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Fig. 1

Consistent query answering for inconsistent databases is a running problem...

CCS Concepts: • Information systems → Database design and models; Database query processing.

Additional Key Words and Phrases: Answer Set Programming, Consistent Query Answering

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1 INTRODUCTION

The aim of this article is to present a fair comparison between two methods for solving the problem of CERTAINTY(q). Considering an inconsistent database, a repair is a maximal set of tuples from this database that respects his constraints. The CERTAINTY(q) problem consists in answering the question of knowing if it exists a repair that falsifies the query. Depending on the query, the CERTAINTY(q) problem can be either in first order complexity class, or in NP or co-NP. For the queries that are in first order, we want to compare the efficiency of the generate-and-test method and of the first order rewriting method.

To make a one to one comparison with the results found by Akhil A.Dixit and Phokion G.Kolaitis in their "A SAT-Based System for Consistent Query Answering", we decided to reuse the same FO-rewritable queries they used to prove that the KW-fo rewriting can be more efficient by using ASP instead of SQL.

2 CHOSEN QUERIES

```
q_{1}(z) := \exists x, y, v, w(R_{1}(\underline{x}, y, z) \land R_{2}(\underline{y}, v, w))
q_{2}(z, w) := \exists x, y, v(R_{1}(\underline{x}, y, z) \land R_{2}(\underline{y}, v, w))
q_{3}(z) := \exists x, y, v, u, d(R_{1}(\underline{x}, y, z) \land R_{3}(\underline{y}, v) \land R_{2}(\underline{v}, u, d))
q_{4}(z, d) := \exists x, y, v, u(R_{1}(\underline{x}, y, z) \land R_{3}(\underline{y}, v) \land R_{2}(\underline{v}, u, d))
q_{5}(z) := \exists x, y, v, w(R_{1}(\underline{x}, y, z) \land R_{4}(\underline{y}, v, w))
q_{6}(z) := \exists x, y, x', w, d(R_{1}(\underline{x}, y, z) \land R_{2}(\underline{x'}, y, w)) \land R_{5}(\underline{x}, y, d)
q_{7}(z) := \exists x, y, w, d(R_{1}(\underline{x}, y, z) \land R_{2}(\underline{y}, x, w) \land R_{5}(\underline{x}, y, d))
```

3 FIRST QUERY

#show certainty/1.

4 SECOND QUERY

```
 \begin{array}{l} certainty \, (W,Z) \colon - \, r1 \, (X,Y,Z) \, , \, not \quad p0 \, (Z,X) \, , \, not \quad q0 \, (W,X) \, , \quad r2 \, (P\,,Q,W) \, . \\ p0 \, (Z,X) \colon - \, r1 \, (X,Y,Z1) \, , \, not \quad Z1 = Z \, , \, r1 \, (X,\_,Z) \, . \\ q0 \, (W,X) \colon - \, r1 \, (X,Y,Z1) \, , \, not \quad q1 \, (W,Y) \, , \quad r2 \, (P\,,Q,W) \, . \\ q1 \, (W,Y) \colon - \, r2 \, (Y\,,V,W) \, , \, not \quad q2 \, (W,Y) \, . \\ q2 \, (W,Y) \colon - \, r2 \, (Y\,,V,W1) \, , \, not \quad W1 = W, \, r2 \, (Y\,,\_,W) \, . \end{array}
```

#show certainty/2.

```
5 FOURTH QUERY
197
                                                                                              246
198
                                                                                              247
     Generate-and-test method. (Does not work yet).
199
                                                                                              248
     1 \{ rr1(X,Y,Z) : r1(X,Y,Z) \} 1 :- r1(X,\_,\_).
200
                                                                                              249
201
                                                                                              250
     1 \{ rr4(X,Y,Z) : r4(X,Y,Z) \} 1 :- r4(X,Y,\_).
202
                                                                                              251
                                                                                              252
     :- rr1(X,Y,Z), rr4(Y,V,W).
204
                                                                                              253
205
                                                                                              254
       FO rewriting
206
                                                                                              255
     p(X,Z) := r1(X,Y,Z2), Z2!=Z, r1(X,Y2,Z).
207
     t(X) := r1(X,Y,Z), \text{ not } q(Y).
208
                                                                                              257
     q(Y) := r4(Y, V, W).
209
                                                                                              258
     answer(Z): - r1(X,Y,Z), not p(X,Z), not t(X).
210
                                                                                              259
211
                                                                                              260
     #show answer/1.
212
                                                                                              261
213
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     6 SEVENTH QUERY
215
     FO rewriting
216
                                                                                              265
     certainty (Z) := not d1(Z,Y), r2(Y,X,W), r1(X,Y,Z).
217
     d1(Z,Y) := not d2(Z,Y,X,W), r2(Y,X,W), r1(X,Y,Z).
218
                                                                                              267
     d2(Z, Y, X, W) := not d3(Z, Y, X, W), r2(Y, X, W), r1(X, Y, Z).
219
220
     d3(Z,Y,X,W) := r2(Y,X,W), \text{ not } d4(Z,Y,X,W,P,Q), r1(X,P,Q), r1(X,Y,Z).
221
     d4(Z,Y,X,W,P,Q) := r1(X,P,Q), P=Y, r2(Y,X,W), Q=Z, d5(Z,Y,X,W).
                                                                                              270
222
                                                                                              271
     d5(Z,Y,X,W) := r5(X,Y,D), \text{ not } d6(Z,Y,X,W), r2(Y,X,W), r1(X,Y,Z).
223
                                                                                              272
     d6(Z,Y,X,W) := not d7(Z,Y,X,W,P,D), r2(Y,X,W), r5(X,P,D), r1(X,Y,Z).
224
                                                                                              273
     d7(Z,Y,X,W,P,D) := r2(Y,X,W), r5(X,Z_{5_0},D), r1(X,Y,Z), P=Y.
225
                                                                                              274
226
                                                                                              275
     #show certainty/1.
227
                                                                                              276
228
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     ACKNOWLEDGMENTS
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