IE 6661 Linear Optimization Syllabus Fall 2026 George Tower 0803 cat

Course Goals :

- Modelling: High level of ability to model problems with networks or as LPs, when possible, and to recognize when it is not possible. Mastery of fundamental modeling principles such as data/model separation, auxiliary variables, penalties, weights, convexity, and documentation. Also, basic knowledge of column/row generation models and IP models.
- Theory: mastery of fundamental theory of LP, including polyhedral representation, projection, extreme points, simplex method, separating hyperplane theorem, Farkas's Lemma, weak and strong duality theorems, dual simplex method, sensitivity analysis. Knowledge of elementary combinatorial algorithms and elementary supporting data structures for shortest paths, min spanning tree, and max flow. Mastery of the theory of the simplex method for min cost flows.
- Duality: familiarity with duality in many of its guises, including LP formulations, shadow prices, reduced costs, Lagrangean functions, game theory, theorems of the alternative, representation, separation. You should be perplexed, fascinated, or ecstatic. Perplexed is good enough — that is where I usually am.

Textbook: *Linear Optimization and Duality, Craig A. Tovey, CRC Press, 2021, ISBN 978-1-4398-874602 (hbk), ISBN 978-1-315-11721-8 (ebk)*

Recommended Supplemental Textbook: *Introduction to Linear Optimization, Arkadi Nemirovski, ISBN 978-9811278730, WSBC, 2024*

Prerequisites: You must be thoroughly comfortable with elementary linear algebra (matrices,bases, dimension, orthogonalization). You should be comfortable (d)reading[1] and writing mathematical proofs. The textbook will help you learn how to find logically correct proofs.

Topics: : Chapters 1-7, 8.1,8.4, 9.1, 9.3, 11-13, 15.1. If time permits we will also cover parts of chapters 10, 15, and/or 16.

Tests: One midterm, one final, each counting as $\frac{1}{3}$ of the course grade, respectively.

Project: The project, counting as $\frac{1}{3}$ of the grade, will be a combination of writing solutions to problems, and critiquing the textbook. Specifics, including whether the projects will be done individually or in pairs, will be decided in class.

Homework: Recommended problems will be assigned every one to two weeks. Solutions will be posted after one week. You are responsible for checking your solutions for

[1] the letter "d" before "reading" was a serendipitous finger fumble.

correctness. If you are not sure that your answer is correct, send me a snapshot or pdf of your answer, and show me what part of your answer you are not sure of. Warning: if you don't work on the problems before reading the solutions, you will sabotage yourself.

Instructor: Dr. Tovey, *cat@gatech.edu*.

Honor Code Students are required to abide by the Ga. Tech honor code. You may not represent work that is not your own as being yours, nor may you enable someone else to do so. I encourage you to work together on homework, and when preparing for tests.

Tentative Schedule **MW 11:00-12:15**

Order of topics: Definitions and weak duality, LP formulation, polyhedral theory, simplex method and strong duality, variants and extensions, speed, network formulation and combinatorial algorithms, network simplex method, integer programming formulation.

Dates	*Chapter*
8/24, 8/26	1,2
8/31, 9/2	3.1-3.4
9/7–9/16	4,8.1
9/21–9/28	5
9/30, 10/5	6
10/7, 10/12	3.6,7.1,7.2,7.3
10/14	Midterm
10/19	9.1
10/21,10/28	11.1, 11.2
10/26	Semester Break
11/2–11/4	11.3, 12.4
11/9–11/11	13
11/16–11/18	15
11/23	10
11/25	optional, day before Thanksgiving
11/30	Slack, Project Due Date
12/7	Final Exam

Homework 1

Chapter 1, Problem 13. Chapter 2, Problems 7, 15, 16(a,c,d,e,g) 17, 20, 21.