Name: Rollno:

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 language L_1 over Σ, define

$$f(L_1) = \{w \in \Sigma^* \mid \exists x \in \Sigma^* \text{ such that } wx \in L_1 \text{ and } |x| = |w|\}.$$

Show that if L_1 is regular then $f(L_1)$ is also regular.

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