CS 2429F – Fall 2009
Location: Tues BA 3000 (Formerly BA 4010)
Time: Tues 12-2

Instructors: Toniann Pitassi and Avner Magen
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Office hours: by appointment

Course Web Site:

http://www.cs.toronto.edu/ toni/Courses/CommComplexity/CS2429.html
Refer to this site periodically for important announcements and other information. All handouts will be available on the site in postscript or pdf form.

Course Materials: The recommended book for this course is *Communication Complexity* by Kushilevitz and Nisan. Each lecture will additionally have supplemental reading material such as a paper or lecture notes, available on the website.

Course Description

This is a topics course in communication complexity. The only prerequisite for this course is the equivalent of CS364 (undergraduate complexity theory). However a graduate course in computational complexity (CS2401) will be very helpful.

(1.) Introduction to two-player communication complexity. Basic concepts and definitions, motivation, connections to complexity theory and logic.

(2.) Deterministic, Randomized, nondeterministic complexity. Connections between the models.

(3.) Lower bound methods. Fooling sets, rank, discrepancy method, the pattern matrix method and lower bounds via polynomial degree.

(4.) The number-on-forehead model of multiparty communication complexity. Randomized, nondeterministic complexity in this model. The BNS discrepancy method and related papers.

(5.) Separating Randomized, deterministic, nondeterministic complexities in the NOF models. The set disjointness lower bound.

(6.) Proof complexity lower bounds via NOF communication complexity.

(7.) ACC circuit lower bounds via NOF communication complexity.

(8.) Other lower bounds via communication complexity. (Branching program lower bounds, data structures.)

(9.) Streaming and communication complexity.

(10.) Differential privacy, mechanism design, and communication complexity.

Grading and Assignments

Grading will be based on 4 assignments which will be handed out during the semester. You will have at least one week to turn in each assignment. Extra challenging questions will be marked with a (*). The work you submit must be your own. You may discuss problems with each other; however you should prepare written solutions alone. Class attendence is manditory and you are encouraged to ask many questions in class. I will present many open problems during the course and hope that some of you will solve some of these problems! It is a great area with lots of connections to other problems, and a wealth of interesting open problems.