Second Midterm Exam Theory of Automata and Processes (2YT15)

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This is a "closed book" exam. The parts add up to 50 points, the grade is obtained by dividing the total number of points by 5. *Motivate your answers!*

Assignment 1 . Given is the following context-free language:

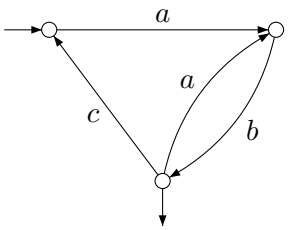
$$L = \{a^n b^k c^n \mid k, n \geq 0\}.$$

a. Give a recursive specification over Sequential Algebra that generates this language. Use S for the initial variable. Give derivations for $S \gtrsim \mathbf{1}$ and $S \gtrsim a.b.c.\mathbf{1}$.

b. Give a pushdown automaton that has this language.

(12 points)

Assignment 2 . Given is the following automaton.



a. Give a linear recursive specification for this automaton.

b. Give an iteration expression that is language equivalent to this automaton.

(11 points)

Assignment 3 Consider the following recursive specification.

$$\begin{aligned} S &= a.S \cdot T + b.\mathbf{1} \\ T &= c.\mathbf{1} \end{aligned}$$

Using the operational rules, give the transition system for S. Argue why S is not a regular process. (11 points)

Assignment 4 . Two students A, B are always talking on the telephone, unless they sleep. Define

$$\begin{aligned} A &= i?call.i!talk.(i?talk.i!talk.\mathbf{1})^* \cdot sleep.A \\ B &= i!call.i?talk.(i!talk.i?talk.\mathbf{1})^* \cdot sleep.B \end{aligned}$$

a. Determine the automaton for A and for B that is generated by the operational rules.

b. Give an automaton for $\partial_i(A \| B)$. You may use laws and bisimulation to simplify the automaton.

c. Give an automaton for $\tau_i(\partial_i(A \| B))$. You may use laws and branching bisimulation to simplify the automaton.

(16 points)