ECS289F — Homework 4

Out Wednesday, 3/3/10; due in class Friday, 3/12/10

Problem 1. Using Ehrenfeucht-Fraïssé games, show that acyclicity of finite graphs is not FO-definable.

Problem 2. Equivalence of Datalog programs is undecidable (Shmueli 1993). Can you think of a sufficient, non-trivial condition for equivalence of Datalog programs that *is* decidable? (How?)

Problem 3. Consider a binary relation $\mathsf{ChildOf}$, where the intended meaning of $\mathsf{ChildOf}(a, b)$ is that a is a child of b. Write a Datalog program computing the set of pairs (c, d), where c and d have a common ancestor and are of the same generation with respect to this ancestor.

Problem 4. Suppose P is some property of graphs definable by a Datalog program. Show that P is preserved under extensions and homomorphisms. That is, if G is a graph satisfying P, then (1) every supergraph of G satisfies P and (2) if h is a graph homomorphism, then $h(G)$ satisfies P.