CS 2401 – Fall 2015
Location: TBA
Time: Tuesday, 12-2 pm

Instructor: Toniann Pitassi
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Office hours: Tuesday 2-3pm

Course Web Site: http://www.cs.toronto.edu/ toni/Courses/Complexity2015/ Refer to this site periodically for important announcements and other information. All handouts will be available on the site in postscript form.

Text: We will be using a very new draft of a textbook, entitled "Computational Complexity: A Modern Approach," to be published Spring 2007. The draft of the textbook can be obtained for free from Sanjeev Arora's homepage.

Course Description

This is a graduate introductory level course in computational complexity theory. It is appropriate for all graduate students in Computer Science. The main part of the course will be an introduction to complexity theory where we will discuss uniform and non-uniform models of computation, time and space complexity classes, complexity hierarchies, reductions and completeness, randomization in computation, approximation algorithms, and lower bound methods. In the latter part of the course, we will discuss several new results in complexity theory. Such advanced topics may include: Hastad's famous switching lemma and its applications, including lower bounds for constant-depth circuits, better upper bounds for satisfiability, and connections to learning theory; communication complexity and its applications; NP, coNP and propositional proof complexity.

Below is a more detailed list of the topics that will be covered.

- Time and space complexity measures and complexity classes. (P, NP, EXPTIME, NEXPTIME, completeness, L, NL, PSPACE)

- Diagonalization and hierarchy theorems
- Alternating Turing machines and the polynomial hierarchy
- Circuit complexity

Some of the following items will be covered in the latter half of the course.

- Circuit lower bounds including Hastad's switching lemma and its applications
- Communication Complexity and some applications
- NP, coNP and Propositional Proof Complexity

Grading:

Grading will be based on two assignments, preparation of scribe notes for one or two lectures, and class attendance.

The work you submit must be your own. You may discuss problems with each other; however you should prepare written solutions alone. You are not permitted to consult other texts, papers or web sites for solutions.