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On the hierarchies for deterministic, nondeterministic and probabilistic ordered read-k-times branching programs

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Abstract

© 2016, Pleiades Publishing, Ltd.The paper examines hierarchies for nondeterministic and deterministic ordered read-ktimes Branching programs. The currently known hierarchies for deterministic k-OBDD models of Branching programs for k = o(n1/2/log3/2n) are proved by B. Bollig, M. Sauerhoff, D. Sieling, and I. Wegener in 1998. Their lower bound technique was based on communication complexity approach. For nondeterministic k-OBDD it is known that, if k is constant then polynomial size k-OBDD computes same functions as polynomial size OBDD (The result of Brosenne, Homeister and Waack, 2006). In the same time currently known hierarchies for nondeterministic read ktimes Branching programs for k=o(logn/loglogn) are proved by Okolnishnikova in 1997, and for probabilistic read k-times Branching programs for k ≤ log n/3 are proved by Hromkovic and Saurhoff in 2003. We show that increasing k for polynomial size nodeterministic k-OBDD makes model more powerful if k is not constant. Moreover, we extend the hierarchy for probabilistic and nondeterministic k-OBDDs for k = o(n/log n). These results extends hierarchies for read k-times Branching programs, but k-OBDD has more regular structure. The lower bound techniques we propose are a “functional description” of Boolean function presented by nondeterministic k-OBDD and communication complexity technique. We present similar hierarchies for superpolynomial and subexponential width nondeterministic k-OBDDs. Additionally we expand the hierarchies for deterministic k-OBDDs using our lower bounds for k = o(n/log n). We also analyze similar hierarchies for superpolynomial and subexponential width k-OBDDs.

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Keywords

Binary decision diagrams, Branching programs, computational complexity, deterministic and nondeterministic models, hierarchy, OBDD