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 6:00-7:00pm at E51-242

Class Times: Tuesday & Thursday 2:30-4:00pm, Room 32-123
Recitations: Wednesday 3:00-4:00pm - Room 3-333, and Friday 1:00-2:00pm Room 56-114

Prerequisites: Calculus, Linear Algebra, and some familiarity with computational tools (e.g., MATLAB), at the level of MIT 18.06, for instance.


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 5: Applications of Linear Optimization. (Chapter 1)
2. Sep 7: Geometry of Linear Optimization (Chapter 2)
3. Sep 12: Simplex Method 1 (Chapter 3)
4. Sep 14: Simplex Method 2 (Chapter 3)
5. Sep 19: Duality Theory 1 (Chapter 4)
6. Sep 21: Student Holiday
7. Sep 26: Duality Theory 2 (Chapter 4)
8. Sep 28: Sensitivity Analysis (Chapter 5)
9. Oct 3: Large Scale Optimization (Chapter 6)
10. Oct 5: Robust Optimization 1
11. Oct 10: Robust Optimization 2
12. Oct 12: Robust Optimization 3
13. Oct 17: Review
14. Oct 19: Mid term 1
15. Oct 24: Sloan Innovation Period (No class)
16. Oct 26: Sloan Innovation Period (No class)
17. Oct 31: Network Flows 1 (Chapter 7)
18. Nov 2: Network Flows 2 (Chapter 7)
19. Nov 7: Discrete Optimization 1 (Chapter 10)
20. Nov 9: Discrete Optimization 2 (Chapter 11)
21. Nov 14: Lagrangean Methods (Chapter 11)
22. Nov 16: Heuristic and Approximation Algorithms (Chapter 11)
23. Nov 21: Dynamic Programming (Chapter 11)
24. Nov 23: Thanksgiving
25. Nov 28: Applications of Nonlinear Optimization
27. Dec 5: First Order Methods
28. Dec 7: Semidefinite programming
29. Dec 12: Review
30. Dec 19: 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: http://stellar.mit.edu/S/course/15/fa18/15.093/

**Requirements:** Homework 20%, Midterm Exam 40%, 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!