CSCI565 - Compiler Design

Spring 2011

Homework 1

Due Wednesday, Jan. 26, 2011 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 $w_1 = \text{“aba”}$ and $w_2 = \text{“aab”}$ 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:

![DFA Diagram]

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 simplifying as much as possible.

Problem 3 [10 points] Let $L$ be a regular language over a finite alphabet $\Sigma$. Show that the language consisting of all strings not in $L$ over the same alphabet is also regular.

Problem 4 [20 points]: Draw a DFA capable of recognizing the set of all binary-valued string (i.e., over the alphabet $\Sigma = \{0, 1\}$) which when interpreted as a decimal number correspond to multiples of 4. Note than the string may have an arbitrary number of leading zero characters.