Resit Automata & Complexity

VU, 10 June 2015, 18:30-21:15

(This exam consists of 90 points in total; every student gets 10 points bonus.)

(At the exam, copies of slides can be used, without handwritten comments. The textbook by Linz, handouts, and laptop are not *allowed!)*

1. Let L be the language of all strings over $\{0,1\}$ that do *not* contain the substring 01 or 10.

   (a) Give the minimal dfa that accepts L. (6 pts)

   (b) Construct from this dfa a regular expression that describes L. (Give all intermediate steps in the construction!) (12 pts)

2. Check using the string matching algorithm whether *baabbabaab* contains a substring that is in $L((bb + ab)^*aa)$.

   (Describe the entire construction: the corresponding nfa, and the on-the-fly construction of the corresponding dfa.) (12 pts)

3. Consider the following context-free grammar G:

$$\begin{array}{lcl} S & \rightarrow & AAA \mid BAB \mid B \mid \lambda \\ A & \rightarrow & AB \mid BA \mid a \\ B & \rightarrow & BA \mid b \end{array}$$

   (a) Eliminate the λ-production and the unit-production, en reduce the resulting grammar to Chomsky normal form. (7 pts)

   (b) Determine using the CYK algorithm whether *ababb* is in $L(G)$. (10 pts)

4. Consider the language $L = \{a^n b^m \mid n, m \geq 0, n \neq m\}$.

   (a) Give a non-deterministic pushdown automaton that accepts L. (10 pts)

   (b) Is L deterministic context-free? (7 pts)

5. Give a context-sensitive grammar for the language

$$\{ww \mid w \in \{a, b\}^+\}$$

(12 pts)

6. Let $f : \{0, 1\}^2 \to \{0, 1\}^2$ be defined as follows:

$$\begin{array}{rcrcl} f(00) & = & f(10) & = & 00 \\ f(01) & = & f(11) & = & 01 \end{array}$$

Perform Simon's algorithm to determine a linear dependency for the digits of $s = 10$. (Give one possible scenario.) (14 pts)