63013 Advanced Models in Complexity Theory

Credits: 3, 3 lecture hours.

Prerequisites: The basic prerequisites for the M.Sc. program

Course Description
Complexity theory is dedicated to characterizing computational problems by the resources required for solving them, first and foremost time and space. In the course we will examine a variety of classes of computational problems and learn about the relations between them. We will get to know some of the most central results and open problems in computer science, whose theoretical and practical importance is crucial.

Lecturer
Dr. Orly Yahalom

Course grade
Home assignments 20%
Final exam 80%

Course Contents
1. Time and space complexity classes.
2. Deterministic and non-deterministic computation: Savich's Theorem and Immerman-Szelepcenyi's Theorem.
3. Class Hierarchies and the existence of gaps (Borodin's Theorem).
4. Completeness and reductions in the classes: P, NP, NL and PSPACE.
5. NP-complete problems: SAT, Independent Set, Vertex Cover, Set Cover, 3-coloring.
6. Approximation algorithms for NP-complete problems and hardness of approximation.
7. Randomized algorithms: The classes RP, BPP and RL.
8. Parallel computation and the class NC.

Bibliography