First Midterm Exam Theory of Automata and Processes (2XT15)

14 March 2009, 9.00 –10.30

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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 . Consider the language of all strings over the alphabet $\{a, b\}$ that contain at least one a and at most one b. Draw an automaton that accepts this language. (10 points)

Assignment 2 . Given is the following recursive specification:

$$\begin{aligned} S &= a.(C + D) + a.(C + E) \\ T &= a.(C + D + E) \\ C &= \tau.(D + E) \\ D &= b.d.\mathbf{1} \\ E &= b.e.\mathbf{1} \end{aligned}$$

Draw the finite automaton of S and of T separately. Are these two automata branching bisimilar? If so, show a branching bisimulation, if not, argue why not. (13 points)

Assignment 3 . In this assignment, we use alphabet $\mathcal{A} = \{a, b\}$. Given is the following recursive specification with initial variable S

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

Draw a deterministic automaton that accepts the language generated by this specification. (13 points)

Assignment 4 . Show, by using the pumping lemma, that the language

$$\{w \in \{a, b\}^* \mid \#_a(w) < \#_b(w)\}$$

is not regular. (14 points)