# CS 6041 Theory of Computation

# Homework 3

**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 (i.e., docx, pages) will not be graded. We don’t accept the hand-written submission.**

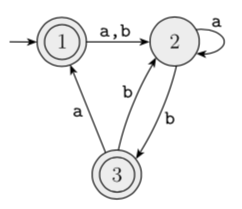
1. Give regular expressions that describe the languages. In all parts, the alphabet is {0,1}. (20 points)

For the correct format, please check our examples in slides and use the following symbols: 0,1, Σ, \*, ( ), U.

Other formats like this ^1(0+1)\*$ will not be graded.

1. {w| w starts with 0 and has an odd length}
2. {w| w starts with 1 and has an even length}
3. {w| w contains at least two 0s}
4. {w| w contains at most one 1}
5. 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.