Exam Theory of Automata and Processes (2IT15)

26 August 2009, 14.00 –17.00

Faculteit Wiskunde en Informatica
Technische Universiteit Eindhoven (TU/e)

This is a "closed book" exam. The parts add up to 100 points, the grade is obtained by dividing the total number of points by 10. Results obtained on midterm exams do not count. *Motivate your answers!*

Assignment 1 . We have the alphabet $\mathcal{A} = \{a, b, c\}$. Given is the language over $\mathcal{A}$

$$L = \{wcw \mid w \in \{a, b\}^*\}.$$

a. Using the pumping lemma for context-free languages, show that this language is not context-free.

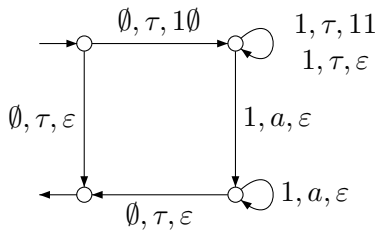
b. Give a Turing machine that accepts this language.

(25 points)

Assignment 2 . Consider the push-down automaton in the picture below.

a. For this push-down automaton, determine the transition system of all its executions.

b. Reduce this transition system with respect to branching bisimulation, by removing all inert τ-steps.



c. Is the resulting transition system finitely branching or infinitely branching?

(25 points)

Assignment 3 . The experimentor E tosses a coin until heads comes up. Then, he can stop or start over. Outcomes are communicated to the receptor R along port c. There are the following specifications.

$$\begin{aligned} E &= toss.(\tau.c!tails.E + \tau.c!heads.(\mathbf{1} + E)) \\ R &= c?tails.R + c?heads.yes.\mathbf{1} \\ S &= \tau_c(\partial_c(E \| R)). \end{aligned}$$

a. Draw the transition system of S.

b. Is there a deadlock in this transition system? If so, where?

c. Reduce this transition system with respect to branching bisimulation, by removing all inert τ-steps.

(25 points)

Assignment 4 . Let L be a deterministic context-free language, and let L' be a regular language. Show that $L \cap L'$ is a deterministic context-free language. (25 points)