

**Title:** Query evaluation via tree-decompositions

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**Abstract:** A number of efficient methods for evaluating first-order and monadic-second order queries on finite relational structures are based on tree-decompositions of structures or queries. We systematically study these methods.

In the first-part of the paper we consider arbitrary formulas on tree-like structures. We generalize a theorem of Courcelle (1990) by showing that on structures of bounded tree-width a monadic second-order formula (with free first- and second-order variables) can be evaluated in time linear in the structure size plus the size of the output.

In the second part we study tree-like formulas on arbitrary structures. We generalize the notions of acyclicity and bounded tree-width from conjunctive queries to arbitrary first-order formulas in a straightforward way and analyze the complexity of evaluating formulas of these fragments. Moreover, we show that the acyclic and bounded tree-width fragments have the same expressive power as the well-known guarded fragment and the finite-variable fragments of first-order logic, respectively.