ECE751 - Spring 2017
Information Theory
(Syllabus updated on January 20, 2017)

Instructor: Professor Yariv Ephraim
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Office Hours: Monday 4:30-5:30 pm; Wednesday 1:45-2:45 pm.

Course Credit: 3 credit hours
Time: Wednesday 4:30-7:10 pm
Place: Innovation Hall, Room 137
Spring Break: 3/13 - 3/17
Final Exam: Comprehensive exam on Wednesday 5/10, 4:30-7:15 pm.
Mid-term exam: March 22, 4:30-7:10 pm.

Exams Policy: All exams are in class. You may use the required textbook below by Cover and Thomas, and the notes that I will provide you. Electronic devices of any kind are not allowed.

Grading: 1st test 45%; 2nd test 45%; homework 10%.
Prerequisites: Grade B or better in ECE 528 or equivalent.

Required Text Books:


Recommended Text Books:


Course Description:

Information theory is the mathematical theory of communications. It was developed in 1948 by Claude E. Shannon. Information Theory sets bounds on achievable performance and communication rates of any communication system. The basic theory is summarized in a set of source and channel coding
theorems, which are expressed in terms of information measures such as entropy, channel capacity and rate-distortion. In this course we introduce these fundamental concepts, we present and prove basic coding theorems, and provide some practical insight on implementation of these theorems. Non-ECE students are welcome.

**Course Outline:**

- Introduction and review (Chap. 1, Week 1)
- Measures of information: entropy, relative entropy and mutual information (Chap. 2, Weeks 1-2)
- Asymptotic equipartition property and the Shannon-McMillan-Breiman Theorem (Chaps. 3, Week 3)
- Entropy rate and the source-coding theorem (Chap. 4, Week 4)
- Huffman code, Arithmetic code and Lempel-Ziv code (Chaps 5, 13, Weeks 5-6)
- The method of Types (Chap. 11, Weeks 6-7)
- Mid term, 22 March, (Week 8)
- Channel capacity and the channel-coding theorem. (Chap. 7, Week 9)
- Joint source-channel coding theorem (Chap. 7, Week 9)
- Differential entropy (Chap. 8, Week 10)
- The Gaussian channel (Chap. 9, Week 11)
- Rate distortion theory and quantization (Chap. 10, Week 12-13)
- Estimation performance bounds (Week 14)

**Attendance and homework:**

1. Students are encouraged to attend all lectures and to submit all homework assignments.
2. Students are encouraged to type their homework submissions in Latex. You may use the Latex editor Texmaker and the Latex compiler MikTex which are available for free on the Internet. A Latex template will be provided upon request.
3. Practicing the material taught in class, by working out the homework problems, is crucially important to your success in this class. Homework will be assigned weekly, and will be due in class the week following their assignment. Graded homework will be returned in class the week following their due date.
4. Late homework submission will not be graded. No exceptions except for medical emergencies.

5. You are encouraged to discuss the material and homework problems with other classmates, but you must submit your OWN solutions.

6. Copying solutions for homework assigned problems, from any source, constitutes a violation of the university honor code. See the paragraph on Academic Integrity below.

7. Electronic devices of any kind are not allowed (and will not be needed) during exams.

8. Audio taping, video taping, or picture snapping, during lectures, are not allowed.

9. Students must use their MasonLive email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information. Homework assignments and other course material will be emailed to your MasonLive email account. Please make sure that your mail box is not full at any time during the semester. Also, when you send me an email, please start the subject line with “ece751.”

10. Students who cannot attend an exam due to religious holidays and observations should contact me as soon as possible to arrange for an alternative date.

Support Resources: A list of support resources on campus may be found in: http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/

University Policies: The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.

Academic Integrity: GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else’s work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.
Office of disability services: If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu

Other useful campus resources:

- Writing center: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu
- University libraries: “Ask a Librarian” http://library.gmu.edu/mudge/IM/IMRef.html
- Counseling and psychological services (CAPS): (703) 993-2380; http://caps.gmu.edu