Formale Baumsprachen

Task 13 (relatedness)

Let $\Sigma = \{\sigma^{(2)}, \alpha^{(0)}, \beta^{(0)}\}$ be a ranked alphabet and $G = (N, \Sigma, Z, P)$ a regular tree grammar where $N = \{Z, A, B, C\}$ and

$$\begin{aligned} P = \{\ & Z \to \sigma(\sigma(A, B), C), && Z \to B, && A \to \alpha, && A \to B, \\ & B \to \beta, && B \to A, && B \to C, && C \to C\ \}\ . \end{aligned}$$

(a) Use the construction from the lecture to give a regular tree grammar in normal form equivalent to G.

(b) Give a bu-det fta that is related to the normal form regular tree grammar constructed in Exercise 13 (a).

(c) Give a regular tree grammar that is related to the normal form bu-det fta $\mathcal{M} = (Q, \Sigma, \tau, \{q_0\})$ where $Q = \{0, 1\}$, $\Sigma = \{\sigma^{(2)}, \alpha^{(0)}, \beta^{(0)}\}$, $q_0 = 0$, and τ is given by

$$\tau_\alpha() = 1, \qquad \tau_\beta() = 0, \text{ and} \qquad \tau_\sigma(p, q) = (p + q) \,\%\, 2 \qquad \text{for each } p, q \in Q.$$

*Task 14 (*yield(Rec) ***and*** CF*)*

(a) Let $\Delta = \{(_a,)_a, (_b,)_b\}$. Give a context-free grammar that generates D_Δ (i.e. the Dyck language of well-bracketed strings).

(b) Let $\Sigma = \{\sigma^{(2)}, \alpha^{(0)}, \beta^{(0)}, \gamma^{(0)}\}$ and G be an rtg over Σ with initial symbol Z and productions

$$Z \to \alpha + \beta + \gamma + \sigma(A, Z) + \sigma(Z, B) \quad A \to \alpha + \gamma + \sigma(A, A) \quad B \to \beta + \gamma + \sigma(B, B).$$

Describe the string languages $\mathrm{yield}_\alpha(L(G))$, $\mathrm{yield}_\beta(L(G))$, and $\mathrm{yield}_\gamma(L(G))$.

(c) Give an rtg H in normal form with $D_\Delta = \mathrm{yield}_e(L(H))$ (see Task 14 (a)) for some e.

(d) Using the construction from the lecture, transform the rtg G (see Task 14 (b)) into a context-free grammar G' such that $L(G') = \mathrm{yield}_\gamma(L(G))$. Is there a simpler context-free grammar generating the same language?

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