ECE 5950 (Spring 2013) **Syllabus**

Selected Topics in Stochastic Control and Optimization

1 Course Description

The problem of sequential decision making in the face of uncertainty is ubiquitous. Examples include: dynamic portfolio trading, operation of power grids with variable renewable generation, air traffic control, livestock and fishery management, supply chain optimization, internet ad display, data center scheduling, and many, many more!

In this course, we will explore the problem of optimal sequential decision making under uncertainty over multiple stages – *stochastic optimal control*. We will discuss different approaches to modeling, estimation, and control of discrete time stochastic dynamical systems (with both finite and infinite state spaces) over finite horizons. Solution techniques based on dynamic programming will play a central role in our analysis. Topics include: Fully and Partially Observed Markov Decision Processes, Linear Quadratic Gaussian control, Kalman Filtering, and if time permits, Model Predictive Control and Approximate Dynamic Programming. Applications to various domains will be discussed throughout the semester.

2 Instructor Information

Instructor:	Eilyan Bitar
Office:	326 Rhodes Hall
Office Hours:	TBD
Email:	eyb5@cornell.edu
Phone:	(607) 255-7156

Course website:	bitar.engineering.cornell.edu/ece5950

3 Lectures

Lectures will be held Tuesday/Thursday (10:10-11:25 AM) in 407 Phillips Hall.

4 Textbooks

There are two recommended textbooks for this course:

1. D. Bertsekas. *Dynamic Programming and Optimal Control.* Vol. I and II. 3rd ed. Nashua, NH: Athena Scientific, 2007. ISBN: 9781886529083.

2. P. R. Kumar and P. Varaiya. *Stochastic Systems: Estimation, Identification and Adaptive Control.* Prentice-Hall, Englewood Cliffs, NJ, 1986.

The second book is out of print. A PDF version can be downloaded from:
bitar.engineering.cornell.edu/varaiyabook

5 Prerequisites

Calculus, Probability, Linear Algebra, basic Matlab programming, and comfort with mathematical proofs.

6 Grading

Your final grade will be based on **homework** (30%, equally weighted, lowest grade dropped if all homework assignments are sincerely attempted), **midterm** (30%), and **final** (40%). The final will either be exam or project based – to be determined 4 weeks into the semester. Homework will also include at least one lecture scribing assignment.

7 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.