Model Checking WS 2011: Assignment 1

Institute for Formal Models and Verification, JKU Linz

Due 13.10.2011

Exercise 1

Let $Q := (S_Q, I_Q, \Sigma_Q, T_Q, F_Q)$ be a finite automaton where $S_Q := \{A, B, C\}$, $I_Q := \{A\}$, $\Sigma_Q := \{a, b\}$, $T_Q := \{(A, b, B), (B, a, B), (B, a, C), (C, b, C), (C, b, A)\}$ and $F_Q := \{A\}$.

Let $R := (S_R, I_R, \Sigma_R, T_R, F_R)$ be a finite automaton where $S_R := \{1, 2, 3\}$, $I_R := \{1\}$, $\Sigma_R := \{a, b\}$, $T_R := \{(1, b, 2), (1, b, 3), (2, b, 2), (3, a, 3), (3, a, 2)\}$ and $F_R := \{1\}$.

Draw the product automaton $P := Q \times R$ for automata Q and R as defined above.

Exercise 2

For finite automaton A as defined below, check if A is deterministic, complete and if $L(K(A)) = \overline{L(A)}$ holds. Justify your answers.

a) Let $A := (S, I, \Sigma, T, F)$ be a finite automaton where $S := \{A, B\}$, $I := \{A\}$, $\Sigma := \{a, b\}$, $T := \{(A, a, B), (A, b, B), (B, a, B), (B, b, B), (B, a, A)\}$ and $F := \{A\}$.

b) Let $A := (S, I, \Sigma, T, F)$ be a finite automaton where $S := \{A, B\}$, $I := \{A\}$, $\Sigma := \{a, b\}$, $T := \{(A, b, B), (B, b, B), (B, a, A)\}$ and $F := \{A\}$.

Exercise 3

Let $A := (S, I, \Sigma, T, F)$ be a finite automaton where $S := \{A, B, C, D\}$, $I := \{A\}$, $\Sigma := \{0, 1\}$, $T := \{(A, 0, B), (A, 0, D), (A, 1, D), (B, 0, C), (C, 1, A), (D, 0, B), (D, 0, D)\}$ and $F := \{C\}$.

Draw the power automaton $\mathbb{P}(A)$. Is $\mathbb{P}(A)$ deterministic and complete? How many states could $\mathbb{P}(A)$ have theoretically? Justify your answers.

Exercise 4

Let A and B be two finite automata and $P := A \times B$ the product automaton of A and B. Do the following two statements hold? If so then give a proof sketch for the claim. Otherwise, provide a *concrete* counterexample, i.e. concrete A, B and P refuting the claim.

a) If both A and B are deterministic then P is deterministic.

b) If P is deterministic then both A and B are deterministic.