

COMP 4200 - Formal Languages: Homework #2

Due on Monday, February 5, 2023, at 10:00 pm

Instructor: Hugh Kwon

Instructions:

- Submit your work as a single PDF through GradeScope (link on Canvas). You will need to match your solution to each question (click for the instruction). Failure to match your solution to the appropriate question will result in a grade of 0 for each unmatched question.
- Note that it is your responsibility to make your submissions readable by TAs. If your handwriting is not readable by the TA, he may not give you full credits (or any credits at all) for the illegible part.
- You will not only be graded on your mathematics, but also on your organization, proper use of English, spelling, punctuation, and logic.
- Late submissions will NOT be graded unless as specified by the Late Assignment Submission policy in the syllabus.
- For any questions regarding the assignment or grading of the assignment, please email our TAs.

Problem 1

Total: 40 points (10 points each)

Draw the state diagram of DFAs recognizing the following languages.

1. $A = \{w \mid \text{length of } w, |w|, \text{ is a multiple of } 3\}$
2. $B = \{11, 111\}$
3. $C = \{w \mid w \text{ contains an even number of 0's and contains exactly two 1's}\}$
4. $D = \{w \mid w \text{ begins with 0 and every 0 in } w \text{ is preceded by 1}\}$

Problem 2

Total: 20 points

Example of set difference: $A = \{0, 01\}$, and $B = \{0, 11\}$. Then, $A - B = \{01\}$.

Prove that regular languages are closed under the set *difference* operation. That is, if A and B are regular languages, then $A - B$ is also a regular language.

Hint: One can prove the statement above by either (1) contradiction or (2) construction. For the proof, you may make use of the theorems that regular languages are closed under *union*, *intersection*, and *complement*.