# CS 6041 Theory of Computation

# Homework 3

You can use online tool to draw the figure: <http://madebyevan.com/fsm/>

**Make sure you follow the instruction before submission:**

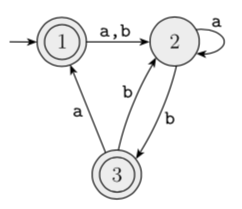
**1, Any late submission due to whatever reason will not be graded.**

**2, The answer should be written in BLUE and the figure can be any color. The wrong format submission might not be considered.**

**3, The submission file must be in PDF. Any other format will not be graded.**

1. Give regular expressions that describe the languages. In all parts, the alphabet is {0,1}. (20 points)
2. {w| w starts with 0 and has odd length}
3. {w| w starts with 1 and has even length}
4. {w|w contains at least two 0s}
5. {w|w contains at most one 1}
6. Use the procedure described in Lemma 1.60 to convert the following finite automata to regular expressions.

**Lemma 1.60: If a language is regular, then it is described by a regular expression.**



**please** first get rid of state 3, then state 1, and finally state 2; **please** also provide the diagrams for all the steps. (20 points)

1. Let Σ = {0,1} and let D = {w| w contains an equal number of occurrences of the substrings 01 and 10}. Thus 101 ∈ D because 101 contains a single 01 and a single 10, but 1010 D because 1010 contains two 10s and one 01. Show that D is a regular language.

you can either construct a DFA/NFA diagram or simply provide the regular expression to prove D is regular. (20 points)

1. (15 points) Prove that the following languages are not regular. You may use the pumping lemma and the closure of the class of regular languages under union, intersection, and complement.

{0n1m0n|m,n≥0}

1. (25 points)

Let B = {1ky| y ∈ {0,1}∗ and y contains at least k 1s, for k ≥ 1}. Show that B is a regular language.

Let C = {1ky| y ∈ {0,1}∗ and y contains at most k 1s,for k≥1}. Show that C isn’t a regular language.