CECS 329, Writing Assignment 2, Due 8:00 am, April 25th, 2024, Dr. Ebert

Directions

1. Make sure your name is on all pages.
2. This assignment has four problems. Solve each problem using one or more sheets, but do *not* write solutions to different problems on the same sheet.
3. Order pages so that solutions are presented in their original numerical order.
4. Please do *not* staple or fold corners of pages since your pages will be placed in different problem stacks.
5. Show all necessary work and substantiate all claims.
6. Plagiarizing the work of another student or using a solution found on the internet will result in a final course grade of "F".

   Note: this writing assignment awards up to 40 course points.

Problems

1. Provide a state diagram for an NFA N that accepts words over the alphabet $\{0, 1, -, =\}$, where each word has the format $x - y = z$, where i) x is a nonempty word over $\{0, 1\}$ and has either zero, or one 1's, ii) y is a nonempty word over $\{0, 1\}$, has either zero or one 1's, but cannot have more 1's than x, and iii) $z \in \{0, 1\}$ equals the difference in 1's (either 0 or 1) between x and y. For example, $w_1 = 00100 - 000 = 1$ should be accepted, but $w_2 = 100 - 1 = 1$ should be rejected, since the difference in 1's between 100 and 1 equals 0. Show the computations of your N on inputs w_1 and w_2, respectively. (10 pts)
2. Consider the language L for which $w \in L$ provided w is a nonempty binary word whose number of 1's is divisible by 3, but does *not* possess the subword 110. Which of the following words are members of L^*? For each word v that is in L^* provide a concatenation of words in L that equals v. For each word v that is not in L explain why. (10 pts)

   (a) $v = 111111011011101$

   (b) $v = 0011101010111011011$

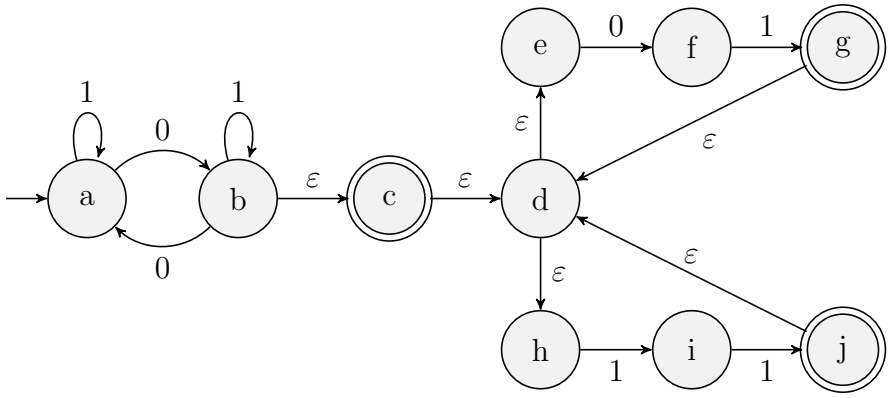
   (c) $v = 11101110101000110011$
3. Use the Intersection Algorithm described in Section 4.1 of the Finite Automata lecture to design a DFA that accepts the language L described in Problem 2. Do so by completing the following parts.

(a) Provide the state diagram for a DFA M_1 that accepts nonempty binary words whose number of 1's is divisible by 3. (2 pts)

(b) Provide the state diagram for a DFA M_2 that accepts binary words that do *not* possess the subword 110. (2 pts)

(c) Apply the Intersection Algorithm to design a DFA that accepts the language $L(M_1) \cap L(M_2)$. (6 pts)

4. Consider the NFA N below.



(a) Provide its δ-transition table. (5 pts)

(b) Use the δ-transition table from part a to convert N to a DFA. (5 pts)