

ITT8040 Cellular Automata

Assignment 6

April 26, 2013

Read pages 54–75 of Prof. Kari’s notes.

1. A *fixed point* for a cellular automaton with global function G is a configuration c such that $G(c) = c$. Prove that it is undecidable whether an arbitrary two-dimensional cellular automaton has a fixed point. *Hint:* use a reduction from the tiling problem.
2. Let $\Gamma = \{\mathbf{0}, \mathbf{1}\}$ where $\mathbf{0}$ is a blank symbol and $\mathbf{1}$ is a dash. Consider the *unary encoding* of natural numbers over Γ , where the number n is represented by a sequence of $n + 1$ consecutive dashes. Construct a Turing machine that, starting from a tape containing a finite sequence of (encodings of) natural numbers, terminates in the accepting state with the tape containing a single sequence of dashes, encoding the sum of the given numbers. *Hint:* modify the Turing machine we described at the end of lecture 8.

Soft deadline: **May 8, 2013**

Hard deadline: **May 15, 2013**