Blocking, Monotonicity, and Turing Completeness in a Database Language for Sequences and Streams

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Abstract

We propose a database language, based on simple extensions of the relational data model and SQL, and show that it is Turing-complete and supportive of sequences and data streams. In fact, we obtain a simple characterization of the blocking/non-blocking behavior of queries and operators on streams: we show that non-blocking operators can be characterized algebraically by the monotonic behavior of the functions they realize, and syntactically, by the structure of the programs used to define them. Finally, we prove that the proposed SQL extensions yield a Turing-complete language for sequences and streams. Furthermore, our query language is also complete for non-blocking computations, inasmuch as every monotonic function can be expressed by a non-blocking program written in the language.