15.093
Optimization Methods
Syllabus - Fall 2018

1 General Information

Instructor:	Bart Van Parys (`http://www.mit.edu/~vanparys/`) Office: E62-569 e-mail: vanparys@mit.edu Office hours: Thursday 5:00-6:00pm at E62-569
Teaching Assistant:	Ryan George Cory-Wright e-mail: ryancw@mit.edu
Teaching Assistant:	Nihal Koduri e-mail: nihalk@mit.edu

Class Times:	Tuesday & Thursday 2:30-4:00pm, Room 2-190
Recitations:	Wednesday 3:00-4:00pm - Room 32-141, and Friday 1:00-2:00pm Room 56-114

Prerequisites: Calculus, Linear Algebra, and some familiarity with computational tools (e.g, Julia), at the level of MIT 18.06, for instance.
Required Book: Dimitris Bertsimas and John Tsitsiklis, Introduction to Linear Optimization, Athena Scientific, Belmont, Mass, 1997. ISBN 1886529191

2 Expectations from the course

Course Description and Objectives: The course offers a unified view of mathematical optimization, covering the main areas of application as well as the core optimization algorithms. It includes the following topics:

1. Linear Optimization
2. Robust Optimization
3. Network Flows
4. Discrete Optimization
5. Dynamic Optimization
6. Nonlinear Optimization

At the end of the course you should be able to

1. Understand in detail the different classes of optimization problems discussed in class, as well as the relative advantages among different formulations.
2. Be able to identify what optimization methodologies are the most appropriate when faced with a concrete problem.
3. Be familiar with the geometric, algebraic, and computational aspects of linear optimization problems, and their associated duality and sensitivity properties.

Tentative plan:

1. Sep 6: Applications of Linear Optimization. (Chapter 1)
2. Sep 11: Geometry of Linear Optimization (Chapter 2)
3. Sep 13: Simplex Method 1 (Chapter 3)
4. Sep 18: Simplex Method 2 (Chapter 3)
5. Sep 20: Duality Theory 1 (Chapter 4)
6. Sep 25: Duality Theory 2 (Chapter 4)
7. Sep 27: Sensitivity Analysis (Chapter 5)
8. Oct 2: Large Scale Optimization (Chapter 6)
9. Oct 4: Robust Optimization 1
10. Oct 9: Columbus Day
11. Oct 11: Robust Optimization 2
12. Oct 16: Robust Optimization 3
13. Oct 18: Mid term 1
14. Oct 23: Sloan Innovation Period (No class)
15. Oct 25: Sloan Innovation Period (No class)
16. Oct 30: Network Flows 1 (Chapter 7)
17. Noc 1: Network Flows 2 (Chapter 7)
18. Nov 6: Discrete Optimization 1 (Chapter 10)
19. Nov 8: Discrete Optimization 2 (Chapter 11)
20. Nov 13: Lagrangean Methods (Chapter 11)
21. Nov 15: Heuristic and Approximation Algorithms (Chapter 11)
22. Nov 20: Dynamic Programming (Chapter 11)
23. Nov 22: Thanksgiving
24. Nov 27: Applications of Nonlinear Optimization
25. Nov 29: Optimality Conditions for Nonlinear Optimization
26. Dec 4: First Order Methods
27. Dec 6: Semidefinite programming
28. Dec 11: Review
29. Dec 17: Final Exam

3 Course Policy

Lecture notes: The lectures notes will be posted on the course website before each lecture. *Students are also responsible to take their own notes,* as well as read the assigned portions of the textbook before class. All handouts, including homework solutions will be posted in the course website (https://mit.instructure.com/courses/700).

Requirements: Homework 30%, Midterm Exam 30%, Final Exam 40%.

Homework: Problem sets will be handed out in an approximately bi-weekly basis, and will be due in two weeks, at the beginning of the lecture on their respective due dates. We expect you to turn in all completed problem sets on time. Late homework will not be accepted, unless there is a prior arrangement with the instructor.

Policy on Individual Work: In the case of written homework assignments and cases, your assignment and/or case write-up must represent your own individual work. Although you are certainly encouraged to discuss the material and homework with other students, the written assignments must represent your own work. You are expected to adhere to the following standards:

- Do not copy all or part of another student's work (with or without "permission").
- Do not allow another student to copy your work.
- Do not ask another person to write all or part of an assignment for you.
- Do not work together with another student in order to answer a question, or solve a problem, or write a computer program jointly.
- Do not consult or submit work (in whole or in part) that has been completed by other students in this or previous years for the same or substantially the same assignment.
- Do not use print or internet materials directly related to a case/problem set unless explicitly authorized by the instructor.
- Do not use print or internet materials without explicit quotation and/or citation.
- Do not submit the same, or similar, piece of work for two or more subjects without the explicit approval of the two or more instructors involved.

During the midterm and the Final Examination, any student who either receives or knowingly gives assistance or information concerning the examination will be in violation of the policy on individual work. The violation of the policy on individual work is a serious offense!