ECE 4800 (Fall 2020) **Syllabus**

Optimal System Analysis and Design

1 Course Information

Instructor:	Eilyan Bitar
Email:	eyb5@cornell.edu
Lectures:	Tuesday/Thursday (4:55 - 6:10 PM)
Office Hours:	Monday (5:00 - 6:00 PM) and Wednesday (1:00 - 2:00 PM)
Piazza link:	https://piazza.com/cornell/fall2020/ece4800
Canvas link:	https://canvas.cornell.edu/courses/18793

Online Instruction: All lectures and office hours will be held over Zoom. Please refer to the course Canvas page for the Zoom meeting URLs. It is expected that students will attend lecture during the regularly scheduled time slot, provided the lecture time falls between 8 a.m. and 10:30 p.m. in their local time zone. Students who cannot attend lectures during the regularly scheduled time slot, because they are sick or are in time zones that make synchronous participation untenable, should contact the instructor.

2 Course Description

This course aims to give students the skills and background needed to recognize, formulate, and solve convex (and certain nonconvex) optimization problems that arise in a variety applications. Students will be presented with the basic theory of such problems, concentrating on results that are useful in computation. Topics include:

- Convex sets, convex functions, and basics of convex analysis
- Convex optimization problems including linear programs, quadratic programs, second-order cone programs, and semidefinite programs
- Optimality conditions and duality theory
- Mixed-integer convex optimization
- Robust and chance-constrained optimization (time permitting)
- First-order and second-order optimization algorithms (time permitting)
- Applications to model predictive control systems, statistics and machine learning, and game theory will be discussed throughout the semester

3 Prerequisites

Multivariable Calculus, linear algebra, basic Matlab programming, elementary probability (helpful, but not required), and comfort with mathematical proofs.

4 Textbooks

There is one required textbook for this course:

- Boyd, Stephen P., and Lieven Vandenberghe. *Convex optimization*. Cambridge university press, 2004.
- Available online: https://stanford.edu/ boyd/cvxbook/bv_cvxbook.pdf

5 Software

We will use *Matlab* for computational assignments in this course. We will also make use of CVX—a Matlab-based software package for convex optimization.

- A brief video introduction to CVX: http://cvxr.com/news/2014/02/cvx-demo-video
- Instructions on how to download and install CVX: http://cvxr.com/cvx/download
- I recommend that you use the *Gurobi solver* with CVX. The Gurobi solver is an industry performance leader in linear, quadratic, and mixed-integer programming, and it is a fantastic solver to use in conjunction with CVX. Instructions on how to obtain a free academic license and installation can be found here: http://cvxr.com/cvx/doc/gurobi.html

6 Grading

Your final grade will be based on **biweekly homework** (40%), **midterm exam** (15%), **project proposal** (7.5%), and **final project** (37.5%).

7 LaTeX Typesetting

Students are encouraged (but not required) to use LaTeX to typeset their homework. Handwritten homework is also completely acceptable. If you decide to use LaTex, we have posted at LaTeX template and style guide (courtesy of Stephen Boyd) on the course Canvas page under "Additional Resources" to to help you get started.

8 Collaboration and Code of Conduct

Every student attending this course is expected to abide by the Cornell University Code of Academic Integrity, which can be found at cuinfo.cornell.edu/Academic/AIC.html. Any piece of work you turn in for credit must

be your own work. Discussion with other students about specific homework problems is permitted to the extent that discussion is limited to problem approach and does not include note taking. In writing up your homework solution, you must acknowledge anyone with whom you collaborated. If you use papers or books or other sources (e.g. material from the web) to help obtain your solution, you must cite those sources. You may not discuss exam problems with other students. Please ask if you are unclear as to what constitutes excessive collaboration.

9 Students with Disabilities

Your access in this course is important to me. Please request your accommodation letter early in the semester, or as soon as you become registered with student disability services (SDS), so that we have adequate time to arrange your approved academic accommodations.

- Once SDS approves your accommodation letter, it will be emailed to both you and me. Please follow up with me to discuss the necessary logistics of your accommodations.
- If you are approved for exam accommodations, please consult with me at least two weeks before the scheduled exam date to confirm the testing arrangements.
- If you experience any access barriers in this course, such as with printed content, graphics, online materials, or any communication barriers; reach out to me or your SDS counselor right away.
- If you need an immediate accommodation, please speak with me after class or send an email message to me and SDS at sds_cu@cornell.edu.
- If you have, or think you may have a disability, please contact Student Disability Services for a confidential discussion: sds_cu@cornell.edu, 607-254-4545, sds.cornell.edu.