Formale Übersetzungsmodelle

Task 25 ($\mathit{TOP}^R \subseteq$ d-QREL ; TOP)

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

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

(a) Give a deterministic state-relabeling bu-tt B that computes $B_{L_1,...,L_n}$.

(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 26 (l-BOT = l-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

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

(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 $\tau(T) = \tau(B') \circ \tau(T')$.

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