

# CECS 329 Group Assignment 2

September 9th, 2021

## Instructions

Pair up with another student to solve both problems below. Each of you is responsible for authoring a (handwritten) solution to ONE of the problems. For example, if you author the solution to Problem A, then your partner authors the B solution. Submit ONE solution to the ONE problem you were assigned. Make sure you write your name as well as your partner's name in the upper-right corner of your solution, since both of you will receive points for each of the solutions. You are only allowed to discuss the problems with your partner and the lab instructor. Use of course notes, textbook, and lecture recordings is permitted, but no other online resources or outside communication is allowed. Upload your solution in a single file to the appropriate drop box before the end of class. **Please show work and make sure you submit on time! At least 10% of points will be lost otherwise.**

## Problems

A. Consider the alphabet

$$\Sigma = \left\{ \begin{array}{cccccccc} 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & , & 0 & , & 1 & , & 1 & , & 0 & , & 0 & , & 1 & , & 1 \\ 0 & & 1 & & 0 & & 1 & & 0 & & 1 & & 0 & & 1 \end{array} \right\}$$

where each symbol is a triple of bits. Provide the state diagram for a DFA that accepts all words  $w$  over  $\Sigma$  for which the top layer of  $w$  minus the middle layer of  $w$  equals the bottom layer of  $w$ , where each layer is viewed as a binary number whose left most bit is the least significant bit, and whose rightmost bit is the most significant bit. For example, the DFA should accept

$$w_1 = \begin{array}{r} 01011 \\ 00110 \\ 01110 \end{array}$$

since the top layer represents the number 26, the middle layer 12, the bottom layer 14, and  $26 - 12 = 14$ . However, it should not accept

$$w_2 = \begin{array}{r} 11001 \\ 10100 \\ 10011 \end{array}$$

since the top layer represents the number 19, the middle layer 5, the bottom layer 25, and  $19 - 5 \neq 25$ . For each state of your DFA, write a few words that describe the purpose of the state and/or the situation that the state represents. Show the computation of your DFA on both inputs  $w_1$  and  $w_2$ . (15 pts)

- B. Give a description of the set of binary words that are accepted by the following DFA. Defend your answer by providing a case-by-case analysis. (10 pts)

