OIDD 910/ESE 504, Fall 2019

Instructor: Monique Guignard-Spielberg, OID Department, Wharton
syllabus as of August 21, 2019.

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.

The goal of sections 401/2 is to make students educated users of optimization, capable of (1) modeling practical optimization problems, (2) solving them with the most appropriate method, (3) correctly interpreting the results and (4) doing sensitivity analysis whenever available. Section 403, taught by another instructor, covers the material in a less applied, more rigorous mathematical way.

There are additional courses that deal in greater details with the topics covered in this course, such as OIDD 914, 915 and 916, offered on alternate spring semesters.

If you have already taken an introductory Mathematical Programming or Optimization course, you must take section 403, or discuss it with the instructors.

TEXTBOOK

The textbook is out of print. It is available as a special authorized copy at the bookstore.
If you find an original copy in another bookstore, or online, at a reasonable price, feel free to buy it. The title is

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

Notice: there are two authors to this version of the textbook.
Another version, by W. L. Winston alone, covers material for two semesters and is twice as heavy, Some chapters are numbered differently from the required textbook, and homework pages and text specific information given in the syllabus may be different. The contents of the correct chapters however are the same.

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 and Duality (Chapter 6)
- Transportation, Assignment and Transshipment Problems (Chapter 7)
- Network Models (Chapter 8)
- Integer Programming (Chapter 9)
- Nonlinear Programming (Chapter 11 or 12)

Schedule

	Dates	Topics	Reading	HW, due date	TA in charge	Project
	8/28-8/30	Class Organization Models. Assignment problem	Ch. 1,7	none		
	Labor Day Mo 9/2	No classes				
	9/3-9/5	Model Building Assignment and transportation problems	Ch. 1 Ch. 7	Hw1, due 9/10	CHEN	
	9/10-9/12	Transportation problem Some Linear Programming Models Simplex Method-I	Ch. 3 Ch. 4	Hw2 due 9/17	SI	Project 1. Give topic
	9/17-9/19	Simplex Method-II	Ch. 4	HW3 due 9/24	PAN	
	9/24-9/26	Simplex method –III Degeneracy.	Ch. 4 Ch. 6	HW4 due 10/1	ZHAO	
	10/1-10/3	Sensitivity Analysis and 2-phase simplex method.	Ch. 6	HW5 Due 10/11	WU	
	10/10-10/13	Fall break, no class				
	10/8-10/15	Sensitivity Analysis (end) and Duality.	Ch. 6			
	10/22	Review for midterm in class				Project 1 due on canvas 10/24
MT	10/24	IN CLASS MIDTERM EXAM				
	10/17	Pricing out. Incomplete outputs. Wrapping up LP.	Ch. 12	HW6 Due 10/29	SI	Project 2 Submit Topic 10/28
	10/29-10/31	Nonlinear Programming KKT conditions in NLP	Ch. 12	HW7 due 11/05	WANG	

	11/5-11/7	Transportation problem by simplex method	Ch. 7	HW8 due 11/12	ZHAO	
	11/12-/11/14	Transportation problem by simplex method Integer Programming	Ch.7	HW9 due 1/19	WU	Update Project 2 report
	11/19	Integer Programming	Ch. 7	HW10 due 11/26	PAN	
	11/21-11/24	No class, Thanksgiving				
	11/26-11/28	Integer Programming	Ch. 9	HW11 due 12/3	CHEN	
	12/3-12/5	Integer Programming Wrapping up the class	Ch. 9	HW12 due 12/9	WANG	Project 2 due

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. Students are expected to be familiar with the readings listed above (column 3, Reading).

The readings follow the chapters in the textbook.

==========

Students must review the material in chapter 2 on their own.

This chapter covers most of the mathematical background necessary to understand what follows.

==========

Tentative final exam date: December 13, 6 to 8 pm.

==========

If you are a non-Wharton student who will need to access public computers as part of the course, then you will need to create a Wharton Class Account.

