CSCI 2115
Theory of Computer Science
Module 2 Assignment

Properties of Regular Languages

Welcome to your assignment for Module 2! This assignment covers topics from properties of regular languages. This assignment includes 4 problems. All questions are graded on **correctness** and not completeness. Please submit your work on Crowdmark. Make sure to show all of your work as questions are graded based on methods used, content written, and correct answers.

1. Construct NFAs that recognize the specified languages using the automaton simulator shown in class, which is located at https://automatonsimulator.com/ to create NFAs to recognize the following languages.

   As with Assignment 1, you will need to upload both your image and your text file to Crowdmark.

   (a) [**5 marks**] The language specified by `dfa.*nfa` where the alphabet is $\Sigma = \{a, d, f, n\}$.

   (b) [**5 marks**] The language specified by `(010|101)*` where the alphabet is $\Sigma = \{0, 1\}$.

   (c) [**5 marks**] The language over the alphabet is $\Sigma = \{a, b\}$ where the number of `as` is equivalent to 2 or 3 mod 5, or the number of `bs` is equivalent to 1 or 2 mod 4.

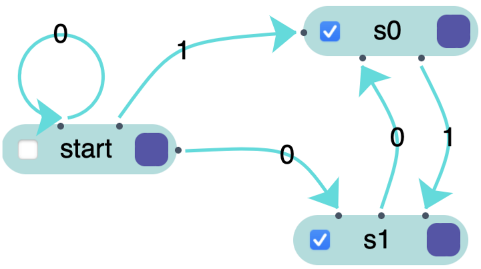
2. Recall the theorem that states how Regular Languages, Regular Expressions, Languages recognized by NFAs, and Lanauges recognized by DFAs are all equivalent. Use that theorem prove the following statements about languages.

   (a) [**4 marks**] The language L consisting of all odd length binary strings is regular.

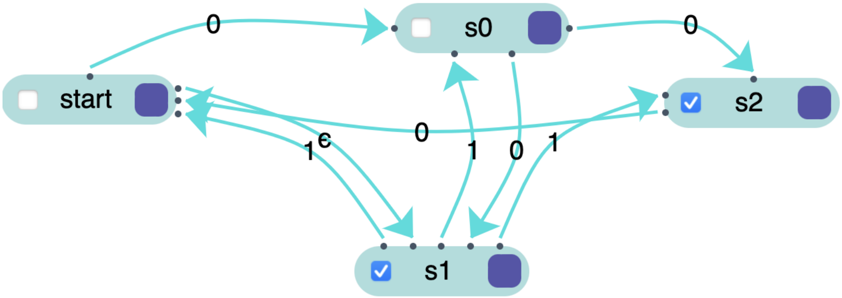
   (b) [**6 marks**] Prove that the language L over the English alphabet such that the length of the string is divisible by 7, 11, and 13 is regular. Hint: Do **NOT** draw the DFA for this language, as it will take you a very long time.

3. Collapse the following NFAs and extract the associated Regular Expression.

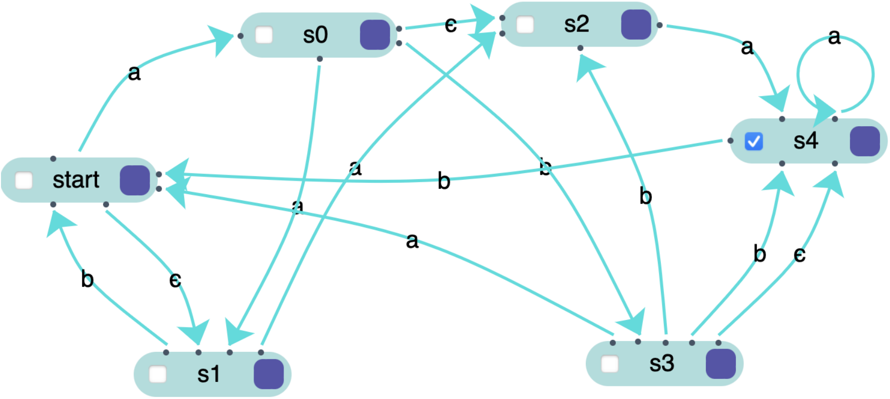
   (a) [**5 marks**]



(b) **[5 marks]**



4. Consider the following NFA:



(a) **[8 marks]** Create a DFA that recognizes the same language as the above NFA by using the subset construction approach. Your answer may be either the DFA itself or just the transition table. Note that the sample solution has 13 total states. You can check your answer by finding the Regular Expression for this NFA and then testing it in the automata simulator.

(b) **[7 marks]** Minimize the DFA that you created in 4a. Note that the sample solution has 8 total states.