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Problem Set 10
Discussions: July 1th, 2015

**Automata, Games, and Verification**

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Please send a mail to `agv15@react.uni-saarland.de` if you can't make it to the discussion session.

1. **LTL to Alternating Büchi** (presented by Group 10)

   Construct an alternating Büchi automaton $\mathcal{A}$ such that $\mathcal{L}(\mathcal{A}) = \mathcal{L}((\Diamond p)\,\mathcal{U}(\Box q))$. Use the construction from the lecture to obtain $\mathcal{A}$.

2. **LTL to Alternating co-Büchi** (presented by Group 14)

   Give a construction to translate an LTL formula $\varphi$ into an alternating co-Büchi automaton $\mathcal{A}_\varphi$ and prove that $\mathcal{L}(\varphi) = \mathcal{L}(\mathcal{A}_\varphi)$. The number of states of $\mathcal{A}_\varphi$ should not increase more than linear in the number of subformulas of $\varphi$.

3. **Alternating Muller Automata** (presented by Group 09)

   Prove or give a counter example to the following statement: If an alternating Muller automaton $\mathcal{A}$ accepts some word $\alpha \in \Sigma^\omega$, then there is an accepting *memoryless* run tree of $\mathcal{A}$ on $\alpha$.

4. **Very Weak Alternating Büchi Automata** (presented by Group 07)

   A very weak alternating automaton $\mathcal{A}$ is an alternating automaton whose transition relation describes a DAG equipped with possibly additional self loops, i.e., there is some total ordering $\preceq$ on the states of $\mathcal{A}$ such that from every state $q$ only states $q'$ with $q \preceq q'$ are reachable (including $q$ itself).

   Prove or give a counter example to the following statement: Each language recognizable by some very weak alternating Büchi automaton is non-counting.

5. **Alternating Büchi vs. Alternating co-Büchi Automata (Challenge)**

   Prove or give a counter example to the following statement: An $\omega$-language $L$ is recognizable by some alternating Büchi automaton if and only if $L$ is recognizable by some alternating co-Büchi automaton.