On the Primitivity and Satisfiability of SPARQL

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Abstract

This report studies two foundational problems of basic SPARQL which consists of five operators UNION, AND, OPTIONAL, FILTER, and SELECT, namely, primitivity and satisfiability.

The primitivity problem for SPARQL operators is whether one operator can be expressed in terms of the other operators. We conclude that only AND is non-primitive. These results are shown to be insensitive to the choice of semantics for filter conditions (three-valued or two-valued). It is also shown that these two semantics can simulate each other.

The satisfiability problem for SPARQL patterns is whether, for a given pattern, we find a RDF graph (model) make it contain at least resolution. This problem is undecidable in general, since the expressive power of basic SPARQL is the same as that of the relational algebra. It is interesting to delineate the boundary of decidability of satisfiability in terms of the constraints allowed in filter conditions. We show that inconsistent filter conditions can be formed, satisfiability is undecidable. When no inconsistent filter conditions can be formed, satisfiability is efficiently decidable by simple checks on bound variables and on the use of literals. We also point out that satisfiability for the so-called ‘well-designed’ patterns can be decided by a check on bound variables and a check for inconsistent filter conditions.

References

