EE5138R OPTIMIZATION FOR COMMUNICATION SYSTEMS

Instructor
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Assessments
Quiz 1: 15%
Midterm: 20%
Homework Assignments: 10%
Final Exam: 55%

Textbooks

The first book is required. We will follow it very closely and homework assignments will be taken from there. You can obtain a pdf copy of the book at the publisher's website.

The second book requires a good course in analysis at the level of baby Rudin ("Principles of Mathematical Analysis") and may be difficult. But we will go through some algorithms and analysis from Bertsekas if time permits.

Description of Course
This course is on convex optimization with applications to communication systems, information theory, signal processing, control systems and machine learning. The first part will be on the theory of convex optimization—recognizing convex sets, convex functions, convex optimization problems and duality. The second part of the course will be on algorithms for solving convex optimization problems. We will draw on numerous engineering examples, not restricted to communication systems. This course is crucial to students and researchers in the above fields of engineering. After successful completion of the course, the student should be able to recognize, formulate and numerically solve convex optimization problems.

Topics covered are listed on the course website. I will also provide details of which subsections of the book you're required to read on the course website.

Homework
There will be approximately weekly homework assignments. You are strongly encouraged to collaborate with each other in solving the homework problems, but you must write up your own solution and submit the homework in class the following week.

A subset of the homework problems will be graded on a coarse scale 0 (did not turn in), 1 (minimal effort), 2 (moderate effort), and 3 (almost perfect understanding). These are meant to help improve your understanding of the subject matter. Even though only 10% of the course grade is assigned to the homework, I feel that it is the most important vehicle for learning. Hence, you should treat the homework very seriously in order to gain the most out of this course.
I anticipate that there will be a total of ~10 problem sets. The worst 2 problem sets will be dropped from your homework grade, so generally I will not entertain any requests for extensions (since if you can't turn in 1 or 2 problem sets that should not affect your homework grade). Solutions to the problem sets will be posted once they are due in class.

**Prerequisites**

There are no formal prerequisites for this course. However, you should have some mathematical maturity, especially in linear algebra. You should be relatively familiar with Appendix A of Boyd and Vandenberghe. In particular, you should have seen symmetric matrices, positive semidefinite matrices, fundamental subspaces (range, nullspace, etc.), eigen-decompositions and singular value decompositions (SVDs). We will go through some of this material but you are expected to do your own reading. You should know what a proof is. Prior exposure to mathematical analysis would be helpful but definitely not required.

**Quiz and Midterm**

There will be one quiz (1 hour) and one midterm exam (1.5 hours). These will be restricted open book, in-class examinations. See the course website for the dates of these tests. You will be allowed to bring in 1 A4-sized cheat sheet (double page) for the quiz and 2 A4-sized cheat sheets to the midterm. Topics examined in the quiz and midterm will be mentioned in class and on the course website.

**Final**

The final exam will be held on 29/04/2015 at 9am. This is a *comprehensive* 3 hour exam, i.e., all topics will be examined. This will be a restricted open book, in-class examination. You will be allowed to bring in 3 A4-sized cheat sheet (double page) for the final exam.