CSS.413.1 Topics in Coding Theory

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Contents

1 Introduction and Targets

The content of this course will be the followings:

- Introduction to Coding Theory: Definitions, Basic Properties, Linear Codes
- Reed Solomon Codes, Reed Muller Codes
- Decoding algorithms for Reed Solomon Codes:
  - Barlekamp-Welch Algorithm
  - Sudan's List Decoding Algorithm
  - Guruswami-Sudan List Decoding Algorithm upto the Johnson Bound
- Univariate Multiplicity Codes – Decoding upto the List Decoding Capacity
- Bounds on the list size
- Local Decoding (LDC), Local Correction (LCC) of Codes
- Local Correction of Reed Muller Codes
- High Variate Locally correctable/decodable codes
- Local Decoding with constant queries – Matching Vector Codes
- Private Information Retrieval – Definitions, constructions
- Lower Bounds for LDCs – Lower Bound for 2-query/4-query/Kalz-Trevisan/Alrabiah-Guruswami
- Local Testing of Codes:
  - Low-Degree Testing
  - Polischuk-Speilman Test
  - Friedl-Sudan Test
  - Arora-Sudan Test
  - Raz-Safra Test
- Applications: Explicit constructions
  - Combinatorial Designs
  - Subspace Designs
  - Derandomization
  - Hardness vs Randomness