CSC2423   FINITE MODEL THEORY AND DESCRIPTIVE COMPLEXITY

Fall 2005

http://www.cs.toronto.edu/~libkin/csc2423/f03

General:

Class meets on Thursdays
BA 2135, 4–6pm

Instructor:

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Office hours: by appointment

Prerequisites:

being familiar with the basic notions of first-order propositional and predicate logic (if you took an undergrad logic course, you should probably be fine);

basic knowledge of complexity theory (classes P, NP, PSPACE, LOGSPACE);

basic knowledge of language theory (regular languages, automata)

Text

L. Libkin, *Elements of Finite Model Theory*, Springer-Verlag, 2004.

How to buy it:
(UofT bookstore, Chapters and amazon.ca are overpriced: $73, $68, and $73!)
Instead:
amazon.con – US$47=CAD$55
Springer with author discount – US$37=CAD$44 plus shipping

Topics

Examples from database theory, language theory, complexity

First-order logic (FO), expressiveness, failure of classical techniques in the finite

Ehrenfeucht-Fraïssé games, winning strategies, locality

Ordered vs unordered settings, Gurevich's and Grohe-Schwentick theorems

Complexity of FO

Extensions of FO: adding counting, locality; Adding second-order quantification, monadic second-order (MSO), connection with regular languages and automata

Coding Turing machines: Trakhtenbrot's theorem (failure of completeness in the finite), and Fagin's theorem (logical chcracterization of NP)

Fixed point logics, Immerman-Vardi theorem (capturing PTIME); other complexity classes (logspace, pspace)

Finite variable logic, pebble games

0-1 law for FO and finite variable logic, the random graph; randomness phenomena over finite structures

Finite structures embedded into infinite ones; connection with constraint databases; new techniques for expressive power

New directions, connections with formal methods and constraint satisfaction

Requirements

Easy problem sets
Assignment 1
Assignment 2

Each assignment consists of three sections: exercises, problems, and challenges. The first two are compulsory.

Collaboration   &   sit-in   policy:

section	collaboration	sit-in
exercises	not allowed	do not submit
problems	allowed but not encouraged	feel free to submit
challenges	encouraged	please do submit

Late Assignments No late submission for exercises. The grading standards will be different for problems submitted late. No deadline for challenges.