Applications of Derandomization Theory in Coding

Mahdi Cheraghchi

(Submitted on 23 Jul 2011)

Randomized techniques play a fundamental role in theoretical computer science and discrete mathematics, in particular for the design of efficient algorithms and construction of combinatorial objects. The basic goal in derandomization theory is to eliminate or reduce the need for randomness in such randomized constructions. In this thesis, we explore some applications of the fundamental notions in derandomization theory to problems outside the core of theoretical computer science, and in particular, certain problems related to coding theory.
First, we consider the wiretap channel problem which involves a communication system in which an intruder can eavesdrop a limited portion of the transmissions, and construct efficient and information-theoretically optimal communication protocols for this model. Then we consider the combinatorial group testing problem. In this classical problem, one aims to determine a set of defective items within a large population by asking a number of queries, where each query reveals whether a defective item is present within a specified group of items. We use randomness condensers to explicitly construct optimal, or nearly optimal, group testing schemes for a setting where the query outcomes can be highly unreliable, as well as the threshold model where a query returns positive if the number of defectives pass a certain threshold. Finally, we design ensembles of error-correcting codes that achieve the information-theoretic capacity of a large class of communication channels, and then use the obtained ensembles for construction of explicit capacity achieving codes.
[This is a shortened version of the actual abstract in the thesis.]

Comments:	EPFL Phd Thesis
Subjects:	**Discrete Mathematics (cs.DM)**; Computational Complexity (cs.CC); Information Theory (cs.IT)
DOI:	10.5075/epfl-thesis-4767
Report number:	EPFL PhD Thesis #4767
Cite as:	**arXiv:1107.4709 [cs.DM]**
	(or **arXiv:1107.4709v1 [cs.DM]** for this version)

Submission history

From: Mahdi Cheraghchi [view email]
[v1] Sat, 23 Jul 2011 21:07:03 GMT (1192kb,D)

Download:

- PDF
- Other formats

Current browse cont
cs.DM
< prev | next >
new | recent | 1107

Change to browse b
cs
cs.CC
cs.IT
math

References & Citatio
- NASA ADS

DBLP - CS Bibliogra
listing | bibtex
Mahdi Cheraghchi

Bookmark(what is this?)