ECE 6605 INFORMATION THEORY

Fall 2009

Lecturer
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Office hours: Fridays, 12:30pm-2pm, Office 214

Class page. http://users.ece.gatech.edu/mbloch/fa09_ece6605.html
Class schedule. Tuesdays 5:30pm-7pm, Thursdays 11am-12:30pm.

Course information

ECE 6605 Information Theory is a graduate-level class that introduces the mathematical theory of communications. This is primarily a theoretical course, whose objective is to understand the fundamental limits of communication systems. Information-theoretic concepts underly virtually all modern communication systems, and some exposure to information theory is definitely required for students who want to pursue research in communications. The objectives of the course are

- to introduce the notion of entropy and information;
- to discuss the fundamental limits of data compression (source coding).
- to discuss the fundamental limits of transmission systems (channel coding).

If time permits, we will also cover some topics in multi-user information theory.

Prerequisites

A good understanding of basic probability theory (ECE 3075 or equivalent) is required. A background in communications and signal processing is also helpful. Although the course will not review probability theory extensively, it is planned that relevant background will be revised.

Textbook

The required textbook for the class is


Note that Georgia Tech Lorraine only has the 1st edition of the book in reserve. The material has not changed fundamentally, but the numbering of chapters and problems is different.
Some recommended textbooks for the course include


These books treat the same material with different analytical tools. The style is much more mathematical, but they are worth reading for anyone interested in pursuing research in information theory.

Problem sets

There will be approximately six homework assignments with due dates every two weeks. You are expected to do all assigned problems, although I will most likely grade a randomly chosen subset. Do not be misled by the relatively few points assigned to homework grades. Even if the homework grade is only a minor component of the overall course grade, working through problems is a crucial part of the learning process and will have a major impact on your understanding of the material, which will in turn be reflected on your course grade.

Joint problem solving with one or two classmates is permitted, provided your writeup is your own. Note that I will assume that you have worked all assigned problems when preparing the exams.

I will often include practice problems in the handouts. You are encouraged to work through these problem to get extra practice, but they will not be graded. I will provide solutions for them along with those for regular problems.

Problem sets must be turned at the beginning of the class in which they are due. Problem set solutions will be distributed on the same day.

Office hours

I will be very available during office hours, and I encourage you to come and see me during the time indicated. If you cannot attend office hours or need extra help, send me an email to try to schedule an appointment, or drop by my office if the door is open.

Midterms and Final

There will be two midterm exams and on final exam. Midterms will be held at regular lecture times and location. Tentative dates are

- Midterm 1: 09/29 from 5:30pm to 7pm (material of topics 1 and 2)
- Midterm 2: 11/3 from 5:30pm to 7pm (material of topics 3 and 4)

The final exam will be 3 hours an will cover the material of the entire semester. It will be scheduled between 12/7 and 12/11.
Course grade

Your course grade will be based upon my assessment of your understanding of the material covered throughout the semester. The weights used for grade assignment will be

- **Problem sets:** 10%
- **Midterm 1:** 20%
- **Midterm 2:** 20%
- **Final:** 50%

Other factors such as participation during lectures and interaction during office hours can make a significant difference in the course grade.

Handouts

Handouts not picked up during lecture will be posted on the class website

http://users.ece.gatech.edu/mbloch/fa09_ece6605.html

In addition to making announcements during lectures, I may send an email to the course mailing-list

ece6605-fa09@georgiatech-metz.fr

Syllabus

Topics covered in this course are listed below. I will indicate any section that I may skip, and I will distribute any supplemental material in class.

1. Entropy, Mutual Information, and Basic Tools
2. Lossless Data Compression
3. Noisy Channel Coding (discrete)
4. Noisy Channel Coding (continuous)
5. Lossy Source Coding
6. Survey Topics
## Tentative calendar

<table>
<thead>
<tr>
<th>Date</th>
<th>#</th>
<th>Material covered</th>
<th>Topic</th>
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<th>PS due</th>
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<tr>
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Dates marked with a (*) are likely to be rescheduled.