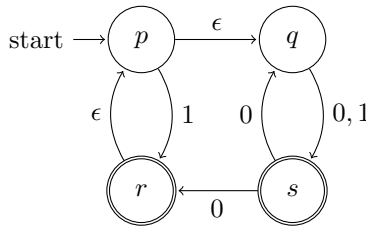

CS 374 LAB 5: REGULAR EXPRESSIONS, NFAs, AND DFAs

Date: February 3, 2016.

Problem 1. [Category: Design] Consider the NFA below.



Construct a DFA that accepts the same language, using the techniques discussed in class. The states of the deterministic machine should be sets of states of the nondeterministic machine. Construct only the reachable part of the automaton. Put your answers in the table below. Indicate the starting state of the DFA.

state	input 0	input 1	accepting?
{ }			
{p, q, r, s}			

Problem 2. [Category: Design] Construct a DFA for the language $L = \overline{\mathbf{L}((01 + 10)^*(\epsilon + 0 + 1))}$ by the following steps.

1. Construct an NFA for $\mathbf{L}((01 + 10)^*(\epsilon + 0 + 1))$ by following the inductive translation from regular expressions to NFAs.
2. **To think about at home:** Convert the NFA constructed in step 1 into a DFA. Construct only the reachable part of the automaton.
3. **To think about at home:** Complement the DFA in step 2 obtain a DFA for language L .

Problem 3. [Category: Design] Fix some alphabet Σ . For a given language $L \subseteq \Sigma^*$, define the following three languages.

$$\begin{aligned} \text{PREFIX}(L) &= \{u \in \Sigma^* \mid \exists w \in \Sigma^* \text{ such that } uw \in L\} \\ \text{SUFFIX}(L) &= \{u \in \Sigma^* \mid \exists w \in \Sigma^* \text{ such that } wu \in L\} \\ \text{MID}(L) &= \{y \mid \exists x, z \in \Sigma^* \text{ such that } xyz \in L\} \end{aligned}$$

Show that $\text{PREFIX}(L)$, $\text{SUFFIX}(L)$ and $\text{MID}(L)$ are regular if L is regular. A useful technique here is to construct an NFA N that accepts each of these languages assuming that there is a DFA M that accepts L . More concretely, assume $M = (Q, \Sigma, \delta, s, A)$. Describe an NFA $N = (Q', \Sigma, \delta', s', A')$ where each of Q', δ', s', A' are defined in terms of Q, δ, s, A and potentially some additional information.