Formale Übersetzungsmodelle

Task 22 (l-TOP $\subsetneq$ l-BOT)

Consider the linear td-tt $T = (\{q_0, q_1\}, \Sigma, \Delta, \{q_0\}, R)$ where

$$
\begin{aligned}
R = \{\ & q_0(\sigma(x_1, x_2)) \to \gamma'(q_1(x_1)), \quad q_0(\sigma(x_1, x_2)) \to \sigma(q_0(x_1), q_0(x_2)), \\
& q_0(\sigma(x_1, x_2)) \to \gamma'(q_1(x_2)), \quad q_1(\sigma(x_1, x_2)) \to \sigma(q_1(x_1), q_1(x_2)), \\
& q_1(\sigma(x_1, x_2)) \to \gamma'(q_1(x_1)), \quad q_0(\gamma(x_1)) \to \gamma(q_0(x_1)), \\
& q_1(\sigma(x_1, x_2)) \to \gamma'(q_1(x_2)), \quad q_1(\gamma(x_1)) \to \gamma(q_0(x_1)), \quad q_0(\alpha) \to \alpha\ \}
\end{aligned}
$$

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

Task 23 (tree transducers and finite state automata)

Let $B = (R, \Sigma, \Delta, H, \kappa)$ be a linear bottom-up tree transducer, $T = (S, \Sigma, \Delta, I, \theta)$ be a non-deleting top-down tree transducer, and $\mathcal{M} = (Q, \Sigma^{(0)}, q_\mathrm{i}, F, \delta)$ and $\mathcal{N} = (P, \Delta^{(0)}, p_\mathrm{i}, G, \mu)$ be finite state automata. Show by construction that there are bottom-up tree transducers $\mathcal{M} \lhd B$ and $B \rhd \mathcal{N}$, as well as top-down tree transducers $\mathcal{M} \lhd T$ and $T \rhd \mathcal{N}$ such that

(a) $\tau(\mathcal{M} \lhd B) = \{(\xi, \zeta) \in \mathrm{T}_\Sigma \times \mathrm{T}_\Delta \mid (\xi, \zeta) \in \tau(B), \mathsf{yield}(\xi) \in L(\mathcal{M})\}$,

(b) $\tau(B \rhd \mathcal{N}) = \{(\xi, \zeta) \in \mathrm{T}_\Sigma \times \mathrm{T}_\Delta \mid (\xi, \zeta) \in \tau(B), \mathsf{yield}(\zeta) \in L(\mathcal{N})\}$,

(c) $\tau(\mathcal{M} \lhd T) = \{(\xi, \zeta) \in \mathrm{T}_\Sigma \times \mathrm{T}_\Delta \mid (\xi, \zeta) \in \tau(T), \mathsf{yield}(\xi) \in L(\mathcal{M})\}$, and

(d) $\tau(B \rhd \mathcal{N}) = \{(\xi, \zeta) \in \mathrm{T}_\Sigma \times \mathrm{T}_\Delta \mid (\xi, \zeta) \in \tau(T), \mathsf{yield}(\zeta) \in L(\mathcal{N})\}$.

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