

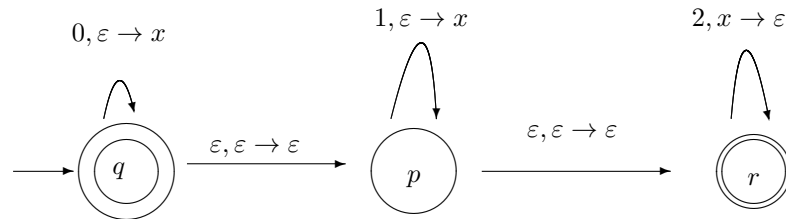
CS 420 Spring 2019
Homework 7

Due: March 27

1. Let G be the grammar

$$\begin{aligned} S &\rightarrow TaT \\ T &\rightarrow aTb|bTa|TT|\varepsilon \end{aligned}$$

- (a) Using the method from class, give a PDA M with $L(M) = L(G)$.
 - (b) Show an accepting computation for M on the string $ababbaa$ by giving a chart with the state, tape contents, and stack contents after each step.
2. Let M be the following PDA:



- (a) Convert M into a “special” PDA M' .
 - (b) Give the Case 2b rules when you convert M' into a CFG G using the method from class.
 - (c) Give a parse tree in G for the string 00122.
3. Use the Pumping Lemma to show that the following languages are not context-free.
 - (a) $\{a^n b^m c^n d^m | n, m \geq 0\}$.
 - (b) $\{a^n c^m b^n | n > m \geq 0\}$.
 - (c) $\{w \in \{a, b, c\}^* | n_a(w) = n_b(w) \text{ and } n_a(w) > n_c(w)\}$
[Here $n_x(w)$ means the number of occurrences of the symbol x in the string w .]
 - (d) $\{w \# t \# w^R | w, t \in \{a, b\}^* \text{ and } |w| = |t|\}$.
 4. What is the minimum value of p that works in the Pumping Lemma for the following context-free languages?
 - (a) $\{0^n 1^n 2^m 3^m | n, m \geq 0\}$.

(b) $\{x\#y \mid x, y \in \{0, 1\}^* \text{ and } |x| = 2|y|\}$.

5. Problem 2.18. [This problem has a solution in the book. You do not have to turn in a solution. I just want you to read and understand the solution given in the book.]