Financial Optimization
ISE 347/447

Preliminaries

Dr. Ted Ralphs

Introductory Stuff

- Welcome!
- Class Meeting Time
- Office Hours TBD
- Surveys

What will this class be about?

- Optimization Modeling and Methods
  - Linear and Nonlinear Programming
  - Integer Programming
  - Dynamic Programming
  - Stochastic Programming
- Financial Applications
  - Asset/Liability Management
  - Option Pricing and Hedging
  - Risk Management
  - Portfolio Optimization
- Modeling Maguages and Software
  - Excel Solver
  - AMPL
  - Python!

What do I expect you to know?

- Undergraduate mathematics
- A little mathematical modeling
- A little probability theory

What are the goals for the course?

After this course, you should be able to:

- Understand the basic optimization methodologies used in financial decision-making.
- Understand how to formulate financial optimization programs using the tools of mathematical programming.
- Understand how to select the optimization technique most appropriate for a given financial optimization problem.
- Understand how to use spreadsheets and modeling languages to interface with optimization software for solving financial optimization problems.

Approximate Syllabus

Category	Topic	Lectures
Introduction	Introduction	2
Models and Methods	Linear Programming	2
Software	Excel Solver and AMPL	2
Application	Asset/Liability Management and Asset Pricing	2
Models and Methods	Quadratic Programming	2
Software	GAMS and software for nonlinear programming	2
Application	Portfolio Optimization	2
Models and Methods	Integer Programming	2
Application	Constructing an Index Fund	2
Models and Methods	Dynamic Programming	2
Application	Options Pricing	2
Models and Methods	Stochastic Programming	2
Software	Software for Stochastic Programming	2
Application	Portfolio Optimization and Option Pricing	2

Course Requirements

- Attendance
- Participation
- Reading
- Homework
- Exams

Homework and Final Project

- There will be approximately 5 problem sets worth 20% of your grade.
- There will also be two mid-terms, a final project, and a final exam, each worth 20% of your grade.
- We will try using Google Classroom for turning in assignments and see how that goes.
- Homework is due at the beginning of Tuesday's class.
- Lateness policy is in the syllabus.
- I encourage working together, but you must write up the homework yourself (unless it is a group assignment).
- Please reference the work of others.
- Basic problem types:
  - Mathematical
  - Modeling
  - Computation

Grading

- Your grade should correspond to your learning and understanding of the course material.
- We will be randomly grading selected problems. Detailed solutions for selected problems will be distributed.
- Weighting
  - 20% Homework
  - 20% Midterm (each)
  - 20% Final Project
  - 20% Final Exam

Class Web Site

- The class Web site will be at

  http://coral.ie.lehigh.edu/~ted/teaching/ie447/

  but this will also be supplemented by the Google Classroom site.
- Slides from the previous time I taught the class are already posted, but they will be updated as I go.
- All handouts for the class will also be available.
- There will also be links to other relevant sites and reference materials.

Textbook

- The primary text is Cornuejols and Tütüncü.
- I will also take material out of some other texts.
- There is an abundance of reference material on the Web.
- Check the Web site for links.
- Please let me know if you want additional supplementary material.

My Approach to Lectures

- Lectures should be as interactive as possible.
- You will get more out of this course if you ask questions during lecture.
- The pace and structure of the lectures can be adjusted.
- I need feedback from you to adjust appropriately.

Some More Notes

- This is only the second time I have taught this course (and the first was a while back), so I will be adjusting as we proceeed.
- The adjustments will be based on your feedback, so please let me know what you like and don't like.
- Please pay attention to the policy regarding citing the work of others in the syllabus.
- I take this policy very seriously.

Acknowledgements

- Dr. Raphael Hauser was kind enough to share some of his course materials from a financial optimization course taught at Oxford University:

  http://www.maths.ox.ac.uk/people/raphael.hauser

- Dr. Jeffrey Linderoth was kind enough to share some of his course materials from a course on stochastic optimization taught at Lehigh:

  http://homepages.cae.wisc.edu/ linderot/classes/ie495/

Questions?