

Formale Übersetzungsmodelle

Task 20 (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 $\mathcal{M} = (Q, \Sigma^{(0)}, q_i, F, \delta)$ and $\mathcal{N} = (P, \Delta^{(0)}, p_i, G, \mu)$ be finite state automata. Show by construction that there are bottom-up tree transducers $\mathcal{M} \triangleleft B$ and $B \triangleright \mathcal{N}$, as well as top-down tree transducers $\mathcal{M} \triangleleft T$ and $T \triangleright \mathcal{N}$ such that

- (a) $\tau(\mathcal{M} \triangleleft B) = \{(\xi, \zeta) \in \mathbf{T}_\Sigma \times \mathbf{T}_\Delta \mid (\xi, \zeta) \in \tau(B), \text{yield}(\xi) \in L(\mathcal{M})\}$,
- (b) $\tau(B \triangleright \mathcal{N}) = \{(\xi, \zeta) \in \mathbf{T}_\Sigma \times \mathbf{T}_\Delta \mid (\xi, \zeta) \in \tau(B), \text{yield}(\zeta) \in L(\mathcal{N})\}$,
- (c) $\tau(\mathcal{M} \triangleleft T) = \{(\xi, \zeta) \in \mathbf{T}_\Sigma \times \mathbf{T}_\Delta \mid (\xi, \zeta) \in \tau(T), \text{yield}(\xi) \in L(\mathcal{M})\}$, and
- (d) $\tau(B \triangleright \mathcal{N}) = \{(\xi, \zeta) \in \mathbf{T}_\Sigma \times \mathbf{T}_\Delta \mid (\xi, \zeta) \in \tau(T), \text{yield}(\zeta) \in L(\mathcal{N})\}$.