Types of exercises

The 'square'

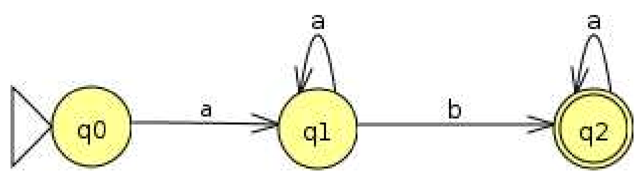
Given is $\Sigma = \{a, b\}$

Consider

$$L = \{a^n b a^m \mid n > 0,\ m \geq 0\}$$

$$e = aa^*ba^*$$

$M =$



$$G = \boxed{\begin{array}{lcl} S & \rightarrow & aA \\ A & \rightarrow & aA \mid bB \\ B & \rightarrow & aB \mid \lambda \end{array}}$$

Prove that $L = L(e) = L(G) = L(M)$

[Hint. Showing $L \subseteq L(e) \subseteq L(G) \subseteq L(M) \subseteq L$ suffices!]

The ‘triangle’

Given is $\Sigma = \{a, b\}$

Consider

$$L = \{w \in \Sigma^* \mid \#_a(w) = \#_b(w)\}$$

$M =$

$$G = \boxed{\begin{array}{lcl} S & \rightarrow & aA \mid bB \mid \lambda \\ A & \rightarrow & bS \mid aAA \\ B & \rightarrow & aS \mid bBB \end{array}}$$

(i) Prove that $L = L(G) = L(M)$

(ii) Prove that there is no regular expression e such that $L = L(e)$

Pumping Lemma

(i) Let $L = \{w \in \{a,b\}^* \mid \#_a(w) \text{ is even}\}$

Show that the conclusion of the pumping lemma for regular languages applies to L

(ii) Let $L = \{w \in \{a,b\}^* \mid \#_a(w) < \#_b(w)\}$

Show that the conclusion of the pumping lemma for regular languages does not apply to L

Transformations 3

Let $L = \{w \in \{a,b\}^* \mid \#_a(w)$ is even$\}$

(i) Construct a regular expression e such that $L(e) = L$

(ii) Construct a FDA M such that $L(M) = L$

(iii) Construct a grammar G such that $L(G) = L$

Transformations 2

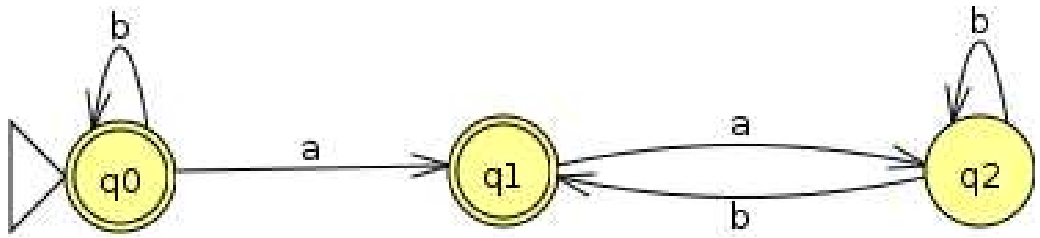
Let $L = \{w \in \{a, b\}^* \mid \#_a(w) < \#_b(w)\}$

(i) Construct a PDA M such that $L(M) = L$

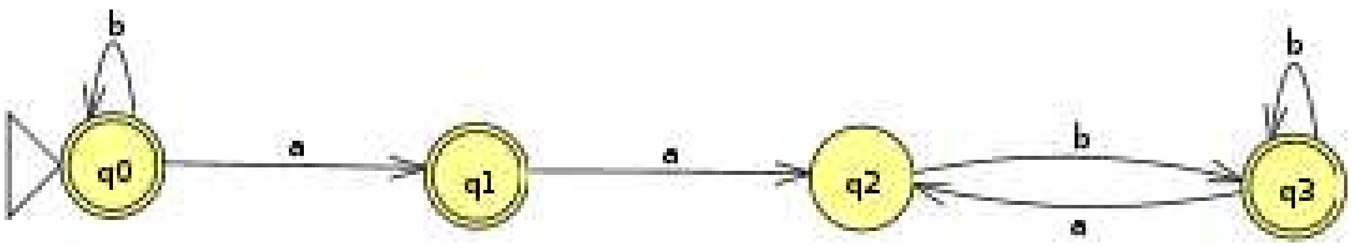
(ii) Construct a grammar G such that $L(G) = L$

(i) Let $e_1 = u^*(u \cup v)^*$ and $e_2 = (u \cup vu^*)^*$, where $u, v \in \Sigma^*$

Show that $L(e_1) = L(e_2)$

(ii) Let $M_1 =$ 

and

$M_2 =$ 

Show that $L(M_1) = L(M_2)$

Equivalences 2

(iii) Let $G_1 = \begin{array}{lll} S & \rightarrow & AB \\ A & \rightarrow & aA \mid \lambda \\ B & \rightarrow & bB \mid \lambda \end{array}$ and $G_2 = \begin{array}{lll} S & \rightarrow & AB \mid A \mid B \mid \lambda \\ A & \rightarrow & aA \mid a \\ B & \rightarrow & bB \mid b \end{array}$

Show that $L(G_1) = L(G_2)$