School: Efi Arazi School of Computer Science M.Sc.

Coding Theory

Lecturer:

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Course No.: 3559  Course Type: Elective  Weekly Hours: 3  Credit: 3

Course Requirements: Final Exam

Group Code: 221355901

Language: English

Prerequisites

Prerequisite:
52 - Calculus I
53 - Calculus II
54 - Linear Algebra I
55 - Linear Algebra II
56 - Discrete Mathematics
59 - Data Structures
Course Description

Coding theory deals with communication over an unreliable channel, which can introduce errors in transmitted information. Beyond numerous practical applications, coding theory also has applications in the theory of computer science. In this course we will cover central topics in coding theory. Topics include linear error-correcting codes, constructions of codes and barriers to quality, Reed-Solomon codes and generalizations, asymptotically good codes, graph-based codes, list decoding, local decoding, LDPCs, hard problems in coding theory, and more.

Course Goals

In this course, you will learn basic concepts of coding theory, limits of tradeoffs between redundancy and error-correction ability, and several specific constructions and applications. A central aim of the course will be to get you in good shape to understand materials and results related to coding theory in the future.

Grading

Grades for the course will be based on the following weighting:
1. Problem sets: 20%
2. Final: 80%

To be eligible for the final exam, you are required to hand in \((n-1)\) homework problem sets, where \(n\) is the number of problem sets we had in the course. To pass the course you must receive at least 60/100 in the final (and of course an average of 60/100 overall).

Reading List

The course will largely follow the book *Essential Coding Theory* by Venkatesan Guruswami, Atri Rudra and Madhu Sudan; a draft can be found online: [http://www.cse.buffalo.edu/faculty/atri/courses/coding-theory/book/](http://www.cse.buffalo.edu/faculty/atri/courses/coding-theory/book/)

A more advanced (graduate-level) exposition of the material can be found in Madhu Sudan’s lecture notes (http://people.csail.mit.edu/madhu/ST13/).
For those interested in more material on computational number theory and algebra, I recommend to take a look at the book *A Computational Introduction to Number Theory and Algebra* by Victor Shoup. You can find it online at http://www.shoup.net/ntb/