CSC2423 FINITE MODEL THEORY AND DESCRIPTIVE COMPLEXITY

Fall 2001

http://www.cs.toronto.edu/~libkin/csc2423/f01

General:
Class meets on Wednesdays
RW 141, 3–5pm

Instructor:
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Office hours: PT370, Wed 5–6pm
or 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)

Topics

Examples from database theory, language theory, complexity

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

Ehrenfeucht-Fraïssé games, examples, FO expressive power in the finite

Local properties of FO

FO over ordered structures; connections with circuit complexity

Adding counting to FO; locality

Adding second-order quantification, monadic second-order (MSO), connection with regular languages and automata, MSO games, star-free languages and FO

Trakhtenbrot's theorem (failure of completeness in the finite)

Fagin's theorem, class NP

Fixpoint logic, capturing PTIME; ordered vs unordered structures

Partial fixpoint, 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

Text

H.-D. Ebbinghaus, J. Flum. *Finite Model Theory.* Springer Verlag, 1999 (2nd printing) **plus** lecture notes.

Requirements

Assignment 1 (50%)
Assignment 2 (50%)

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	please do not submit
problems	allowed	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.