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

Introduction to Property Testing

Lecturer:
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Course No.: 3619  Course Type: Elective  Weekly Hours: 3  Credit: 3

Course Requirements: Final Paper  Group Code: 222361901  Language: Hebrew

Prerequisites

Prerequisite:
52 - Calculus I
53 - Calculus II
54 - Linear Algebra I
55 - Linear Algebra II
56 - Discrete Mathematics
59 - Data Structures
69 - Logic And Set Theory
77 - Algorithms
417 - Introduction To Computer Science
Course Description

In the world of big data, in which massive data-sets are being analyzed and processed constantly, classical models of computation, for which polynomial-time algorithms are considered efficient, may become inadequate. In the field of sublinear-time algorithms, the goal is to design extremely fast algorithms that probe only a minuscule portion of the input, and analyze their behavior rigorously.

One of the main areas of sublinear-time algorithms is the area of Property Testing that is concerned with approximate decision problems. A tester for a property $P$ is required to distinguish between objects that have the property $P$ and objects that are “far” (according to some predetermined distance measure) from any object that has the property $P$.

In this course we will cover a variety of Property Testing algorithms of several objects: graphs, functions, and distributions.

We will analyse their complexity and learn about lower bound techniques. Specific topics will include:

- Testing graph properties:
  - in the adjacency matrix model (subgraph freeness, bipartiteness),
  - the bounded-degree model (one-sided error bipartiteness, two-sided error cycle-freeness, partition oracles)
  - the general graph model (bounded arboricity)
- Testing algebraic properties (linearity)
- Testing properties of Boolean functions (monotonicity, dictatorship, juntas)
- Testing properties of distributions (uniformity, identity)
- Property testing in the distributed Congest model

Course Goals

Upon successful completion of this course students should be able to describe the main models in property testing and will be familiar with the basic techniques and some of the main results in the field.

Grading

There will be 4 assignments and an additional final assignment. You have to submit all assignments but only the final assignments will be graded. The grade in the course will be the grade in the final assignment.
Solutions to all assignments will be published.

Lecturer Office Hours

TBA

Reading List

Most of the lectures will follow closely chapters from the book *Introduction to Property Testing* by Oded Goldreich.