

CSE340: Theory of Computation (Homework Assignment 1)

Due Date: 31st August, 2021, 11:59 PM

Total Number of Pages: 1

Total Points 50

Question 1. (18 points) Give DFAs for the following languages.

- (a) $A = \{x \in \{a, b\}^* \mid x \text{ alternates between } a \text{ and } b \text{ and has at least 2 } a\text{'s}\}$
- (b) $B = \{x \in \{a, b\}^* \mid x \text{ has } ababb \text{ as a substring}\}$
- (c) $C = \{x \in \{0, 1\}^* \mid x \text{ has at most 2 occurrences of 3 consecutive 1's with possible overlapping}\}$
(For example the string 1111 is in the language C but the string 11111 is not in the language C .)

Question 2. (12 points) Give DFAs accepting the same language as the following regular expressions using the minimum number of states possible.

- (a) $\epsilon + (0 + 1)0(0 + 1)^*$
- (b) $(a^*b^* + b^*a^*)$

Question 3. (10 points) For two language A and B over Σ , define

$$f(A, B) = \{w \in \Sigma^* \mid w = a_1b_1a_2b_2 \dots a_kb_k, \text{ where } a_1, a_2, \dots, a_k \in A \text{ and } b_1, b_2, \dots, b_k \in B \text{ and each } a_i, b_i \in \Sigma^*\}.$$

Show that if A and B are regular then $f(A, B)$ is also regular.

Question 4. (10 points) Find the minimum-state finite automaton corresponding to the following DFA. Show in details all the steps of minimization.

