

Course Title: Design and Analysis of Algorithms (0510.6401)**Lecturer:** Prof. Dana Ron (Goldreich), danaron@tau.ac.il**Semester:** Fall 2020**Prerequisites:** *Data Structures and Algorithms*.

Please note that this prerequisite is not just a formality: Students are expected to have the necessary background and sufficient command of rigorous analysis of algorithms.

Objective of the Course:

This course aims at two targets. One is to get the students acquainted with a selection of techniques in algorithmic theory, which are more advanced than those they studied in the basic undergraduate data structures and algorithms course. The other is to let the students have a taste of contemporary algorithmic research. The topics are selected in light of these guidelines.

Topics. The course will include topics from the following list.

- Approximation background: Decision and optimization problems, approximation algorithm, approximation schemes,.
- Basic approximation algorithms: vertex and set cover, traveling salesperson, subset sum, knapsack.
- Randomized algorithms: the probabilistic method with applications to max-cut and max-SAT; randomized rounding.
- Random sampling and its application to approximating the number of satisfying assignments for a DNF formula.
- Random sampling in the context of learning theory and sublinear algorithms.
- Online algorithms.
- Distributed algorithms.

Textbooks:

Since the course covers diverse areas, no single book contains all the material. The most comprehensive book is the classical [CLRS] below. Specialized texts for approximation and randomized algorithms are [V] and [MR], respectively. For an introduction to computational learning theory, see [KV]. For on-line algorithms, see [BE]. [P] is an excellent introduction to distributed network algorithms.

1. [Introduction to Algorithms, 2nd ed.](#) Cormen, Leiserson, Rivest and Stein (CLRS). MIT Press, 2001. [A Hebrew version of the first edition](#) was published by the Open University in two parts.
2. [Randomized Algorithms](#), Motwani and Raghavan (MR). Cambridge University Press, 1995.
3. [Approximation Algorithms](#), Vazirani (V). Springer-Verlag, Berlin, 2001.
4. [An Introduction to Computational Learning Theory](#), Kearns and Vazirani (KV). MIT Press, 1994.
5. [Online Algorithms and Competitive Analysis](#), Borodin and El-Yaniv (BE). Cambridge University Press, 1998.
6. [Distributed Computing: A Locality-Sensitive Approach](#), D. Peleg (P). SIAM, 2000.

Additional bibliography may be provided during the course.

Homeworks, exam and the final grade: Homeworks will be given about once every two weeks and there is a final exam. The homeworks contribute 10% to the final grade, and the exam 90%.