CS 374 Lab 5: Regular Expressions, NFAs, and DFAs

Date: January 30, 2018.

Problem 1. [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. Convert the NFA constructed in step 1 into a DFA. Construct only the reachable part of the automaton.
3. Complement the DFA in step 2 obtain a DFA for language L.

Problem 2. [Category: Design] Fix some alphabet Σ. For a given language $L \subseteq \Sigma^*$, define the following three languages.

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

Show that PREFIX(L), SUFFIX(L) and 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.