

OID 910/ESE 504, Fall 2016.

Instructor: Monique Guignard-Spielberg, OID Department, Wharton

Audience

This is a first course in optimization, introducing students in engineering, mathematics and business to Mathematical Programming. It is open to undergraduates with permission and to MS and Ph.D. students.

Background

This course assumes elementary background in multivariate differential calculus and in linear algebra, plus familiarity with vector/matrix notation and arithmetic.

The course will be based on the required textbook **Introduction to Mathematical Programming: Applications and Algorithms, Volume 1, 4th Edition** by W. L. Winston and M. Venkataramanan, Brooks/Cole Thomson. The slides available on the course canvas site are based on those by J. Orlin from MIT and are closely related to the text book. Students should be aware, however, that occasionally the slides do not follow the book's sign conventions. The convention to follow will always be that of the book.

Textbook

There is one required textbook for the class, and one recommended for students who want to have, in addition, access to a more theoretical text.

Required:

Introduction to Mathematical Programming: Applications and Algorithms, Volume 1, 4th Edition by W. L. Winston and M. Venkataramanan, Brooks/Cole Thomson.

Recommended:

Introduction to Linear Optimization (Athena Scientific Series in Optimization and Neural Computation), Dimitris Bertsimas and John N. Tsitsiklis.

The first textbook contains more applications and is more appropriate for MS students; the second one is more theoretical and is more appropriate for PhD or future PhD students.

Topics

- Model Building (Chapter 1)
- Introduction To Linear Programming – Geometry (Chapter 3A)
- Introduction To Linear Programming – Models (Chapter 3)
- The Simplex Algorithm And Goal Programming (Chapter 4)
- Sensitivity Analysis: An Applied Approach (Chapter 5)
- Sensitivity Analysis And Duality (Chapter 6)
- Transportation, Assignment And Transshipment Problems (Chapter 7)
- Introduction to Networks (Chapter 8)
- Integer Programming (Chapter 9)
- Nonlinear Programming (Chapters 11 and 12)
- Game Theory (Chapter 14)
- IP, LP and NLP Hardness.

Schedule

Week	Dates	Topics	Reading	HW due date	TA in charge	Project
1	8/30-9/1	Class Organization Models.	Ch. 1	none		
2	9/6-9/8	Model Building Linear Programming	Ch. 1 Ch. 3	Hw1 due 9/13	Goyal	
3	9/13-9/15	Some Linear Programming Models Simplex Method-I	Ch. 3 Ch. 4	Hw2 due 9/20	Ni	Project 1. Give topic
4	9/20-9/22	Simplex Method-II	Ch. 4	HW3 due 9/27	Dong	
5	9/27-9/29	Degeneracy and Big-M method Sensitivity Analysis and Duality-I	Ch. 4 Ch. 6	HW4 due 10/4	Solanki	
6	10/4	Review sessions	All so far			
	10/6	Fall break, no class				
7	10/11-10/13	Sensitivity Analysis and Duality-II;-III	Ch. 6	HW5 due 0/18	Goyal	
8	10/18-10/20	Nonlinear Programming-I Nonlinear Programming-II	Ch. 12 Ch. 12	HW6 due 10/27	Oh	Project 1 due 10/18
MT	Monday, 10/24, 6 to 8 pm	MIDTERM EXAM				
9	10/25-10/27	Nonlinear Programming-III Quadratic Programming with LINDO-Markowitz portfolio model		HW7 due 11/1	Ni	Project 2 proposal due 10/25
10	11/1-11/3	Transportation problem	Ch. 7	HW8 due 11/8	Dong	
11	11/8-11/10	Network Problems	Ch. 8	HW9 due 11/15	Goyal	
12	11/15-/11/17	Assignment Problems	Ch.7	HW10 due 11/29	Solanki	

13	11/22	Integer Programming-I	Ch. 9			
	11/24	No class, Thanksgiving				
14	11/29-12/1	Integer Programming-II	Ch. 9	HW11 due 12/6	Oh	
15	12/6-12/8	Project Presentations.				

