Lecture L&M 6

Pushdown Automata

6.1 Pushdown automata (PDA)

For each of the following languages L, give a PDA that accepts the language.

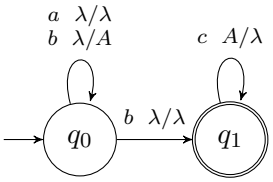
A. $L = \{a^i b^j \mid 0 \leq i \leq j\}$
(Give a small nondeterministic PDA and a deterministic PDA.)

B. $L = \{a^i b^j \mid 0 \leq i \leq j \leq 2i\}$

C. $L = \{a^i b^j \mid i \neq j\}$

D. Construct a PDA with $|\Gamma| \leq 2$ (i.e. there are only two different stack symbols) that accepts the language $L = \{wdw^R \mid w \in \{a, b, c\}^*\}$ (with alphabet $\Sigma = \{a, b, c, d\}$).

E. Consider the following pushdown automaton M:



(a) What are $\mathcal{L}(M)$, $\mathcal{L}_F(M)$ and $\mathcal{L}_E(M)$?
(b) Construct an automaton M_1 such that $\mathcal{L}_F(M_1) = \mathcal{L}_E(M_1) = \mathcal{L}(M)$
(c) Construct an automaton M_2 such that $\mathcal{L}(M_2) = \mathcal{L}_F(M)$
(d) Construct an automaton M_3 such that $\mathcal{L}(M_3) = \mathcal{L}_E(M)$

6.2 Conversion from CFG to PDA

F. Use the technique from the lecture to construct a PDA that accepts the language of the following grammar (which is in Greibach normal form):

$$S \to aABA \mid aBB$$
$$A \to bA \mid b$$
$$B \to cB \mid c$$

6.3 Conversion from CFG to GNF

Using the procedure from the lecture, transform the following grammars given in Chomsky normal form to Greibach normal form.

G.

$$S \to BB$$
$$A \to AA \mid a$$
$$B \to AA \mid BA \mid b$$

H. *(extra)*

$$S \to AB \mid BC$$
$$A \to AB \mid a$$
$$B \to AA \mid CB \mid b$$
$$C \to a \mid b$$

6.4 Operations on context-free languages

I. *(extra)* Prove that the set of context-free languages is closed under reversal.