# ITT8040 Cellular Automata
# Assignment 5

April 17, 2013

Read pages 41–54 of Prof. Kari's notes.

1. Let $A = (S, 1, N, f)$ be a one-dimensional cellular automaton with global function $G$. Prove the following:

   (a) Every spatially periodic point has a spatially periodic preimage.

   (b) If $A$ has a fixed point (that is, a configuration $c : \mathbb{Z} \to S$ such that $G(c) = c$) then it also has a spatially periodic fixed point.

   *Hint:* use the labeled de Bruijn graph of $A$.

2. Let $S$ be a semi-algorithm for the problem $P$. Suppose that there exists a function $f$ with nonnegative integer values, defined on all instances $x$ of $P$, such that, if $S$ halts on $x$, then it does in at most $f(x)$ steps. Suppose that there exists an algorithm $A$ that, given any instance $x$ of $P$, returns the value $f(x)$. Prove that $P$ is decidable.

Soft deadline: **April 24, 2013**
Hard deadline: **April 30, 2013**