Each homework is based on the material of that week and the previous weeks, and is normally due on the first day of class of the following week. For instance, HW1 is based on the material of all weeks up to, including week 2, and is due on the first day of class of the following week, that is, week 3.

The readings follow the chapters in book (1).

Students must review the material in chapter 2 on their own. This chapter covers most of the mathematical background necessary to understand what follows.

Exams/Quizzes/Homework

Two in-class exams will be scheduled, in the middle and at the end of the semester. They will be closed book but with a single handwritten sheet containing all information you find useful for the exam. The second exam will be comprehensive. The final exam date is TBA.

Class attendance is compulsory. There will be frequent in-class quizzes, and one homework assignment every week, normally returned on Tuesday. HWs will be submitted on canvas. One homework = 2 quizzes. Students will be allowed to miss up to one HW-equivalent with no penalty. Beyond this, the score for a missing HW or quiz will be 0.

Teaching Assistants

The teaching assistants will be

"Tianxiang Dong" <dtianx@seas.upenn.edu>

"Prakhal Goyal" <prakhal@seas.upenn.edu>

"Arthur Ni" <tianyuni@seas.upenn.edu>

"Simon Oh" <sangmino@wharton.upenn.edu>

"Rishisingh Solanki" <rsolanki@seas.upenn.edu>

Office hours and email addresses:

The TAs and the instructor will each have office hours (1 ½ hours) each week on Monday (TA) and Friday (TA) and on Tuesday at 4:30 (instructor). TA hours TBA.

Students should always write using their Penn email address.

There is one email address specifically reserved for the course:

ese504@seas.upenn.edu@gmail.com

Students can use it to contact the TAs and the instructor throughout the semester for questions related to the course. It will be monitored on a daily basis. If the question is of general interest, expect that the answer will be sent to the whole class, but your name will be hidden.

Only email addressed personally to either a TA or the instructor should be sent to their individual addresses:

For the instructor: guignard_monique@yahoo.fr (please do not use the Wharton address).

For the TA's: see above.

Codes of conduct

Students should be aware that the University requires adherence to several codes of conduct. These are available here:

<https://secure.www.upenn.edu/osc/pages/codes.html>

The code of academic integrity is particularly important in relation to students' behavior in their studies. It is reproduced here. It is important that you read this, as some requirements may be new to you. Pay particular attention to A, B, C and D, as they are most relevant to course taking.

CODE OF ACADEMIC INTEGRITY

Since the University is an academic community, its fundamental purpose is the pursuit of knowledge. Essential to the success of this educational mission is a commitment to the principles of academic integrity. Every member of the University community is responsible for upholding the highest standards of honesty at all times. Students, as members of the community, are also responsible for adhering to the principles and spirit of the following Code of Academic Integrity.

Academic Dishonesty Definitions

Activities, that have the effect or intention of interfering with education, pursuit of knowledge, or fair evaluation of a student's performance are prohibited. Examples of such activities include but are not limited to the following definitions:

- A. Cheating: using or attempting to use unauthorized assistance, material, or study aids in examinations or other academic work or preventing, or attempting to prevent, another from using authorized assistance, material, or study aids. Example: using a cheat sheet in a quiz or exam, altering a graded exam and resubmitting it for a better grade, etc.
- B. Plagiarism: using the ideas, data, or language of another without specific or proper acknowledgment. Example: copying another person's paper, article, or computer work and submitting it for an assignment, cloning someone else's ideas without attribution, failing to use quotation marks where appropriate, etc.
- C. Fabrication: submitting contrived or altered information in any academic exercise. Example: making up data for an experiment, fudging data, citing nonexistent articles, contriving sources, etc.
- D. Multiple submission: submitting, without prior permission, any work submitted to fulfill another academic requirement.
- E. Misrepresentation of academic records: misrepresenting or tampering with or attempting to tamper with any portion of a student's transcripts or academic record, either before or after coming to the University of Pennsylvania. Example: forging a change of grade slip, tampering with computer records, falsifying academic information on one's resume, etc.

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