RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

LEHRSTUHL FÜR INFORMATIK 2
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Introduction to Model Checking
Summer term 2010

– Series 4 –

Hand in on May 19 before the exercise class.

Exercise 1 (5 points)

Let $AP = \{a, b\}$ and let P be the LT property of all infinite words $\sigma = A_0 A_1 A_2 \cdots \in \left(2^{AP}\right)^\omega$ such that there exists $n \geq 0$ with $a \in A_i$ for $0 \leq i < n$, $\{a, b\} = A_n$ and $b \in A_j$ for infinitely many $j \geq 0$. Provide a decomposition $P = P_{safe} \cap P_{live}$ into a safety and into a liveness property.

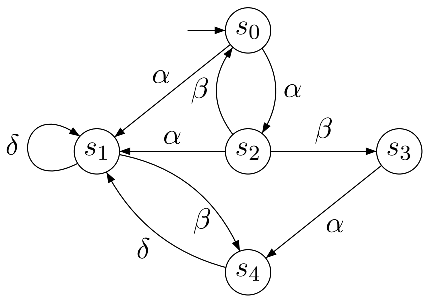
Exercise 2 (1 + 1 + 1 points)

Consider the transition system TS on the right (where atomic propositions are omitted). Decide which of the following fairness assumptions $\mathcal{F}_i$ are realizable for TS. Justify your answers!

a) $\mathcal{F}_1 = (\{\{\alpha\}\}, \{\{\delta\}\}, \{\{\alpha, \beta\}\})$

b) $\mathcal{F}_2 = (\{\{\alpha, \delta\}\}, \{\{\alpha, \beta\}\}, \{\{\delta\}\})$

c) $\mathcal{F}_3 = (\{\{\alpha, \delta\}, \{\beta\}\}, \{\{\alpha, \beta\}\}, \{\{\delta\}\})$



Exercise 3 (1 + 1 points)

Let $n \geq 1$. Consider the language $L_n \subseteq \Sigma^*$ over the alphabet $\Sigma = \{A, B\}$ that consists of all finite words where the symbol B is on position n from the right, i.e., L_n contains exactly the words $A_1 A_2 \ldots A_k \in \{A, B\}^*$ where $k \geq n$ and $A_{k-n+1} = B$. For instance, the word $ABBAABAB$ is in L_3.

a) Construct an NFA $\mathcal{A}_n$ with at most $n + 1$ states such that $\mathcal{L}(\mathcal{A}_n) = L_n$.

b) Determinize this NFA $\mathcal{A}_n$ using the powerset construction algorithm.