Mathematical Structures in Formal Methods, *MSFM*
Handout for Lecture 12 (2018/8/2)

Ichiro Hasuo, NII/SOKENDAI, Tokyo, Japan `http://group-mmm.org/~ichiro`

1 Today's Lecture

Parity games, synthesis.

Final Report Assignment

Logistics

- Due: Friday 24 August 2018 (Anywhere on Earth)
- Submit electronically
  - To: `i.hasuo [at] acm.org` *and* `soichi [at] is.s.u-tokyo.ac.jp` (Soichiro Fujii, TA).
  - Title: "MSFM Final Report Assignment" (we filter messages)
- Remember: *plagiarism does not pay off*

Question 1.

Answer *one* of the following questions.

1. State and prove the Myhill–Nerode theorem on DFAs.
2. Prove memoryless determinancy of parity games. The result is cited as Theorem 1 in the following paper.

   > Jurdzinski M. (2000) Small Progress Measures for Solving Parity Games. In: Reichel H., Tison S. (eds) STACS 2000. STACS 2000. Lecture Notes in Computer Science, vol 1770. Springer, Berlin, Heidelberg

3. Describe the *automata learning* algorithm from the following paper.

   > D. Angluin. Learning regaular sets from queries and counterexamples. Information and Computation, 75 (1987), pp. 87–106

4. **(Added after the last lecture)** Choose a problem that you believe is at least as challenging and relevant as the above ones, and solve it. You can ask the lecturer (Ichiro Hasuo) if you are not sure about the relevance of your problem.

Question 2.

Implement an algorithm that solves *one* of the following problems.

1. Given two Büchi automata A_1 and A_2, decide if $L_\omega(A_1) \cap L_\omega(A_2)$ is empty or not.
2. Given an LTL formula φ, return a (*not* alternating) Büchi automaton A_φ that recognizes the language $\{w \in (2^{\mathrm{AP}})^\omega \mid w \models \varphi\}$.
3. Given a parity game, return its winner and her winning strategy.
4. **(Added after the last lecture)** Choose a problem that you believe is at least as challenging and relevant as the above ones, and implement an algorithm that solves it. You can ask the lecturer (Ichiro Hasuo) if you are not sure about the relevance of your problem.