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van Zijl, Lynette (SA-STEL-C)

Generalized acceptance, succinctness and supernondeterministic finite automata. (English. English summary)

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Let $\mathcal{P}(Q)$ denote the power set of Q, and let $\mathcal{P}^n$ be defined by $\mathcal{P}^0(Q) = Q$ and $\mathcal{P}^{n+1}(Q) = \mathcal{P}(\mathcal{P}^n(Q))$ for $n \geq 0$. For a nondeterministic finite automaton (NFA) $M = (Q, \Sigma, \delta, q_0, F)$, the transition function $\delta\colon Q \times \Sigma \to \mathcal{P}(Q)$ is usually extended to $\delta\colon Q \times \Sigma^\star \to \mathcal{P}(Q)$ by $\delta(q, \lambda) = \{q\}$ and $\delta(q, aw) = \cup\{\delta(q', w) \mid q' \in \delta(q, a)\}$ with $q \in Q$, $a \in \Sigma$ and $w \in \Sigma^\star$; λ denotes the empty word. Then a word w over Σ is accepted by M if $\delta(q_0, w) \cap F \neq \varnothing$. This standard way of acceptance is "generalized" as follows: F is defined as a subset of $\mathcal{P}(Q)$ rather than of Q, and M accepts w if $\delta(q_0, w) \in F$.

For NFAs both ways of acceptance yield the family of regular languages, but generalized acceptance allows a more succinct description (i.e., using fewer states) of some regular languages.

In a supernondeterminstic finite automaton of level k (k-sNFA), $M = (Q, \Sigma, \delta, q_0, F, k)$ and the type of δ is $\delta\colon Q \times \Sigma \to \mathcal{P}^k(Q)$. Extending δ to $\delta\colon \mathcal{P}^k(Q) \times \Sigma \to \mathcal{P}^k(Q)$ as well as the detailed definition of standard ($F \subseteq Q$) and generalized acceptance ($F \subseteq \mathcal{P}^k(Q)$) is a bit complicated. Now level 0 of this hierarchy corresponds to deterministic FAs, level 1 to NFAs, and level 2 to alternating (or, equivalently, to Boolean) FAs. Finally, it is shown that there exists a 2-state 3-sNFA with generalized acceptance, such that its equivalent deterministic FA possesses more than 2^{2^2} states. *Peter R. J. Asveld* (NL-TWEN-C)

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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.

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