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Foundations of Query Languages
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9. Exercise Set: Datalog

Exercise 1
Suppose we are given an **undirected graph** with colored vertices represented by a binary relation Color giving the colors of vertices and a binary relation Edge giving the connection between them. Say that a vertex is good if it is connected to a blue vertex (blue is a constant) or if it is connected to an excellent vertex. An excellent vertex is a vertex that is connected to an outstanding vertex and to a red vertex. An outstanding vertex is a vertex that is connected to a good vertex, an excellent one, and a yellow one. Write a Datalog program that computes the excellent vertices.

Exercise 2
We are given two directed graphs G_{black} and G_{white} represented as binary relations over the same set of vertices V. Write a Datalog program that computes the set of pairs (a, b) of vertices such that there exists a path from a to b where black and white edges alternate, starting with a white edge.

Exercise 3
Let Π be a Datalog program.

a) Prove that Π is monotonic, i.e. for all database instances I, J (over the extensional relations of Π only) we have that if $I \subseteq J$, then $\Pi(I) \subseteq \Pi(J)$.

b) Assume further that Π is constant-free. Given an arbitrary intensional relation T as input, decide the satisfiability of T w.r.t. Π. I.e. give an algorithm that decides whether there is a database instance I such T is a non-empty relation in $\Pi(I)$.

Exercise 4
Consider the following Datalog program:

$$T(X,Y) \leftarrow E(X,Y)$$
$$T(X,Y) \leftarrow E(X,Z), T(Z,Y)$$
$$compT(X,Y) \leftarrow \neg T(X,Y)$$

What is the result of evaluating this program using the naive strategy presented in the lecture? What would you expect the evaluation result to be?

Due by: June 30, 2010 before the tutorial starts.