
Formale Übersetzungsmodelle

Task 26 (Baker's theorem for BOT)

Theorem [Bak79, Thm. 6]. Let B_1 and B_2 be bu-tt. Then $\tau(B_1); \tau(B_2) \in \text{BOT}$ if the following two conditions hold:

1. B_1 is linear or B_2 is deterministic;
2. B_1 is nondeleting or B_2 is total.

- (a) Give bu-tts B'_1 and B'_2 that fulfill Condition 1 but not Condition 2 such that $\tau(B'_1); \tau(B'_2) \notin \text{BOT}$. Give bu-tts B''_1 and B''_2 that do not fulfill Condition 1 but fulfill Condition 2 such that $\tau(B''_1); \tau(B''_2) \notin \text{BOT}$. For each bu-tt, use the minimum number of rules necessary.
- (b) Construct the instance B' and B'' (for B'_1 and B'_2 , and B''_1 and B''_2 , respectively) of the bu-tt B defined in the proof (from the lecture) of the above theorem.
- (c) Give trees s', t', s'', t'' such that
 - (i) $\neg((s', t') \in \tau(B'_1) \circ \tau(B'_2)) \iff (s', t') \in \tau(B')$ and
 - (ii) $\neg((s'', t'') \in \tau(B''_1) \circ \tau(B''_2)) \iff (s'', t'') \in \tau(B'')$.
- (d) Prove the following corollary:

Corollary. Let B_1 and B_2 be bu-tt. Then $\tau(B_1); \tau(B_2) \in \text{BOT}$ if B_1 is linear or B_2 is deterministic.
- (e) Apply the above corollary to B'_1 and B'_2 from Task 26 (a).

Task 27 (Baker's theorem for TOP)

Theorem [Bak79, Thm. 1]. Let T_1 and T_2 be td-tt. Then $\tau(T_1) \circ \tau(T_2) \in \text{TOP}$ if the following two conditions hold:

1. T_1 is deterministic or T_2 is linear;
2. T_1 is total or T_2 is nondeleting.

Let $T_1 = (Q, \Sigma, \Delta, I_1, R_1)$ and $T_2 = (P, \Delta, \Omega, I_2, R_2)$ be td-tt.

- (a) Construct a td-tt T such that $\tau(T_1) \circ \tau(T_2) = \tau(T)$ if the above conditions hold.
- (b) Prove that $\tau(T_1) \circ \tau(T_2) = \tau(T)$.
- (c) Give two td-tt T'_1 and T'_2 that fulfill Condition 1 but not Condition 2. For each td-tt use the minimum number of rules necessary.
- (d) Construct the instance T' (for T'_1 and T'_2) of the td-tt T defined in Task 27 (a).
- (e) Give a tree transformation (s, t) such that $\neg((s, t) \in \tau(T'_1) \circ \tau(T'_2)) \iff (s, t) \in \tau(T')$.

References

- [Bak79] B. S. Baker. “Composition of top-down and bottom-up tree transductions”. In: *Information and Control* 41.2 (1979), pp. 186–213. doi: 10.1016/S0019-9958(79)90561-8.