Compiler Design

Spring 2010

Homework 1

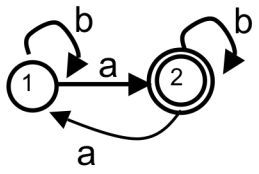
Due *Wednesday*, *Jan. 27*, 2010 at 3.30 PM in class

Please label all pages you turn in with your name and student number.

Problem 1 [40 points]: Consider the alphabet $\Sigma = \{a,b\}$.

a) Construct a Non-Deterministic-Finite Automaton (NFA) using the Thompson construction that is able to recognize the sentences generated by the regular expression RE = (ab)*.(a)*.
b) Do the sentences w_1 = "abaa" and w_2 = "aaa" belong to the language generated by this regular expression? Justify.
c) Convert the NFA in part a) to a DFA using the subset construction. Show the mapping between the states in the NFA and the resulting DFA.
d) Minimize the DFA using the iterative refinement algorithm discussed in class. Show your intermediate partition results and double check the DFA using the sentences w_1 and w_2.

Problem 2 [30 points]: Consider the DFA below with starting state 1 and accepting state 2:



a) Describe in English the set of strings accepted by this DFA.
b) Using the Kleene construction algorithm derive the regular expression recognized by this automaton symplifying as much as possible.

Problem 3 [10 points]: Given a regular language L. *i.e.,* a language described by a regular expression, prove that the reverse of L is also a regular language (**Note**: the reverse of a language L is L^R where for each word w in L, w^R is in L^R. Given a word w over the given alphabet, w^R is constructed by spelling w backwards).

Problem 4 [20 points]: Draw the DFA capable of recognizing the set of all strings beginning with a 1 which interpreted as the binary representation of an integer (assuming the last digit to be processed is the least significant) is congruent to zero modulo 3 *i.e.*, the numeric value of this binary representation is a multiple of 3.