# 1. Formalising Databases and 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. 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. Databases in the Unnamed and Logic Programming Perspective

This exercise is concerned with the equivalence of definitions of database schemas and database instances in different perspectives.

  (i)  Develop a formal definition of

- relation schemas and database schemas
- relation and database instances

both in the unnamed and in the Logic Programming perspective.

  (ii)  Prove that the two definitions are equivalent, that is,

- for every schema in one perspective there is exactly one corresonding schema in the other perspective, and vice versa;
- given two corresponding schemas in the two perspectives, there is a bijection (i.e., a one-to-one correspondence in both directions) between the instances of the two schemas.

(12 Points)

## 2. Properties of Conjunctive Queries

We consider conjunctive queries that are defined by a single rule. The semantics is the one introduced in the lectures.

  (i)  Show that for any rule-based conjunctive query $q$ and any database instance $\mathbf{I}$ the query result $q(\mathbf{I})$ is finite.

(6 Points)

(ii) Give a formal definition of monotonicity of queries and show that rule-based conjunctive queries are monotonic.

(7 Points)

(iii) Give a formal definition of satisfiability of queries and show that a rule-based conjunctive query $q$ is satsifiable, provided that '=' and '$\neq$' do not occur in $q$.

(5 Points)

Submission: 10:30am, 11 March 2009, at the lecture