UNIVERSITY OF HELSINKI
Department of Computer Science
P.O. Box 68 (Gustaf Hällströmin katu 2b)
00014 UNIVERSITY OF HELSINKI

581330-2 Models for Programming and Computing

Exercise 6 (28.2-4.3.2005)

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1. Transform the grammar

$$\begin{aligned} S &\rightarrow (S) \mid A \\ A &\rightarrow SS \mid \epsilon \end{aligned}$$

   into Chomsky normal form. Show also the intermediate stages.

2. Simulate the CYK-algorithm when it solves whether the strings $aaaa$ and $aaaaaaa$ are produced by the following grammar:

$$\begin{aligned} S &\rightarrow AB \mid BC \\ A &\rightarrow BA \mid a \\ B &\rightarrow CC \mid b \\ C &\rightarrow AB \mid a \end{aligned}$$

   In positive cases show also a parse tree for the string.

3. Simulate the CYK-algorithm when it solves whether the strings 11001 and 00110 are produced by the following grammar:

$$\begin{aligned} S &\rightarrow AS \mid 1 \\ A &\rightarrow SA \mid 0 \end{aligned}$$

   In positive cases show also a parse tree for the string.

4. Construct a push-down automaton for recognizing the following languages:
   (a) $\{wcw^R \mid w \in \{a,b\}^*\}$
   (b) $\{w \in \{a,b\}^* \mid w$ contains as many as and bs $\}$

5. (a) Use the methods presented on the course to construct an ϵ-automaton that corresponds to the regular expression $(aa \cup bb)^*$.
   (b) Construct a non-deterministic automaton (without ϵ-transitions) that corresponds to the automaton in part (a).
   (c) Determinize the end result of part (b).
   (d) Minimize the end result of part (c).

6. Fill in the "Kurssikysely" question sheet that can be found at `http://ilmo.cs.helsinki.fi/kurssit/servlet/Valinta`. The questions are in Finnish. If you have trouble understanding them, ask a Finnish-speaking co-student or the lecturer at the exercise session.