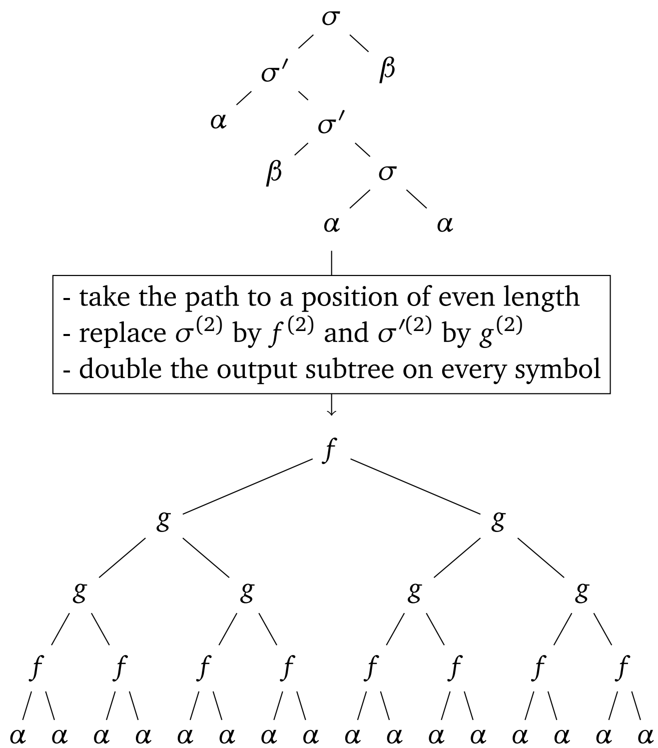
Advanced Topics on Weighted Tree Automata

Exercise 10 (BOT ⊆ REL ∘ FTA ∘ HOM)

Let $\Sigma = \{\sigma^{(2)}, \sigma'^{(2)}, \alpha^{(0)}, \beta^{(0)}\}$ and $\Delta = \{f^{(2)}, g^{(2)}, \alpha^{(0)}, \beta^{(0)}\}$. We consider the tree transformation $\tau \subseteq T_\Sigma \times T_\Delta$ such that $(s, t) \in \tau$ if there is a position $w = w_1 \dots w_n \in \mathrm{pos}(s)$ with even length (viewed as string over $\mathbb{N}$) such that $s(w) \in \Sigma^{(0)}$ and t is obtained from s by walking up the path starting from w towards the root of s and at w outputting $s(w)$ and at each position $w_1 \dots w_i$ with $1 \le i < n$ (a) replacing σ by f and σ' by g and (b) copying the output tree computed at $w_1 \dots w_{i+1}$.



(a) Give a bu-tt B such that $\tau = \tau(B)$.

(b) Give a relabeling B_1, a bottom-up finite state tree automaton B_2, and a tree homomorphism B_3 such that $\tau(B) = \tau(B_1) \circ \tau(B_2) \circ \tau(B_3)$.

(c) Give a derivation of $\sigma(\sigma(\sigma(\alpha, \alpha), \alpha), \alpha)$ in B and the related derivations in B_1, B_2, and B_3.

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