Syllabus
Coding Theory
CS395T, EE381V, M390C

INSTRUCTORS: Alex Dimakis (UTA 7.210, ph. 512-471-3068 dimakis@austin.utexas.edu), Felipe Voloch (RLM 9.122, ph. 512-471-2674, voloch@math.utexas.edu) and David Zuckerman (GDC 4.508, ph. 512-471-9729, diz@cs.utexas.edu).

Place and Time: TTh 11:00 -- 12:30 in RLM 11.176

Texts: Book draft by V. Guruswami, A. Rudra, and M. Sudan, available here

Prerequisites: Basic undergraduate Algebra background

Grading Policy:Final Exam: 50%, Homework (every other week): 40%, Participation: 10%

DESCRIPTION: Error-correcting codes provide a way to efficiently add redundancy to data, so that the original data can be recovered even in the presence of noise. Such codes are essential in modern communication and storage of data, where high reliability is required. From its engineering roots, coding theory has evolved to use sophisticated mathematical techniques, centering around algebra but also involving probability and combinatorics. Moreover, coding theory has recently found unexpected uses in computer science.
In this interdisciplinary course, we study coding theory from the different perspectives of professors in math, computer science, and electrical engineering. We develop the mathematical tools, construct important codes and associated algorithms, and discuss applications in computer science and communication.

Class Outline

Part I: Algebraic coding: including Hamming, Reed-Solomon, BCH and Golay codes.

Part II: Algorithmic coding: including decoding algorithms, concatenated codes and applications to complexity theory

Part III: Random Coding and Communications: Shannon's coding theorem, LDPC and rateless coding, network coding and related topics.