3. Satisfiability, Active Domain Semantics and Safety

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 (i.e., a boolean query) that is satisfiable, but not finitely satisfiable. Explain why your formula has these properties.

(8 Points)

2. Active Domain Semantics

We say that a relational calculus query Q is *satisfiable* with respect to active domain semantics if there is a database instance $\mathbf{I}$ such that

$$Q_{adom}(\mathbf{I}) \neq \emptyset.$$

Task: Show that it is undecidable whether a relational calculus query is satisfiable with respect to active domain semantics.

Hint: You can take for granted that Trakhtenbrot's Theorem holds:

> Finite satisfiability of first order logic formulas is undecidable.

Trakhtenbrot's Theorem holds even for formulas without function symbols, constants and equality.

(12 Points)

3. Safety of Relational Queries

A query written in logical notation is safe if it returns finite results over all (finite) databases.

Task: Show that safety is not a decidable property.

Hint: Make use of the preceding exercise.

(10 Points)

Submission: 8 April 2009, 10:30 am, at the lecture