(Once created, a class account will then link to your PennKey account and allow you to log into public computers with your PennKey account.)

For class account creation, go to:
https://apps.wharton.upenn.edu/iam/accountcreator/

Software used in the course.

In order to solve larger size optimization problems, it is necessary to use optimization software. The software available is highly specialized and uses the latest improvements in solution methods. Specific optimization packages are regularly updated, and each one requires learning its specific rules and language. Starting in the early 80's, a new type of package, generically called algebraic modeling system, has become available, starting with development efforts at the World Bank, with the goal of remaining platform (i.e., machine) independent, programming language (i.e., Fortran, C, C++, etc.) independent, and optimization software independent. A code in one of these systems should normally remain valid indefinitely. GAMS Corp. makes available a free license for the length of the semester to the students enrolled in sections 401 and 402. This license will allow free access to a large number of the best solvers currently available, using a single optimization programming language, for solving problems of linear programming, nonlinear programming, network flow optimization and integer programming, which would otherwise require learning specific systems and languages. The GAMS language is easy to learn, and if coded with care and properly documented, GAMS codes are easy to decipher. In addition, an included extension to the GAMS language, called GDX for **G**AMS **D**ATA E**X**CHANGE, allows reading and writing data files written in other languages, such as EXCEL. Finally an extensive MODEL LIBRARY, included with the package, contains hundreds of examples of industrial, as well as academic examples of GAMS programs. Learning GAMS frees you from learning different systems for linear, nonlinear, network and/or integer optimization problems, while giving you access to the best, most up-to-date, optimization packages.
Students will be required to download GAMS from the GAMS website http://www.gams.com

Without the license file, the programs will run in demo mode.

There are different versions for Windows, Mac or UNIX machines.

Grades.

There is no absolute rule for determining the final grades, your grade will depend on your average grade and that of every student in the class.
The final grade will be the sum of the grades of the homework, the two projects, the midterm and the final, with equal weights (1/5 each). Be careful about the homework, a lower homework average will place you lower in the final ranking.

This was particularly obvious the last few years.
It is allowed to work with other students on the homework problems, but every student must write his/her final answers. The homework must be submitted on canvas as a single file. It should be typed, except for computation that should be done by hand.

You must scan your typed and handwritten parts as pdf files.

The final file type will be specified for each homework. If you must combine separate files into a single file, you must use zip. No tar file will be accepted.
Canvas is very strict about the exact time at which you submit your homework. Make sure you submit it on time, which means that you should give yourself a little slack as it can happen that your file is not uploaded the first time, for no particular reason, so always wait until canvas acknowledges your HW file is indeed uploaded. That will save you some headaches!

Exams/Quizzes/Classes/Homework

Two exams will be scheduled, the first in-class in the middle of the semester and the final during the official final exam period. They will be closed book with a single handwritten sheet containing all information you find useful for the exam. The final exam will be comprehensive, its date is decided by the University. At this point, it is scheduled for December 13, 6 to 8 pm.

Class attendance is compulsory. Laptops should remain closed, unless specifically required by the instructor or TA. Cellphones must be turned off, and placed face up on the student's desk.

There will be one homework assignment every week, normally returned on Tuesday. HWs must be submitted on canvas. There may be occasional in-class quizzes. 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. The lowest HW-equivalent score will be ignored for the final grade.

Office hours and email addresses:

The TAs and the instructor will each have office hours (normally 1½ hours at least) each week. Office hours will start after the first HW is published.

Students should always write using their Penn email address, NOT their gmail address.

Students can contact the TAs and the instructor throughout the semester for questions related to the course.

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.

TAs names and_____email addresses

Yue Cheng_____yue2@seas...

Jingyi PAN_____jypan@seas...

Zishuo SI_____zsi@seas...

Po-Yuan WANG_____poyuanw@seas...

Quinn WU_____quinnwu@seas...

Xuanyi Zhao_____xuanyizh@seas...