

## **ECE 563 - Information Theory Fall 2022**

**Lectures:** TTh 12:30-1:50pm, ECEB 3081

**Lecturer/Professor:** Prof. Olgica Milenkovic, [milenkov@illinois.edu](mailto:milenkov@illinois.edu)

**Office Hours:** Tuesday 3:30-4:30pm, 311 CSL

**Teaching Assistant:** Rebecca Golm, [rgolm2@illinois.edu](mailto:rgolm2@illinois.edu)

**Office Hours:** Wednesday 3:00-4:30pm (tentative)

**Course Webpage:**

<https://courses.engr.illinois.edu/ece563/>

Homework and additional reading material will be posted on the class website. Homework are due in class, at the start of the lecture. Late submissions are not accepted, but in special circumstances you will be allowed to skip a HW submission.

There will be a class project and project paper topics/related reading material will be posted on the class website.

### **Textbook**

- T. M. Cover and J. A. Thomas, Elements of Information Theory, 2nd ed., Wiley, 2006.
- Further readings and lecture notes will be provided through the course website.

### **Reference Texts**

- R. Yeung, A First Course in Information Theory, Springer, 2006.
- I. Csiszár and J. Körner, Information Theory: Coding Theorems for Discrete Memoryless Systems

### **TOPICS**

- Information measures and their properties: Axiomatic approach to formulating Shannon's entropy, Rényi entropy and beyond
- Concentration of measure, asymptotic equipartition property
- Source and channel coding

- Variable-length and universal source coding
- Huffman codes, adaptive Huffman codes and applications in learning and other areas
- Universal compression and Lempel-Ziv coding
- Entropy rates for stochastic processes
- The Slepian-Wolf theorem and coding approaches
- The Noisy channel coding theorem
- Source-channel separation theorems
- Constrained coding and coding for modern recorders
- Strong data processing inequalities and applications
- Large deviations and error exponents
- Quantization theory
- Rate-distortion theory
- The Blahut-Arimoto algorithm
- Elements of quantum information theory and information theory for molecular storage and computing
- Supplementary topics in statistics and machine learning (based on class feedback)

### **Academic Integrity**

Academic integrity and discipline will be based on the standards set forth by the College of Engineering and the University of Illinois. The University has the responsibility for maintaining academic integrity so as to protect the quality of education and research on our campus and to protect those who depend upon our integrity. It is the responsibility of the student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.

#### Examples of Infractions of Academic Integrity

A. Cheating -- Using or attempting to use in any academic exercise materials, information, study aids, or electronic data that the student knows or should know is unauthorized. During

examinations, students should assume that external assistance (e.g., books, notes, calculators, conversation with others) is prohibited unless specifically authorized by the instructor. Substantial portions of the same academic work may not be submitted for credit more than once or by more than one student without authorization.

B. Fabrication -- Unauthorized falsification or invention of any information or citation in an academic endeavor. Fabrication also includes altering the answers given for an exam after the examination has been graded. Fabrication also includes submitting false documents for the purpose of being excused from a scheduled examination or other academic assignment.

C. Facilitating Infractions of Academic Integrity -- Helping or attempting to help another to commit an infraction of academic integrity, where one knows or should know that through one's acts or omissions such an infraction may be facilitated. Examples include: 1) allowing another to copy from one's work during an examination, 2) taking an exam by proxy for someone else, and 3) unauthorized removal of an examination or quiz from a classroom, faculty office, or other facility (such as the proctor's office) would be committing a breach of academic integrity.

A complete listing of Infractions of Academic Integrity and University Policy can be found at this web site: [http://studentcode.illinois.edu/article1\\_part4\\_1-401.html](http://studentcode.illinois.edu/article1_part4_1-401.html)