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On computational power of classical and quantum Branching programs

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Abstract

We present a classical stochastic simulation technique of quantum Branching programs. This technique allows to prove the following relations among complexity classes: PrQP-BP ⊆ PP-BP and BQP-BP ⊆ PP-BP. Here BPP-BP and PP-BP stands for the classes of functions computable with bounded error and unbounded error respectively by stochastic branching program of polynomial size. BQP-BP and PrQP-BP stands the classes of functions computable with bounded error and unbounded error respectively by quantum branching program of polynomial size. Second. We present two different types. of complexity lower bounds for quantum nonuniform automata (OBDDs). We call them "metric" and "entropic" lower bounds in according to proof technique used. We present explicit Boolean functions that show that these lower bounds are tight enough. We show that when considering "almost all Boolean functions" on n variables our entropic lower bounds gives exponential (2c(δ)(n-logn)) lower bound for the width of quantum OBDDs depending on the error δ allowed.

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Keywords

Branching programs, Computational complexity, OBDD, Quantum computations