3rd Exercise Sheet (October 30, 2014)

Formale Übersetzungsmodelle

Exercise 7 (Shape-preserving tree transformations)

Let $M = (Q, \Sigma, \Delta, F, R)$ be a bu-tt. Prove the following statements:

(a) If M is a bottom-up state relabeling and $(s, t) \in \tau(M)$, then $\mathrm{pos}(s) = \mathrm{pos}(t)$.

(b) If M is a bottom-up finite state tree automaton and $(s, t) \in \tau(M)$, then $s = t$.

Exercise 8 (Nondeterminism and determinism)

Consider the r.a. $\Sigma = \{\gamma^{(1)}, \alpha^{(0)}\}$, $\Delta = \Sigma \cup \{\delta^{(1)}\}$, and the (nondeterministic) bu-tt $M = (\{q\}, \Sigma, \Delta, \{q\}, R)$, where R is given by

$$\alpha \to q(\alpha), \qquad \gamma(q(x_1)) \to q(\gamma(x_1)), \qquad \gamma(q(x_1)) \to q(\delta(x_1)).$$

(a) What is the tree transformation of M?

(b) Show that there is no deterministic bu-tt N such that $\tau(M) = \tau(N)$.

Exercise 9 (Subclasses of BOT)

Describe the relations of the classes of tree transformations induced by the following transducers:

- bu-tt,
- deterministic bu-tt,
- total bu-tt,
- total and deterministic bu-tt,
- tree homomorphisms,
- relabelings,
- state relabelings,
- bottom-up finite state tree automata,
- linear bu-tt,
- nondeleting bu-tt,
- and linear and nondeleting bu-tt.

Use the abbreviations BOT, d-BOT, t-BOT, HOM, QREL, REL, l-BOT, n-BOT, and FTA.