Database Theory
Winter Term 2013/14
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2. Unit: Datalog

Discussion by 15./22.1.2014

Exercise 1 (Äquivalenz von Algebra und Datalog) Show that for every expression of the relational algebra there is an equivalent stratified Datalog program.

Exercise 2 (Datalog to Algebra)
Consider the translation of Datalog programs with a distinguished answer predicate to the relational algebra.

- Given a rule $B \leftarrow C_1 \wedge \ldots \wedge C_m \wedge \neg D_{m+1} \wedge \ldots \wedge \neg D_{m+n}$
  where the C_i and D_i are of the form $R_i(a_1, \ldots, a_\ell)$, a_j constants or variables. Give an algebra expression that returns the relation defined by it.

- Which additional construct must also be translated?

- Consider the following program (arbitrary arity of predicates, each rule assumed to be safe):
  res(X,Z) :- v(X,_,_Y), q(_,_Y,Z), ¬r(Z,_).
  res(X,Z) :- v(X,_Y,Z), ¬r(_Y,_), ¬w(X).
  v(X,Y,Z) :- p(Z,_,X), q(X,Y,_).
  v(X,Y,Z) :- p(X,Y,Z), Y<4.
  w(X) :- s(_,X), t(X,_).
  where p/3, q/3, r/2, s/2, t/2 are EDB relations, v/3, w/1 are IDB relations (views).
  Give the algebra expression that corresponds to the res predicate.

Exercise 3 (Stratified Datalog)

Give an example for the nonmonotonicity of the stratified semantics,

show that for a stratifiable program P there can be multiple minimal models.

Exercise 4 (Datalog-Anfragen an Mondial: Landlocked)
- Give a Datalog program that returns the names of all countries that have no coast.
- Give a Datalog program that returns the names of all countries that have no coast and that have no neighbor country that has any coast.
- Give the dependency graph of your program.

Asking `?- hasnonlandlockedneighbor(C)` yields many countries several times, e.g., MK (Macedonia) three times since `C2` can be bound by three ways to coastal neighbors: AL, GR, BG.

This can be avoided by a Prolog cut in the "subquery" that searches for possible `C2` bindings:

Exercise 5 (Aggregation in Datalog/XSB) Define the aggregation operators in XSB in a module `aggs.P`.

The syntax of the comparison predicates and of the arithmetic operators is given in Sections 3.10.5 (Inline Predicates) and 4.3 (Operators) of the XSB Manual Part I.

Then use `aggs.P` for answering the following queries in Datalog:

a) Give for each country the name and the number of neighbors.
b) Give the name of the country that has the highest number of neighbors (and how many).
c) Give the average area of all continents (to test avg).
d) Give the average latitude and longitude of all cities.