Formale Übersetzungsmodelle

Exercise 13 (Decomposition of a bu-tt)

Let $\Sigma = \{\sigma^{(2)}, \gamma^{(1)}, \alpha^{(0)}\}$. Consider the bu-tt $M = \big(\{q_0, q_1, p\}, \Sigma, \Sigma, \{q_0\}, R\big)$, where R is given by

$$\alpha \to q_0(\alpha)\,, \qquad \alpha \to p(\alpha)\,, \qquad \gamma(p(x_1)) \to p(\gamma(x_1))\,,$$
$$\sigma(q_0(x_1), p(x_2)) \to q_1(\sigma(x_2, x_1))\,, \qquad \sigma(q_1(x_1), p(x_2)) \to q_0(\sigma(x_1, x_1))\,.$$

(a) Describe $\tau(M)$.

(b) Construct, according to the decomposition result from the lecture, a relabeling M_1, an fta M_2, and a homomorphism M_3 such that $\tau(M) = \tau(M_1) \circ \tau(M_2) \circ \tau(M_3)$.

Exercise 14 (Decomposition of bu-tt, but with qrels)

(a) Sketch the construction of the qrel in the proof of $\mathrm{BOT} \subseteq \mathrm{QREL} \circ \mathrm{HOM}$.

(b) Apply this construction to exercise 13, i.e., give a qrel M_1' and a homomorphism M_2' such that $\tau(M) = \tau(M_1') \circ \tau(M_2')$.

Exercise 15 (Bimorphisms)

Prove the following (slightly modified) decomposition result for bu-tt:

$$[1]\text{-BOT} \subseteq \text{d-REL}^{-1} \circ \mathrm{FTA} \circ [1]\text{-HOM}\,.$$

Exercise 16 (Finishing the proof)

Complete the proof of the decomposition result from the lecture by proving the following statement: For every $s \in T_\Sigma$, $q \in Q$, and $t \in T_\Delta$, if there is a $u \in T_\Omega$ such that $s \Rightarrow^*_{B_1} *(u)$, $u \Rightarrow^*_{B_2} q(u)$, and $u \Rightarrow^*_{B_3} *(t)$, then $s \Rightarrow^*_{B} q(t)$.

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