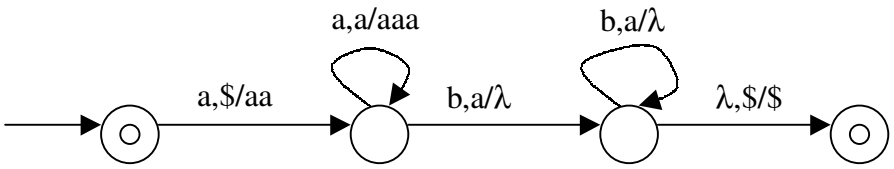
CSCI-2400 Models of Computation

Homework 4

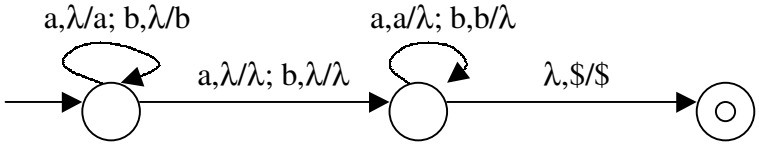
Problems

Remark: The notation a, b/c stands for a, b→c

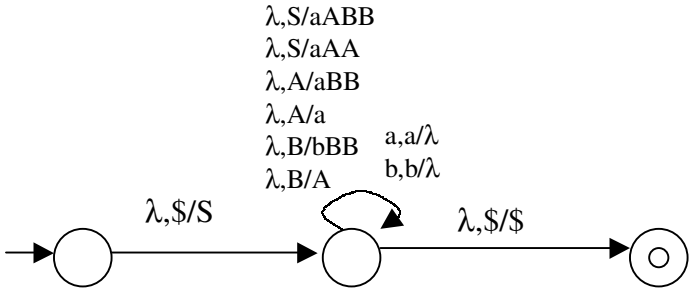
1. Find a NPDA that accepts L = $\{a^n b^{2n}: n \geq 0\}$.



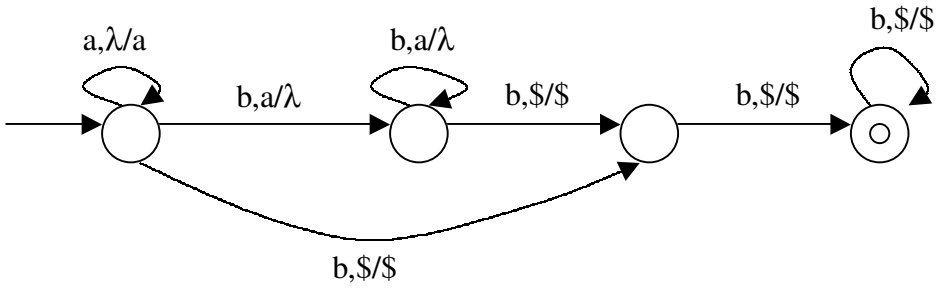
2. Find a NPDA that accepts L = $\{\omega\sigma\omega^R: \omega \in \{a,b\}^*, \sigma \in \{a,b\}\}$



3. Problem 5 one page 194



4. Problem 2 on page 199.



Since there is a DPDA that accepts L, L is deterministic.

5. Problem 17 on page 220.

We want to prove that the language $L = \{a^n b^n : n \geq 0 \text{ and } n \text{ is not a multiple of } 5\}$ is a context-free language.

Consider the following two languages:

$L_1 = \{w :$ w is made from a's and b's and the length of w is a multiple of ten$\}$

$L_2 = \{a^n b^n : n \geq 0\}$

Let L_1' denote the complement of L. We have that $L = L_1' \cap L_2$.

It is easy to see that L_1 is a regular language, since we can easily build a finite automaton with 10 states that accepts any string in this language.

Since L_1 is regular it must be that L_1' is regular too, since regular languages are closed under complement (Theorem 4.1).

The language L_2 is context-free (the grammar is: S->aSb | λ).
Therefore, the language $L = L_1' \cap L_2$ is also context-free, since context-free languages are closed under regular intersection (Theorem 8.5).