CS 3133

HW 1

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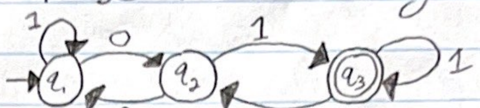
1. L is a finite set of binary strings. A language is regular if some finite automaton recognizes it.

★ Prove that L is regular. for L to be regular $L = \{i \mid M \text{ accepts } i\}$

where "i" is a binary String

$i = i_1 i_2 i_3 \dots i_n$. Let i be the finite binary String "011" where $i \in L$

Let M be the DFA :

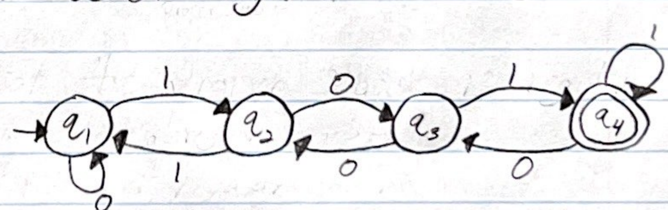


The input on M is $i = 011$ which leads to the accept state q_3 via the following order of states: Start q_1, read 0, move to q_2, read 1, Move to q_3, read 1, move to q_3, end at q_3, accept.

We have proved that there exists a DFA, M, that recognizes L, So L must be regular.

2. Prove that the language of all binary strings containing a fixed binary String S of length K as a Subsequence is a regular language. Considering that $L = \Sigma^*$ for $\Sigma = \{0, 1\}$ lets arbitrarily define S to be of length $K=4$ and $S = 1011$. Also, $S \subseteq L$

Let DFA M be:

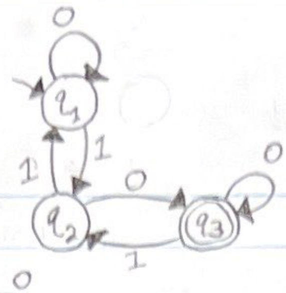


Input $S=1011$ accepts via the following order of states: Start, q_1, read 1, move to q_2, read 0, move to q_3, read 1, move to q_4, read 1, loop to q_4, accept.

This process of arbitrarily choosing S ; K could be repeated until all subsets are exhausted and have been given a DFA. We could then perform a Union operation on every $S_1, S_2, S_{\dots}$ until we've got the lang of all binary strings which has it's regularity preserved through the union operation.

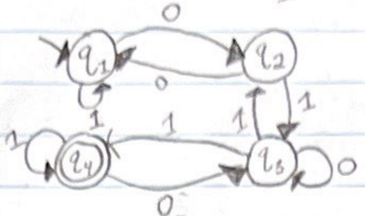
(1, 0 accepts)

1.6 b, c, d 3. b)



ω begins with a 1 ; ends with 0

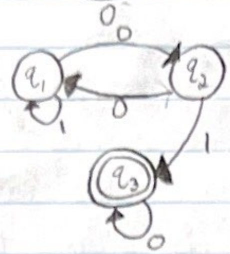
c)



(101011 accepts)

ω contains 0101

d)



(0 1 0 accepts)

ω is at least 3 states ; 3^{rd} symbol is 0

1.20 bcde 4.

	Member	Nonmember
b)	abab	aabb
	ababab	aaabbb
c)	a	ba
	b	ab
d)	aaa	abb
	aaaaaaaaa	baa
e)	aaabaaa	bbbbb
	babbbab	aaaa

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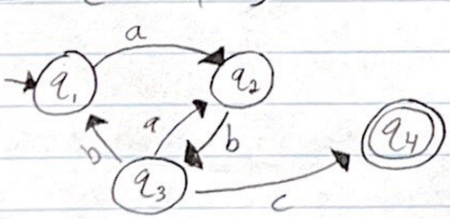
5. Give an NFA where the final character in the input is the first time that character has appeared.

$\Sigma = \{a, b, c\}$



This NFA only accepts strings that end in the letter c.