

Math 4280: Introduction to Information Theory - SPRING 2018

- **Instructor:** Prasad Tetali, tetali-at-math.gatech.edu
- **Time/Location:** MWF 12:20–1:10pm; Skiles 270
- **Office hours:** Skiles 132; Tue: 3-4pm, Wed: 10-11am, Thurs: 1:30-2:30pm.
- **Prerequisites:** Undergraduate-level Probability

Recommended Textbook : “Elements of Information Theory” (2nd edition), by Thomas Cover and Joy Thomas, Wiley 2006.

Objectives: To understand quantitative formulations of *information*, efficiency in *communication* and *compression* of information, computational aspects of *description* of information. To learn of applications of entropy in probability and combinatorics.

List of Topics:

- (1 lecture) Introduction
- (2 lectures) Chapter 2: Entropy, Relative Entropy, Mutual Information
- (2 lectures) Chapter 2 (contd.): Data Processing and Fano’s Inequalities
- (2 lectures) Chapter 3: Asymptotic Equipartition Property (independent r.v.s)
- (2 lectures) Chapter 4: Entropy Rates of Markov Chains (dependent r.v.s)
- (1 lecture) Review of main concepts, some example exercises
- (1 lecture) **Test 1 (Friday, Feb. 2nd)** : in class, closed book, closed notes.
- (4 lectures) Chapter 5: Coding: Shannon, Huffman codes, Optimality
- (7 lectures) Chapter 7: Communication and Capacity: Channels, Channel coding theorem, Source-channel theorem
- (1 lecture) **Test 2 (Friday, March 2nd)** : in class, closed book, closed notes.
- (2 lectures) Chapter 8: Differential Entropy (continuous r.v.s)
- (3 lectures) Chapter 9: Gaussian channel
- (7 lectures) Chapter 14: Kolmogorov (algorithmic) Complexity: Turing machine, Information and Entropy
- (1 lecture) Review of main concepts, some example exercises
- (1 lecture) **Test 3 (Wednesday, April 11th)** : in class, closed book, closed notes.
- (3 lectures) Entropy and Combinatorial Applications
- (3 lectures) Miscellaneous, review and wrap-up

- **Final Exam on Wednesday, May 2nd; 11:30am – 2:20pm in Skiles 270**

Grading policy : Three Tests 60% ; Final 40%

Homework will be assigned on a regular basis, but not collected. You are strongly advised to (attempt to) solve all the homework problems, for better understanding of the material and to help prepare for the tests.

Academic Dishonesty: All students are expected to comply with the Georgia Tech Honor Code. Any evidence of cheating or other violations of the Georgia Tech Honor Code will be submitted directly to the Dean of Students. The institute honor code is available at: <http://www.policylibrary.gatech.edu/student-affairs/academic-honor-code>