

Quiz 1

Instructions: Show your work and explain every step.

- (1) Give the mathematical definition of DFA.
- (2) Give the mathematical definition of NFA.
- (3) Given that L is a regular language recognized by the DFA $M = (Q, \Sigma, \delta, q_0, F)$. Give the 5-tuple of a DFA (write its elements in terms of the elements of M) that recognizes $\overline{L}$. Also, show by example that the above does not work for NFA.
- (4) Use the above question (i.e. the complement of a regular language is regular) and the fact that the union of two regular languages is regular to prove that if L_1 and L_2 are regular, then $L_1 \cap L_2$ is regular.
- (5) Determine whether the following are true or false:
 - (a) DFA are as powerful as NFA (i.e. NFA and DFA recognize the same languages).
 - (b) The language $\{a^n b^n \in \{a, b\}^* \mid n \geq 0\}$ is regular.

(6) Given the following NFA

δ	0	1	ϵ
q_0	-	q_1	q_1
q_1	$\{q_0, q_4\}$	-	$\{q_2, q_3\}$
q_2	-	$\{q_4\}$	-
q_3	q_4	-	-
q_4	-	-	q_3

$$F = \{q_3\}.$$

(a) Is ϵ recognized by the NFA?

(b) What is $\delta(q_0, 0)$?

(c) What is $\delta(q_0, \epsilon)$?