Formale Übersetzungsmodelle

Task 19 (l-TOP $\subseteq$ 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 20 (generalized sequential machines and top-down tree transducers)

GSM is the class of string transformations $\tau \subseteq \Sigma^* \times \Delta^*$ that are be induced by some gsm.

(a) Give formal definitions for the syntax and derivation relation of a gsm, and the string transformation induced by a gsm.

(b) Prove by construction that GSM is closed under composition.
Hint: Use a product construction where the right hand side of a rule of the first gsm is processed by the second gsm (pipelining).

Let $G = (Q, \Sigma, \Delta, q_0, F, R)$ be a gsm.

(c) Give a gsm G^R such that $\tau(G^R) = \{(w_l^R, w_r^R) \mid (w_l, w_r) \in \tau(G)\}$ where w^R denotes the reverse of w.

(d) Give a td-tt that simulates the run of G on the nodes of monadic trees from root to front.

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