1. Satisfiability, Safety, and Positive Queries

Instructions: Work in groups of 2 students. You can write up your answers by hand (provided your handwriting is legible) or use a word processing system like Latex or Word. However, experience shows that Word is in general difficult to use for this kind of task. Please, include name and email address in your submission.

1. Finite vs. Infinite Satisfiability

A formula is *finitely satisfiable* if it has a finite model. Write down a closed formula that is satisfiable, but not finitely satisfiable. Explain why your formula has these properties.

(6 Points)

2. Positive Queries

A predicate logic formula is *positive* if it contains only the logical symbols "$\wedge$", "$\vee$", and "$\exists$". A relational calculus query Q_φ is *positive* if the defining formula φ is positive.

1. Is satisfiability of positive queries decidable? If yes, what does an algorithm look like? If not, how can one prove undecidability?

   Consider two cases: the one of queries without built-in predicates and the one of queries with built-in predicates. To keep things simple, you may consider as built-ins just comparisons with "$\leq$" over the rational numbers.

   (6 Points)

2. Are positive queries safe?

   (4 Points)

3. Can one represent positive queries in relational algebra? If one can, explain how. If not, provide a proof.

   (4 Points)

3. Undecidability of Safety

Prove that safety of relational calculus queries is undecidable.

Hint: Encode the finite satisfiability problem for FOL, which is known to be undecidable (Trakhtenbrots Theorem).

(10 Points)

Submission: 28 March 2013, 10:30 am, at the lecture or by email