Applied Automata Theory (SS 2011)	Out: Wed, May 25 Due: Wed, June 1

Exercise Sheet 6

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Exercise 6.1

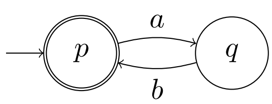
Let A be a Büchi automaton and $U, V \subseteq \Sigma^*$ be equivalence classes with respect to $\sim_A$.

(a) Let $w \in \mathsf{L}(A)$ and $w \in UV^\omega$. Then $UV^\omega \subseteq \mathsf{L}(A)$.

(b) Suppose $w \in \overline{\mathsf{L}(A)}$ and $w \in UV^\omega$. Then $UV^\omega \subseteq \overline{\mathsf{L}(A)}$.

Exercise 6.2

Consider the following NBA A:



Determine the languages $L_{q,q}$ and $L_{q,q}^{\mathsf{fin}}$ and calculate the index (i.e., the number of equivalence classes) of $\sim_A$.

Exercise 6.3 (Disjunctive Well-Foundedness)

A partially ordered set $(A, \leq)$ is said to be *well-founded* if for every sequence

$$a_1 \geq a_2 \geq a_3 \geq \cdots ,$$

$a_i \in A$, $i \in \mathbb{N}$, there is an $n \in \mathbb{N}$ such that $a_m = a_n$ for any $m \geq n$. Let $T_1, \ldots, T_n \subseteq A \times A$ be well-founded partial orders and $R \subseteq A \times A$ be a partial order such that $R \subseteq T_1 \cup \cdots \cup T_n$. Show that R is well-founded too. *Hint:* Use Ramsey's Theorem.

Exercise 6.4

Consider the program

$$(\texttt{x} := 5;\ \textbf{while}\ \ x > 0\ \ \textbf{do}\ \ \texttt{x} := \texttt{x} - \texttt{1}\ \ \textbf{end})\ ||\ (\texttt{y} := \texttt{7};\ \texttt{z} := \texttt{3}),$$

in which || stands for concurrent execution.

(a) Describe how this program can be translated into a finite automaton that simulates its behaviour.

(b) Draw 5 states of the automaton together with the edges connecting them.