Determinization of Parity automata

June 26, 2017

Abstract

A central result in the theory of ω-automata is McNaughton's Theorem which states that every Buchi automaton is equivalent to a deterministic Muller automaton. The complexity of McNaughton's algorithm is huge. Safra provided an optimal construction. Safra's algorithm converts a Buchi automaton with n states to a deterministic Rabin automaton with $n^{O(n)}$ states. Much efforts have been invested to reduce constants in Safra's determinization procedure and to highlight and improve many ideas incorporated in it, such as: naming mechanism, acceptance mechanism, etc. Still, the procedure has an operational definition which makes it difficult to teach.

Muller and Schupp provided another determinization algorithm. It can be explained more easily and has the same asymptotic complexity. They also proved that every parity automaton with n states and m priorities is equivalent to a deterministic automaton with $n^{O(mn)}$ states.

We use a variant of Muller-Schupp's algorithm and prove that every parity automaton with n states and m priorities is equivalent to a deterministic automaton with $n^{O(n)}$ states and $O(nm)$ Rabin acceptance conditions. Our determinization procedure is declarative and thus is easy to explain.

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