

EECS 550

Information Theory

Fall 2004

- Synopsis:** The main objectives are to derive the fundamental limits to the performance of the three principal communication tasks: lossless source coding (data compression), channel coding (error control), and lossy source coding (quantization). Typical sequence concepts are used extensively. Quantitative measures of information and uncertainty are introduced. Relationships between them and the performance of decision and estimation rules are explored. Elementary source and channel coding techniques are covered.
- Time:** Tues.-Thurs 1:30-3 PM
- Room:** 153 EWRE
- Credit hours:** 3
- Instructor:** Prof. David L. Neuhoff, 4215 EECS, 764-6586, neuhoff@eecs.umich.edu
- Office hours:** To be determined. You may also make appointments at mutually convenient times. Contact me by phone, by email, or by coming to my office.
- Office hours are a good time for general discussions about class material, as well as specific questions about homework or exams.
- email questions:** I try to respond to all email. However, I cannot guarantee a timely response. email is best for short inquiries. Conceptual questions, which generally require an interactive discussion, are best left to face-to-face discussions.
- Prerequisite:** EECS 501, Probability and Random Processes
- Textbook:** *Information Theory*, a manuscript by D.L. Neuhoff and G.D. Forney.
This will be updated and posted to the class website chapter-by-chapter, as needed. The complete previous version from Fall 2000 is available on the class website.
- Reference Books:** See attached list. Most are available from the Media Union Library.
- Books on reserve:** Asterisks mark the references that will be on reserve in the Media Union Library.
- Honor Code:** The UM College of Engineering Honor Code applies. You should familiarize yourself with it. The Honor Code has recently been updated. The new version will be posted to the class website. The previous version can be found at <http://honor.personal.engin.umich.edu>. This website will likely be updated soon.
- Homework:** Roughly weekly.
- Collaboration policy:** Homework assignments are to be completed on your own. You are allowed to consult with other students during the conceptualization of a solution, but all written work, whether in scrap or final form, is to be generated by you, working alone. Also, You are not allowed to use, or in anyway derive advantage from, the existence of solutions prepared in prior years. Violation of this policy is an honor code violation. If you have questions about this policy, please contact me.
- Midterm Exams:** Two Midterm Exams, two hours each, at dates to be announced. Each will be held in the evening, unless the entire class is available 1-3 or 1:30-3:30 on the exam date.
- Final Exam:** Thurs. Dec. 23, 1:30-3:30 PM. This is the date and time fixed by the University. Make your travel plans accordingly!

Course Grade: Homework - 15 %, Exam 1 - 25%, Exam 2 - 25%, Final Exam 35%.

Homework is important and counts enough to encourage you to take it seriously, but not so much that you cannot afford mistakes.

After each exam is graded, I will announce the score that represents the threshold between A and B performance, as well as the score that represents the threshold between B and C performance. At the end of the semester, thresholds will also be established for the average homework score. To determine your course grade, your average exam and homework scores (weighted as indicated above) will be compared to the average of the A/B thresholds and the average of the B/C thresholds. The A and B ranges will also be divided into thirds to determine “-” and “+” scores. For example, if your course average lies just above the average A/B threshold, you will receive an A-, while if it lies in the upper third of the B range, you will receive a B+.

Class email mailing list: Many important announcements (e.g. homework hints and corrections, exam schedules, changes to office hours etc.) will be emailed to the class. **YOU MUST REGISTER** for the class email list **RIGHT AWAY** by sending email to eeecs550-request@eeecs.umich.edu with the word "subscribe" in the subject line. You should receive a confirming email. I will send one or more test emails, which will be announced in class. Let me know if you do not receive them. (If you have difficulties, please check to make sure you have typed the address and subject line exactly as indicated above and try again. If this still does not work, please try again, but this time with an email copy to me and another email to me explaining the problem.)

Class web page: www.eecs.umich.edu/courses/eeecs550. Homework assignments, solutions, other handouts, the previous version of the text, and various announcements will be posted here.

Class Syllabus

1. Introduction to information theory and the course.
2. Review of probability and random variables (Appendix A).
3. Lossless source coding: fixed-length codes (Chapter 2), typical sequences (Chapter 3), and variable-length codes (Chapter 2).
4. Measures of information (Chapter 4): entropy, mutual information, divergence, conditional measures.
5. Relations between measures of information and the performance of estimation and decision rules (Chapter 5).
6. Channel coding: Block and linear channel codes (Chapters 6 and 7), jointly typical sequences (Chapter 8), and channel capacity (Chapter 9).
7. Lossless information transmission (Chapter 10).
8. Lossy source coding (time permitting)
9. Multiuser information theory (time permitting)
10. Coding for sources and channels with memory (time permitting)