

Formale Übersetzungsmodelle

Exercise 27 (Incomparability of TOP and BOT)

Recall the bu-tt B_1 and the td-tt T from the lecture. Prove formally that

- (a) $\tau(B_1) \notin \text{TOP}$, and
- (b) $\tau(T) \notin \text{BOT}$.

Exercise 28 (Simulation of BOT and TOP)

Let $\Sigma = \{\sigma^{(2)}, \gamma^{(1)}, \alpha^{(0)}, \beta^{(0)}\}$ be a ranked alphabet. Consider the bu-tt $B = (Q_B, \Sigma, \Sigma, F, R_B)$ and the td-tt $T = (Q_T, \Sigma, \Sigma, I, R_T)$ where $Q_B = \{*, q, q_f\}$, $F = \{q_f\}$, $Q_T = \{*, q\}$, $I = \{*\}$, and

$$\begin{array}{ll}
 R_B = \{ \sigma(*x_1, *x_2) \rightarrow *(\sigma(x_1, x_2)), & R_T = \{ q(\sigma(x_1, x_2)) \rightarrow \sigma(q(x_1), q(x_2)), \\
 \sigma(*x_1, qx_2) \rightarrow q_f(x_1), & *(\sigma(x_1, x_2)) \rightarrow \sigma(q(x_1), *(x_1)), \\
 \gamma(*x_1) \rightarrow *(\gamma(x_1)), & *(\sigma(x_1, x_2)) \rightarrow \sigma(*x_1, q(x_1)), \\
 \gamma(qx_1) \rightarrow q(\gamma(x_1)), & *(\gamma(x_1)) \rightarrow \gamma(*x_1), \\
 \gamma(q_f(x_1)) \rightarrow q_f(\gamma(x_1)), & q(\gamma(x_1)) \rightarrow \gamma(q(x_1)), \\
 \alpha \rightarrow *(\alpha), \alpha \rightarrow q(\alpha), \beta \rightarrow q(\beta) \} & *(\alpha) \rightarrow \alpha, q(\alpha) \rightarrow \alpha, *(\beta) \rightarrow \beta \}
 \end{array}$$

- (a) Identify the bottom-up and top-down specific properties of the tree transformations induced by B and T respectively.
- (b) Give td-tt T_1 and T_2 and bu-tt B_1 and B_2 such that $\tau(B) = \tau(T_1) \circ \tau(T_2)$ and $\tau(T) = \tau(B_1) \circ \tau(B_2)$.

Exercise 29 (GSM)

GSM is the class of all string transformations induced by some gsm.

- (a) Recall the formal definitions for the derivation relation of a gsm and its induced string transformation.
- (b) Prove by construction that GSM is closed under composition.
- (c) *Bonus task:* Let G be a gsm. Give a gsm G^R such that $\tau(G^R) = \{(v^R, w^R) \mid (v, w) \in \tau(G)\}$ where w^R denotes the reverse of the word w .