

Homework #5 due April 22 Tuesday before the recitation

(1) Let M be the PDA defined by $Q = \{q, q_0, q_1, q_2\}$, $\Sigma = \{a, b\}$, $\Gamma = \{a\}$, $F := \{q, q_1\}$.

$$\delta(q_0, a, Z_0) = \{(q, Z_0)\}$$

$$\delta(q, a, Z_0) = \{(q, aZ_0)\}$$

$$\delta(q, a, a) = \{(q, aa)\}$$

$$\delta(q, b, a) = \{(q_1, e)\}$$

$$\delta(q_1, b, a) = \{(q_1, e)\}$$

$$\delta(q_1, b, Z_0) = \{(q_2, e)\}$$

a) Describe the language accepted by M .

b) Trace all computations of the strings aab , abb , aba in M .

c) Show that $aaabb, aaab \in L(M)$.

(2) Construct PDAs that accept each of the following languages.

a) $\{a^i b^j \mid 0 \leq i \leq j\}$

b) $\{a^i c^j b^i \mid i, j \geq 0\}$

(c) $\{a^i b^j c^k \mid i+k = j\}$

(d) $\{a^i b^j \mid 0 \leq i \leq j \leq 2i\}$

f) $\{a^{i+j} b^i c^j \mid i, j > 0\}$

(3) $L = \{w \in \{a, b\}^* \mid \text{at least one prefix of } w \text{ contains strictly more } b\text{'s than } a\text{'s.}\}$.

For example, baa , abb , $abbbbaa$ are in L , but aab , $aabbab$ are not in L .

(a) Construct a PDA that accepts L by final state.

(b) Construct a PDA that accepts L by empty stack.

(4) From the main text *Exercises 6.2.6, 6.3.2, 6.3.4*