INTERPRETING
TUPLE RELATIONAL CALCULUS
VIA SQL TRANSLATION

A DISSERTATION SUBMITTED TO THE UNIVERSITY OF MANCHESTER
FOR THE DEGREE OF MASTER OF SCIENCE
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Juan Pablo Romero Valle
School of Computer Science
Abstract

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The need for efficient storage and manipulation techniques for large amounts of
structured information eventually resulted in arguably one of the most important achieve-
ments in computer science: databases. The relational model, originally proposed by
Codd in [Cod70], has received vast academic and industrial attention.

The Relational Algebra (RA) was proposed as a procedural query language and,
even today, it is used to explain the steps in query computations. In contrast, the Tuple
Relational Calculus (TRC) was proposed as a declarative query language. It was, as
inferable through its semantics, one of the main inspirations behind SQL. Despite this,
and perhaps because of its abstract nature, TRC lacks a standard grammar recorded in
the literature and has fewer options regarding the practical evaluation of queries.

The motivation behind this thesis was to enable the (regrettably thus far neglected)
hands-on study of TRC. An evaluation tool for TRC queries was built for this purpose.
It is capable of parsing a TRC query expression, translating it into SQL, executing it
against an SQL database and displaying the results. Ultimately, the application aims
to help students build TRC queries and verify their correctness, rather than resorting to
pen-and-paper calculations.

The tool was built as a web application, with dependencies on a JavaScript gener-
ated PEG parser and a JavaScript-compiled version of SQLite 3. While the TRC evalu-
ator was found to be expressively powerful, it could be further extended with additional
functionality such as nulls and aggregate functions. In addition, a more human-factors
oriented research with the proposed tool could also prove to be insightful.