

Assignment 1

Fall 2014

Due at 23:59 on Friday 21–11–2014

Requirements: Assignments have to be handed in by each student separately. Please write your name and student number on the top of the first sheet that you hand in. Remember that assignments have to be typeset in English and submitted through the peach system. **Always justify your answers!**

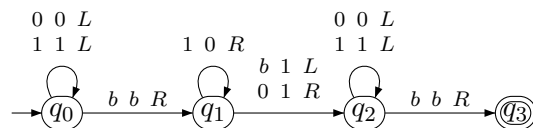
You can score 20 points in total for this assignment; your grade will be the number of points you score divided by two.

Problem 1: [3 points] Give a finite automaton that accepts the language consisting of all sequences over a, b, c that do not contain the pattern ac and in which the number of b 's is even.

Problem 2: [3 points] Give a finite automaton that accepts the language denoted by the regular expression $a(bb)^*a$.

Problem 3: [4 points] There is a finite automaton with three states that accepts the same language as Automaton 4 of the Exploratory Assignment at <http://www.win.tue.nl/~wstomv/edu/2is80/explore-automata/>. Determine this automaton by systematic exploration.

Problem 4: [3 points] Consider the following Turing machine, in which b stands for blank:



Initially the tape contains 110101 and the machine reads the leftmost 1. Describe the computation of the Turing machine and determine the content of the tape when the final state has been reached.

Problem 5: [7 points]

- (a) Give the state transition diagram of a Turing machine that inverts an arbitrary sequence of 0's and 1's, while keeping the original. More precisely, if the tape content is BwE for some sequence w of 0's and 1's, then after finitely many steps the Turing machine should end in the final state while the tape content is $BwE\bar{w}$, where \bar{w} is the sequence obtained from w by replacing every 0 by a 1 and every 1 by a 0. For instance, starting in $B0100011E$ the computation should end in the final state while the tape content is $B0100011E1011100$.
- (b) Describe the working of your Turing machine with an algorithm.