

CONCORDIA UNIVERSITY
Dept. of Computer Science and Software Engineering
COMP 335 – Introduction to Theoretical Computer Science
Fall 2018

Assignment 1

Submission deadline: Thursday September 27th at 23:55

Note: This is a theoretical course. That means, while the WHAT is important, the WHY is absolutely essential. Show the steps of your solution for the full mark.

Total mark is 70.

1. [10 Points] Let R and L be any languages over an alphabet Σ . Show the following statements are true.
 - (a) $L^2 \subseteq L$ if and only if $L = L^+$.
 - (b) If $L \subseteq R$, then $\min\{|x| : x \in L\} \geq \min\{|y| : y \in R\}$.
2. [10 Points] Suppose L_1 and L_2 are languages over an alphabet Σ . In each of the following cases, find at least three instances of the languages for which the equality holds.
 - (a) $L_1L_2 = L_2$.
 - (b) $L_1\Sigma^* = L_1$.
3. [20 Points] For each of the following languages over $\Sigma = \{a, b\}$, design a DFA.
 - (a) $L_1 = \{w : w \in \Sigma^*, \text{ where } w \text{ does not have } bbb \text{ as a substring}\}$.
 - (b) $L_2 = \{w : w \in \Sigma^*, \text{ where } n_a(w) \bmod 3 = 0 \text{ and } w \text{ begins with } ab\}$.
 - (c) $L_3 = \{vww : v, w \in \Sigma^*, \text{ and } |v| = 2\}$.
 - (d) $L_4 = \{a^mb^n : mn > 4\}$.
4. [5 Points] Give a regular expression for $(L_1 \cup L_2)L_3$, where L_1, L_2 , and L_3 are the languages defined in question 3 above.
5. [5 Points] Give a simple, verbal description of the complement of $L = \{a^n b^{n+1} : n \geq 0\}$.
6. [10 Points] Let L be any regular language over an alphabet Σ . Using L , we define $\text{chop}(L) = \{w : \exists x, y, z \in \Sigma^*, xyz \in L, w = xz\}$.
Show that $\text{chop}(L)$ is regular or give a counter-example.
7. [10 Points] Give a FA for $L = L_1 \cup \bar{L}_3$, where L_1 and L_3 are languages defined in question 3 above.
Extra homework, NOT marked: Give a DFA for L .