Formale Übersetzungsmodelle

*Task 15 (*BOT ; HOM ⊆ BOT*)*

Let $B = (Q, \Sigma, \Delta, F, R)$ be a bu-tt and $H = (\{*\}, \Delta, \Omega, \{*\}, R_H)$ a tree homomorphism. Also let $X_{\max} = \{x_i \mid i \in [\max \mathsf{rank}(\Sigma)]\}$. Define the bottom-up tree homomorphism $H' = (\{*\}, \Delta, \Omega \cup X_{\max}, \{*\}, R_H)$ and the bottom-up tree transducer $\hat{B} = (Q, \Sigma, \Omega, F, \hat{R})$ where

$$\sigma(q_1(x_1), ..., q_k(x_k)) \to q(u') \in R \wedge u'[*(x_1), ..., *(x_k)] \Rightarrow^*_{H'} *(t')$$
$$\Longleftrightarrow \sigma(q_1(x_1), ..., q_k(x_k)) \to q(t') \in \hat{R} \ .$$

Show that for every $s \in T_\Sigma$, $q \in Q$, and $t \in T_\Delta$ the following equivalence holds:

$$s \Rightarrow^*_{\hat{B}} q(t) \iff \exists u \in T_\Delta \colon s \Rightarrow^*_B q(u) \wedge u \Rightarrow^*_H *(t) \ .$$

Task 16 (regular tree grammars)

Consider the ranked alphabet $\Sigma = \{\alpha^{(0)}, \sigma^{(2)}\}$, the tree $\xi = \sigma(\sigma(\alpha, \alpha), \sigma(\alpha, \alpha)) \in T_\Sigma$, and the regular tree grammar $G = (\{S, A\}, \Sigma, S, R)$ where

$$R\colon \qquad S \to A \qquad\qquad S \to \sigma(S, S) \qquad\qquad A \to \sigma(\alpha, S) \qquad\qquad A \to \alpha.$$

(a) Give a derivation and the corresponding derivation tree of ξ in G.
How many derivation trees of ξ do exist in G?

(b) Give an RTG H and a tree ζ such that ζ has infinitely many derivations in H.

(c) Give an RTG G' such that G' is in normal form and $L(G') = L(G)$.
Give a derivation tree of ξ in G'.

(d) Prove by construction that for every RTG G there exists an RTG G' in normal form such that $L(G') = L(G)$.

`http://www.orchid.inf.tu-dresden.de` `Tobias.Denkinger@tu-dresden.de`