

Theoretical Computer Science II

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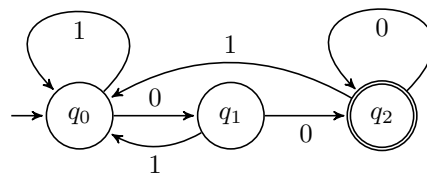
University of Freiburg
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Exercise Sheet 9

Due: January 9, 2012

Exercise 9.1 (Context-free grammars, 1 + 1 + 2 marks)

(a) Construct a context-free grammar for the following DFA:



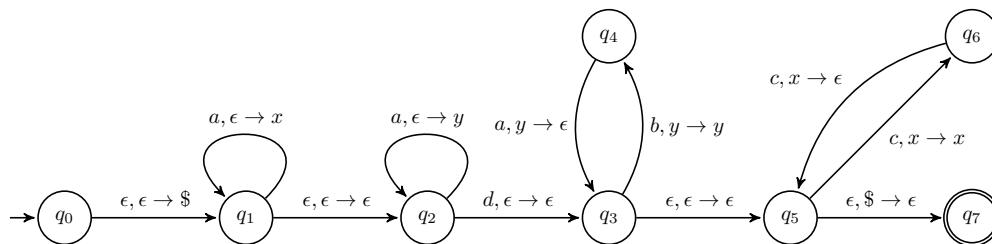
(b) Show that the grammar $(\{S\}, \{a, b\}, R, S)$ with rules $R = S \rightarrow aS \mid aSbS \mid \epsilon$ is ambiguous.

(c) Give a grammar in Chomsky Normal Form that generates the same language as the grammar $G = (V, \Sigma, R, S)$ with $V = \{S, X, Y\}$, $\Sigma = \{a, b, c\}$, and R being the following set of rules:

$$\begin{aligned}
 S &\rightarrow XY \\
 X &\rightarrow abb \mid aXb \mid \epsilon \\
 Y &\rightarrow c \mid cY
 \end{aligned}$$

Exercise 9.2 (Pushdown Automata, 1 + 2 marks)

Consider the following PDA:



(a) Show that the PDA accepts the word $aaadbabacc$ by giving an accepting sequence of steps (similar to the right-hand side of slide 31).

(b) Which language L does the given PDA accept?

Exercise 9.3 (Pushdown Automaton, 3 marks)

Create a PDA that recognizes the following language.

$$L = \{a^i b^j c^k \mid i = j \text{ or } j = k\}$$