Homework 2

CptS 317, Spring 2021

Due Date: February 10, 2021 by 11:59pm Pacific.

To be submitted on Canvas.

1. Build NFAs for the following two languages.

   a) The set of strings over the alphabet $\{c, e, g\}$ such that the last symbol in the string has appeared before.

   b) The set of strings over the alphabet $\{c, e, g\}$ such that the last symbol in the string has *not* appeared before.

   You can assume that neither of these two languages contain ϵ in them.

2. Show that if M is a DFA that recognizes language B, swapping the accept and nonaccept states in M yields a new DFA recognizing the complement of B.

3. Each of the following languages is the **intersection** of two simpler languages. In each part, construct DFAs for the simpler languages, then combine to give the state diagram of a DFA for the language given. In all parts, $\Sigma = \{0, 1\}$.

   a) $\{w | w$ has at least three 0's and at least two 1's$\}$

   b) $\{w | w$ has an even number of 0's and one or two 1's$\}$

   c) $\{w | w$ starts with a 0 and has at most one 1$\}$

4. Give state diagrams of NFAs with the specified number of states recognizing each of the following languages. In all parts, the alphabet is $\{0, 1\}$.

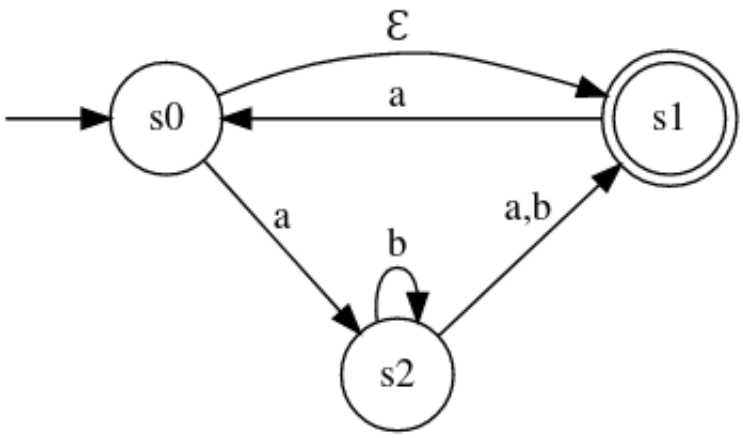
   (a) $\{w | w$ contains an even number of 0's, or contains exactly two 1's$\}$ with six states.

   (b) The language $0^*1^*0^+$ with three states.

   (c) The language $\{\epsilon\}$ with one state.

   As a reminder, part b uses regular expression notation. A symbol followed by * occurs 0 or more times, while $^+$ indicates it should occur 1 or more times.

5. Convert the following NFA to an equivalent DFA:



6. Give regular expressions generating the following languages. In all cases, the alphabet is $\{0, 1\}$.

   a) $\{w | w$ contains at least three 1s$\}$

   b) $\{w | w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$

   c) $\{w |$ the length of w is at most 5$\}$

   d) $\{w | w$ is any string except 11 and 111$\}$