CPSC-637 Complexity Theory

Spring 2010

Instructor: Dr. Jianer Chen
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Office Hours: T-Th 10:00am-11:10am

Textbook:

and supplementary reading materials to be handed out in class.

Prerequisites:
Background in algorithm design and automata theory, or permission from the instructor.

Course Description

Computational complexity has been one of the most active subareas in theoretical computer science. Here we are focused on the study of computational models and computational resources required to solve a variety of problems.

Given a problem, how much computing power and/or resources do we need in order to solve it? To date, we have not made much progress toward finding precise answers to such questions. We have, however, made a great deal of progress in classifying problems into general “complexity classes”, which characterize, at least in a rough way, something of their inherent difficulties.

This course will provide an overview of the major results and developments, as well as introduce the most active research to date in computational complexity. The course topics will be divided into three parts. Part I is on the fundamentals of NP-completeness theory, Part II is on more advanced topics in general complexity theory, and Part III is on the recent development on parameterized complexity theory. Most materials for Part I and Part II will be selected from Part I, Part III, Part IV, and Part V of the textbook, plus certain supplementary handouts. Materials for Part III will be provided in class.
The course is heavily research oriented. Reading the textbook and selected research papers to understand the fundamentals of the area is essential to the course. However, the most important parts of the course are the participation in course research and working on a course project in which students will have an opportunity to practise what they learn from the course to try to derive new research results interesting in the area. Problems for the research project will be suggested by the instructor in the class. Students are also encouraged to find research problems by themselves.

The course performance will be evaluated based on three components of the course: homework assignments based on class lectures, research paper reading, and a course research project. Each student should pick a recent research paper, read it, and give a 15-minute presentation on the paper to the class. Students should contact the instructor to arrange a time slot in class to give the presentation. Each student also needs to pick a research topic to work on as his/her course project, and write a project report on his/her research. Students should submit a project proposal by March 23 to give an outline on their course project research. The final project report is due April 29.