Automaten und Berechenbarkeit

9. Übungsserie

Aufgabe 1:

(a) $G_a = (N_a, T, S_a, P_a)$

$N_a = \{Q_0, Q_1, Q_2, Q_3, Q_4\}$

$T = \{a, b\}$

$S_a = Q_0$

$P_a = \{Q_0 \to \lambda, Q_0 \to aQ_1, Q_0 \to bQ_0, Q_1 \to aQ_2, Q_1 \to bQ_1, Q_2 \to aQ_3, Q_2 \to bQ_2,$
$Q_3 \to aQ_4, Q_3 \to bQ_3, Q_4 \to aQ_0, Q_4 \to bQ_4\}$

$G_{a2} = (N_{a2}, T, S_{a2}, P_{a2})$

$N_{a2} = \{Q_0, Q_1, Q_2, Q_3, Q_4\}$

$T = \{a, b\}$

$S_{a2} = Q_0$

$P_{a2} = \{Q_0 \to \lambda, Q_1 \to Q_0a, Q_0 \to Q_0b, Q_2 \to Q_1a, Q_1 \to Q_1b, Q_3 \to Q_2a, Q_2 \to Q_2b,$
$Q_4 \to Q_3a, Q_3 \to Q_3b, Q_0 \to Q_4a, Q_4 \to Q_4b\}$

(b) $G_b = (N_b, T, S_b, P_b)$

$N_b = \{Q_0, Q_1, Q_2, Q_3\}$

$T = \{a, b\}$

$S_b = Q_0$

$P_b = \{Q_0 \to \lambda, Q_1 \to \lambda, Q_2 \to \lambda, Q_2 \to \lambda, Q_0 \to bQ_0, Q_0 \to aQ_1, Q_1 \to aQ_1, Q_1 \to bQ_2,$
$Q_2 \to aQ_3, Q_2 \to bQ_0, Q_3 \to aQ_3, Q_3 \to bQ_3\}$

$G_{b2} = (N_{b2}, T, S_{b2}, P_{b2})$

$N_{b2} = \{Q_0, Q_1, Q_2, Q_3, S\}$

$T = \{a, b\}$

$S_{b2} = S$

$P_{b2} = \{Q_0 \to \lambda, S \to Q_0, S \to Q_1, S \to Q_2, Q_0 \to Q_0b, Q_1 \to Q_0a, Q_1 \to Q_1a, Q_2 \to Q_1b,$
$Q_3 \to Q_2a, Q_0 \to Q_2b, Q_3 \to Q_3a, Q_3 \to Q_3b\}$

(c) $G_c = (N_c, T, S_c, P_c)$

$N_c = \{Q_0, Q_1, Q_2, Q_3, Q_4\}$

$T = \{a, b\}$

$S_c = Q_0$

$P_c = \{Q_0 \to \lambda, Q_1 \to \lambda, Q_2 \to \lambda, Q_2 \to \lambda, Q_3 \to \lambda, Q_0 \to aQ_0, Q_0 \to bQ_1, Q_1 \to aQ_0, Q_1 \to bQ_2,$
$Q_2 \to aQ_3, Q_2 \to bQ_2, Q_3 \to aQ_4, Q_3 \to bQ_2, Q_4 \to aQ_4, Q_4 \to bQ_4\}$

$G_{c2} = (N_{c2}, T, S_cc2, P_{c2})$

$N_{c2} = \{Q_0, Q_1, Q_2, Q_3, Q_4, S\}$

$T = \{a, b\}$

$S_{c2} = Q_0$

$P_{c2} = \{Q_0 \to \lambda, S \to Q_0, S \to Q_1, S \to Q_2, S \to Q_3, Q_0 \to Q_0a, Q_1 \to Q_0b, Q_0 \to Q_1b, Q_2 \to Q_1b,$
$Q_3 \to Q_2a, Q_2 \to Q_2b, Q_4 \to Q_3a, Q_2 \to Q_3b, Q_4 \to Q_4a, Q_4 \to Q_4b\}$

Aufgabe 2:
Pumping-Lemma: $z = 10^{n_L}1^{n_L}\$10^{n_L-1}10^{n_L}$. Damit $z_i = uv^iwx^iy \in L_{bin-bin+1}$,
muss $|v| = |x|$ und $w = 1^a\$10^b$ mit $a, b \in \mathbb{N}$. Da $|vwx| \leq n_L$ und $|vx| \geq 1$, muss $v = 1^c, x = 0^c$ mit $c \geq 1$.
$\implies z_0 = 10^{n_L}1^{n_L-c}\$10^{n_L-(c+1)}10^{n_L} \notin L_{bin-bin+1} \implies L_{bin-bin+1}$ ist nicht kontextfrei.

Aufgabe 3:

(a) jkdas

(b) Beispiel aus der Vorlesung: $L = \{a^ib^jc^k \mid i = 0 \lor j = k\}$, Nicht-Regularität kann mit Präfix-Version nicht nachgewiesen werden.
Suffix-Version: $z = ab^{n_L}c^{n_L}, v = c^x, x \geq 1$, da $|vw| \leq n_L$. $\implies z_0 = ab^{n_L}c^{n_L-x} \notin L$