studies, including several real life data sets obtained from companies.

Subject Matter Description:
Manufacturing, Distribution, Transportation and Service Logistics Systems Modeling, Analysis, and Optimization.

Prerequisite:
Graduate standing, ORI 391Q (Topic 4) or equivalent, or the consent of the instructor.

Text
There is no required text. See below for recommended references. There will be lecture notes and handouts based on these references and papers. See the other references for a reading list.

Recommended Texts

- G. Ghiani, G. Laporte, and R. Musmanno, *Introduction to Logistics Systems Management*, Wiley-Interscience, 2013 (available in electronic format from UT's E-book Library).
- A. Langevin, and D. Riopel (editors), *Logistics Systems: Design and Optimization*, Springer, 2005 (available in electronic format from UT's E-book Library).
- M.S. Daskin, *Network and Discrete Location: Models, Algorithms and Extensions*, 2nd edition, Wiley, 2013 (available in electronic format from UT's E-book Library).
- D. Simchi-Levi, X. Chen, J. Bramel, *The Logic of Logistics*, 3rd edition, Springer, 2014 (available in electronic format from UT's E-book Library).
- Pochet and Wolsey, *Production Planning by Mixed Integer Programming*, Springer, 2006 (available in electronic format from UT's E-book Library).

(Tentative) Outline

- Introduction: Supply Chain and Logistics.
- Optimization: Exact and Heuristic Methods
- Building Block Models and Problems
- Supply Chain Design (Facility Location, Logistics Network Design)
- Manufacturing Logistics (Production Planning, Shop Floor Control and Scheduling)
- Distribution Logistics
- Service Systems Logistics
- Transportation Logistics (Freight Transportation, Vehicle Routing, Less-than Truckload Trucking, Truckload Trucking, Pickup and Delivery)
- Logistics and Inventory (Inventory Routing, Vendor Managed Inventory, Network Design/Location and Inventory, Location and Routing)
- Special Topics (a subset to be covered)
  - Integrated and Extended Logistics
  - Supply Chain Management and Logistics Coordination
  - Logistics Revenue Management and Auctions
  - Closed-loop Supply Chains and Reverse Logistics
  - Humanitarian Logistics and Disaster Management
  - Healthcare Logistics
  - Robust and Stochastic Supply Chain Management
  - Global Logistics
  - Sustainable Logistics and Energy
  - Military Logistics
  - Industrial Applications (such as Semiconductor Manufacturing, After-market Service Parts Logistics, Truckload Trucking).

Grading

You will have one exam (about two thirds of the semester), several homework assignments, and a term paper during the semester. The grading will be based on the following weights: Homework: 20%, Term Paper: 40%, Exam: 40%. I expect that each assignment (homework, term paper, and exam) be neat and professional. You will not be allowed to make-up the exam unless there is documented emergency.

Homework is graded according to the following scale: Outstanding - 5, Good - 4, OK - 3, Poor - 2, Not passing work - 1, Did not turn in - 0.

Homework assignment that is one class late will be penalized with a grade level reduction in the grade scale; it will not be accepted after that date.

Term Paper
Each student will write a term paper, and present this paper near the end of the semester. The topic of the paper is flexible, and can be derived from the student's interests. Students can conduct literature surveys covering theory, algorithms, and/or applications on specific problems or models, apply a model to a practical problem, develop new methods for an existing problem, or implement, test, and improve an existing algorithm. Potential topics may be drawn from the special topics listed in the tentative outline above. This list will be customized according to the enrolled students' interests. Students may also propose a topic for the term paper and obtain the professor's approval.The expectation is that students will have selected their topic within the first four weeks of class. At that time, the students will submit a proposal describing the topic, defining the problem to be addressed, the focus of the paper, the nature of work to be done, and a timeline. Each student will present his/her paper during the last week of class and will turn in the final term paper at the same time.

Software

- Modeling languages: AMPL (www.ampl.com), GAMS (www.gams.com), or Xpress-MOSEL (www.fico.com/en/products/fico-xpress-optimization-suite)
- Solvers and callable libraries: CPLEX (www-01.ibm.com/software/commerce/optimization/cplex-optimizer/), XPRESS-MP (www.fico.com/en/products/fico-xpress-optimization-suite), GUROBI (www.gurobi.com)
- Open source optimization software: COIN OR Project: www.coin-or.org
- MS Excel Solver

Journals

- INFORMS Journals: Operations Research, Management Science, Manufacturing and Service Operations Management, Transportation Science (pubsonline.informs.org)
- IIE Transactions (www.tandfonline.com/toc/uiie20/current)
- Naval Research Logistics (onlinelibrary.wiley.com/journal/10.1002/(ISSN)1520-6750)
- Computers and OR (www.sciencedirect.com/science/journal/03050548)
- Transportation Research Part E (www.sciencedirect.com/science/journal/13665545)

Academic Dishonesty

Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. Since dishonesty harms the individual, fellow students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. Cheating will not be tolerated, and incidents of dishonesty will be reported. For more information, and for what constitutes "cheating," see: deanofstudents.utexas.edu/conduct/academicintegrity.php.

Students with Disabilities
The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259, diversity.utexas.edu/disability/.

Course Evaluation
Near the end of the semester, you will have an opportunity to anonymously evaluate the course and instructor using the standard Cockrell School of Engineering evaluation form.

Dropping the Course
An engineering student must have the Dean's approval to add or drop a course after the 12th class day of the semester. A student seeking to drop a class after the 12th class day should visit the Cockrell School of Engineering Student Services (Engineering Student Services Building, 471-4321).