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Comparative complexity of quantum and classical OBDDs for total and partial functions

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Abstract

© 2015, Allerton Press, Inc. We consider a model of computation for discrete functions—Ordered Binary Decision Diagrams (OBDD).We investigate comparative complexity of quantum, deterministic, probabilistic and nondeterministic (quantum and classical) OBDDs for total and partial functions. The measure of complexity is a width of OBDD. It is known that for total functions bounded error quantum OBDDs can be exponentially more effective than deterministic and bounded error probabilistic OBDDs. We show that such quantum OBDDs also can be exponentially more effective than nondeterministic OBDDs (both quantum and classical). For partial functions the gap can be more significant. For partial function depending on a parameter k exact quantum OBDD has the width two. Deterministic and bounded error probabilistic OBDD for this function must have a width exponentially depending on k.

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Keywords

complexity, nondeterminism, ordered binary decision diagrams, partial functions, probabilistic OBDDs, quantum computation