COMP 4200 - Formal Languages: Homework #6

Due on Wednesday, April 12, 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 mark your solution to each question (click for the instruction).
- 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: 15 points
Problem 2.30 (textbook, page 157)
Use Pumping Lemma for CFLs to prove the following language is not context-free.

$$A = \{0^n 1 0^{2n} 1 0^{3n} \mid n \geq 0\}$$

Problem 2

Total: 15 points
Is the following language B context-free? If yes, show a context-free grammar (CFG) that generates B. If no, please prove it using Pumping Lemma for CFLs.

$$B = \{0^n 0^{2n} 1 0^{3n} \mid n \geq 0\}$$

Note: B is the same as A in Problem 1, except that there is one less 1 in each string of B compared to the strings in A.

Problem 3

Total: 15 points
Problem 2.31 (textbook, page 157)
Let C be the language of all palindromes over $\{0, 1\}$ containing equal numbers of 0s and 1s. Show that C is not context free.

Problem 4

Total: 15 points
Problem 2.31 (textbook, page 157)
Let $\Sigma = \{1, 2, 3, 4\}$ and $D = \{w \in \Sigma^* \mid$ in w, the number of 1s equals the number of 2s, and the number of 3s equal the number of 4s$\}$. Show that D is not context free.