
Formale Übersetzungsmodelle

Task 28 ($TOP^R \subseteq d\text{-QREL}; TOP$)

Let $L_1, \dots, L_n \in \text{REC}(\Sigma)$ be recognizable tree languages, $\mathcal{U} = \{0, 1\}^n$, and Σ and Ω be ranked alphabets where $\Omega = \{ \langle \sigma, (u_1, \dots, u_k) \rangle^{(k)} \mid \sigma \in \Sigma, \text{rank}(\sigma) = k, u_1, \dots, u_k \in \mathcal{U} \}$. Note that if $k = 0$ we write σ rather than $\langle \sigma, () \rangle$. Consider the function $B_{L_1, \dots, L_n} : T_\Sigma \rightarrow \mathcal{P}(T_\Omega)$ that is recursively defined for every $\sigma \in \Sigma$ and $t_1, \dots, t_k \in T_\Sigma$ by

$$B_{L_1, \dots, L_n}(\sigma(t_1, \dots, t_k)) = \{ \langle \sigma, (u_1, \dots, u_k) \rangle (t'_1, \dots, t'_k) \mid t'_1 \in B_{L_1, \dots, L_n}(t_1), \dots, t'_k \in B_{L_1, \dots, L_n}(t_k), \\ \forall i \in [k], \forall j \in [n]: u_i \in \mathcal{U}, u_i(j) = 1 \text{ if } t_i \in L_j \text{ then } 1 \text{ else } 0 \}$$

- (a) Give a deterministic state-relabeling bu-tt B that computes B_{L_1, \dots, L_n} .
- (b) Let $\Sigma = \{ \sigma^{(2)}, \gamma^{(1)}, \alpha^{(0)}, \beta^{(0)} \}$ be a ranked alphabet, $n = 2$, and $L_1 = \{ \gamma^k(\beta) \mid k \in \mathbb{N} \}$ and $L_2 = \{ \gamma^k(\alpha) \mid k \in \mathbb{N} \}$ be recognizable tree languages. Construct a deterministic state-relabeling bu-tt B' that computes B_{L_1, L_2} .

Task 29 ($l\text{-BOT} = l\text{-TOP}^R$)

Consider the linear bu-tt $B = (Q, \Sigma, \Sigma, F, R)$ where $\Sigma = \{ \sigma^{(2)}, \gamma^{(1)}, \alpha^{(0)}, \beta^{(0)} \}$, $Q = \{ *, q, q_f \}$, $F = \{ q_f \}$, and R contains is given by

$$\begin{array}{lll} \alpha \rightarrow q(\alpha), & \alpha \rightarrow *(\alpha), & \beta \rightarrow *(\beta), \\ \gamma(q(x_1)) \rightarrow q(\gamma(x_1)), & \gamma(*(\alpha)) \rightarrow *(\gamma(x_1)), & \\ \sigma(*(\alpha), q(x_2)) \rightarrow q_f(x_1), & \sigma(*(\alpha), *(x_2)) \rightarrow *(\sigma(x_1, x_2)) & \end{array}$$

- (a) Give a linear td-tt with regular look-ahead T such that $\tau(T) = \tau(B)$.
- (b) Construct a deterministic state-relabeling bu-tt B' and a linear td-tt T' such that $\tau(T) = \tau(B') \circ \tau(T')$.