

GROUP HOMEWORK 3, CPSC 421/501, FALL 2020

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Please note:

- (1) You must justify all answers; no credit is given for a correct answer without justification.
- (2) Proofs should be written out formally.
- (3) Homework that is difficult to read may not be graded.
- (4) You may work together on homework in groups of up to four, **but you must submit a single homework as a group submission under Gradescope.**

(1) [Sip], Exercise 1.5(d,f).

(2) [Sip], Exercise 1.6(b) and Exercise 1.7(b).

(3) [Sip], Problem 1.31. Explain your general method for doing this, and give one example that illustrates all of the main parts of your method.

(4) Let $L \subset \{0,1\}^*$ be the language of integers expressed in binary that are multiples of 5, where the empty string is in L and we allow leading 0.

[Hence, listed in increasing string length, and in lexicographical order, L begins $\{\epsilon, 0, 00, 000, 101, 0000, 0101, 1010, 1111, \dots\}$.]

Give a DFA recognizing L .

(5) Fix an alphabet, Σ .

(a) Consider the set of DFA's $(Q, \Sigma, \delta, q_0, F)$ such that $Q = \{1, \dots, m\}$ for some $m \in \mathbb{N}$. Is this set countable or uncountable?

(b) Prove that there are languages over Σ that are not recognized by any DFA, using only facts about countable and uncountable sets (and nothing particular about DFA's, such as the Myhill-Nerode Theorem, beyond what is covered in Section 1.1 of [Sip]).

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