Applied Automata Theory (WS 2012/2013) Technische Universität Kaiserslautern

Exercise Sheet 13

Jun.-Prof. Roland Meyer, Reiner Hüchting, Georgel Călin Due: Tue, Jan 29 **(noon)**

Exercise 13.1 Finite Hedge Automata

Consider the NHA $A = (Q, \Sigma, Q_F, \to)$ over $\Sigma = \{\wedge, \vee, \neg, 0, 1\}$ with $Q = \{q_0, q_1\}$, $Q_F = \{q_1\}$ and such that

$$\to_0 q_0 \qquad q_0 \to_\neg q_1 \qquad Q^* q_1 Q^* \to_\vee q_1 \qquad q_1 q_1^* \to_\wedge q_1$$
$$\to_1 q_1 \qquad q_1 \to_\neg q_0 \qquad q_0 q_0^* \to_\vee q_0 \qquad Q^* q_0 Q^* \to_\wedge q_0$$

Pick two unbalanced trees (t_1 and t_2) with 9 nodes and branching degree (of each node) in $\{2, 3\}$ such that (i) they differ in one leaf label, and (ii) $t_1 \in L(A)$ and $t_2 \notin L(A)$.

Apply the membership algorithm for NHA to establish $t_1 \in L(A)$ and $t_2 \notin L(A)$.

Exercise 13.2 XML Validation

(a) Create an XML document containing information about a collection of 3 books. A book has the following attributes: *author(s)* (at least 1), *title*, *publisher*, *ISBN*, *year*, and possibly a *series*. We want to store information about each author's *name*, *year of birth*, and *city*. Finally, a publisher has the attributes *name* and *city*.

(b) Give a DTD specification for book collections and use it to validate your document.

Exercise 13.3 Parity Games: Strategy

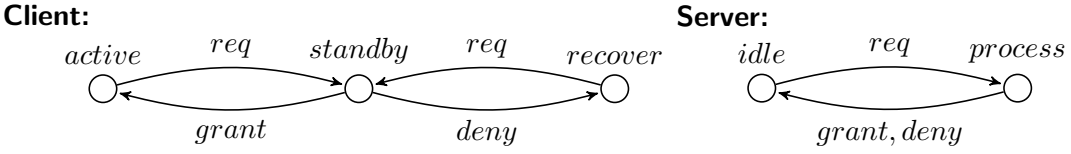
In the handwritten notes you find the proof of the following lemma:

> Let $i \in \{A, P\}$, $G = (Pos_A, Pos_P, \to \Omega)$ be a parity game, and $U \subseteq Pos$ such that i has a positional winning strategy s_p from every $p \in U$.
> Then there is a single positional strategy s of i that wins from every $p \in U$.

Give a rigorous argument to why the s defined in the proof is winning from all $p_i \in U$.

Exercise 13.4 Construction of Parity Games, Attractors

(a) Consider the following automata, describing a client server system where the client can request resources and the server may grant or deny them:



Transform this system into a parity game that is won by the client if it can reach its *active* state infinitely often.

(b) Compute the attractor of a for player A for the following game: