SABANCI UNIVERSITY, CS 302 Automata Theory, Spring 2023

Midterm Examination

QUESTION 1 *(50 pts)*

Name :

Surname :

Closed book and notes (of paper and electronic kind);
Calculators are not allowed and all phones must be switched off;
Duration: 60 minutes

Consider the language $L \subseteq \{0,1\}^*$ *where in each string of* ***L*** *every* ***0*** *is followed* ***precisely*** *by two* ***1****'s.*

(a) *(15 pts) Write down a* ***regular expression E*** *corresponding to this language* ***L****.*

(b) *(35 pts) Sketch (i) an epsilon-NFA* ***X****; (ii) an NFA* ***Y*** *(without epsilon-transitions) ; (iii) a DFA* ***Z*** *and (iv) a* ***minimal state*** *DFA* ***W*** *that all accept the language* ***L****.*

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QUESTION 2 *(50 pts)*

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Duration: 60 minutes

(a) *(10 pts) For a* ***non-deterministic*** *finite automaton (NFA)* ***A*** *state the definition of the language* ***L(A)*** *accepted by* ***A*** *in terms of its* ***extended transition function*** δE

(b) *(15 pts) State the* ***pumping lemma*** *for regular languages.*

(c) *(25 pts) Consider the languages* L_1 *and* L_2 *below:*

$L_1 = (\omega \in \{0,1\}^* | \omega = 0^n 1^m$; $n+m$ = *an* ***odd*** *number* ; ***n,m*** *nonnegative integers)*

$L_2 = (\omega \in \{0,1\}^* | \omega = 0^n 1^m$; $n > 3m$; ***n,m*** *nonnegative integers)*

For each case ***state*** *whether the language is a* ***regular*** *or an* ***irregular context-free language****. If it is regular exhibit an accepting NFA (or a regular expression), if it is not then exhibit a CFG that generates it.*