EECS 2001N W '20: INTRODUCTION TO THEORY OF COMPUTATION
Assignment 2
Weight: 4%, Due: Feb 18, 11:59 pm

<u>Notes:</u>

1. The assignment MUST be typed, and submitted as a SEPARATE .pdf file for every question. This is a requirement of Crowdmark. Photos/scans of handwritten work will not be graded.

2. Use the moodle link to submit your assignments. No late submissions will be accepted. Please do NOT send files by email.

3. You must do this assignment individually.

4. Submit this assignment ONLY if you have read and understood the policy on academic honesty on the course web page. If you have questions or concerns, please contact the instructor.

5. Copying solutions from any source, including books and wesites, without attribution, constitutes a breach of academic honesty. Please cite your sources properly.

Problem 1

[3 points] Let A, B be regular languages over alphabet Σ. Is the following language regular? Prove your answer.
$$A_1 = \{x | x \in A, x^R \notin B\}$$

Problem 2

[3 points] Let C be a language defined over alphabet $\{0, 1\}$ as follows. Is C regular? Prove your answer.

$$C = \text{The set of strings with equal number of 010's and 101's}$$

Problem 3

[5 points] Construct a NFA for the following language defined over $\Sigma = \{0, 1\}$.

$$D = \{0^n 10^m 10^q | n, m, q \in \mathbb{N}, q \equiv nm \pmod 5\}$$

Problem 4

[5 points] Prove that the following language defined over $\Sigma = \{0, 1\}$ is not regular.

$$E = \{x | x = 0^{pq}, \text{ where } p, q \text{ are prime numbers}\}$$

Practice Problems - Do not submit

1. (medium) Prove that the following language defined over $\Sigma = \{0, 1\}$ is not regular.
   $F = $ set of all strings with unequal number of 0's and 1's.

2. (hard) Consider a regular language L over an alphabet Σ. Design a finite automaton that accepts the set of prefixes of all words in L. A word w_2 is a prefix of a word w_1 if $w_1 = w_2 v$ for some $v \in \Sigma^*$.