

SABANCI UNIVERSITY, CS 302 Automata Theory, Fall 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**

(a) (10 pts) State the definition of : (i) the **extended** transition function  $\delta^E(q,s)$  for an NFA  $X = (Q, \Sigma, \delta, Q_0, F)$  and (ii) the language  $L(X)$  accepted by  $X$ .

(b) (15 pts) Compute the NFA  $Y$  that accepts the language corresponding to the regular expression  $E = 0^*.1.(0^*.1.0^*.1)^*.0^*$

(c) (25 pts) State the **pumping lemma** (PL) for regular languages and prove that the palindrome language  $L := \{ \omega \in \{0,1\}^* \mid \omega = \omega^R \}$  where  $\omega^R$  denotes  $\omega$  written in reverse is **not** a regular language using the PL.

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QUESTION 2 (50 pts)

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**Duration: 60 minutes**

(a) (25 pts) Write down a regular expressions  $E_1$  and  $E_2$  over the set  $\{0,1\}$  corresponding to the languages  $L_1$  and  $L_2$  where : (i) in each string in  $L_1$  the number of 1's is an **even** number ; and (ii) in each string in  $L_2$  the number of 1's is an **odd** number .

(b) (25 pts) Compute minimal state DFAs  $X$  and  $Y$  that accept the complement languages  $L_1^c$  and  $L_2^c$  respectively where  $L_1$  and  $L_2$  are as defined in part (a).