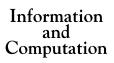


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On the computational power of probabilistic and quantum branching program

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Abstract

In this paper, we show that one-qubit polynomial time computations are as powerful as NC^1 circuits. More generally, we define syntactic models for quantum and stochastic branching programs of bounded width and prove upper and lower bounds on their power. We show that any NC^1 language can be accepted exactly by a width-2 quantum branching program of polynomial length, in contrast to the classical case where width 5 is necessary unless $NC^1 = ACC$. This separates width-2 quantum programs from width-2 doubly stochastic programs as we show the latter cannot compute the middle bit of multiplication. Finally, we show that bounded width, and thus are in NC^1 . For read-oncequantum branching programs (QBPs), we give a symmetric Boolean

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