CSCE-433 Formal Languages & Automata
CSCE-627 Theory of Computability

Spring 2022

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Assignment # 2
(Due February 14, 2022)

Instructions.

- Your assignment must be typed using your favorite word processor. You may draw diagrams by hand, but only if you are very neat and the diagram is legible.
- Turn in a PDF file of your homework on Canvas.
- Homework is always due at the **beginning** of the class on the due day.

Questions.

1. Draw the state diagram of a DFA that recognizes the following language:

$$L = \{w \mid w \text{ contains an even number of 0's or contains exactly two 1's}\}$$

Then draw the state diagram of an NFA for the same language. The alphabet is $\{0, 1\}$. Try to use as few states as you can. Discuss the relative ease in designing the NFA versus the DFA.

2. Textbook, page 85, Exercise 1.14.

3. Textbook, page 86, Exercise 1.16.

4. Give regular expressions that generate the following languages, assuming the alphabet $\{0, 1\}$:
   a) $L_1 = \{w \mid w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$;
   b) $L_2 = \{w \mid w$ does not contain the substring 110$\}$;
   c) $L_3 = \{w \mid w$ contains an even number of 0's, or contains exactly two 1's$\}$.

5. Textbook, page 86, Exercise 1.21(b).

6. [CSCE-433 Students only] Let L_n be the set of all binary strings of length at least n that are the base-2 representations of integers that are a multiple of 2^n. Show that for any fixed $n \geq 2$, L_n is a regular language.

7. [CSCE-627 Students only] Textbook, page 87, Exercise 1.22.

Further suggested practice. Pick some subproblems in Problems 1.4, 1.5, 1.6 and 1.7 in the textbook.