CS 2401 – Fall 2006
Location: MS 2173
Time: Thursday, 2-4 pm

Instructor: Toniann Pitassi
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Office hours: Thurs 4-5pm

Course Web Site: http://www.cs.toronto.edu/ toni/Courses/Complexity/complexity.html
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, time-permitting. Such advanced topics may include: Reingold's logspace algorithm for graph connnectivity; the celebrated PCP characterization of NP and related inapproximation algorithms; hardness/randomness tradeoffs; and new lower bounds in circuit and 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
- Randomized computation
- Interactive proofs

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

- Communication Complexity

- Circuit lower bounds
- Amplification of Hardness
- Derandomization
- PCP theorem, and hardness of approximation

Marking Scheme:

There will be 5 assignments, each worth 1/9th of your grade. There will be no exams.

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. Copying assignments is a serious academic offense and will dealth with accordingly.