National University of Computer and Emerging Sciences

Theory Of Automata

(CS-3005)

Date: Feb 29 2024

Course Instructor(s)

Mr. Fraz Yousaf

Sessional-I Exam

Total Time: 1 Hours
Total Marks: 25
Total Questions: 03

Semester: SP-2024
Campus: Lahore
Dept: Computer Science

Student Name _____ Roll No _____ Section _____ Student Signature _____

Vetted by _____ Vetter Signature _____

CLO #:1 Identify formal language classes and prove language membership properties

Question1: **[3+2+2marks]**

PART A

Give regular expression for the following language

L= {x| x ε{a,b}* where every b is immediately followed by at least 3 a's}

Ans: (a+baaa)*

PART B

How many strings of length less than 4 contains the language described by the regular expression (x+y)*y(a+ab)*?

a) 7
b) 10
c) 12
d) 11

PART C

Is it possible that for any language (denoted by L) L*=L? If so what is L? **(Yes/NO)** L={ε}

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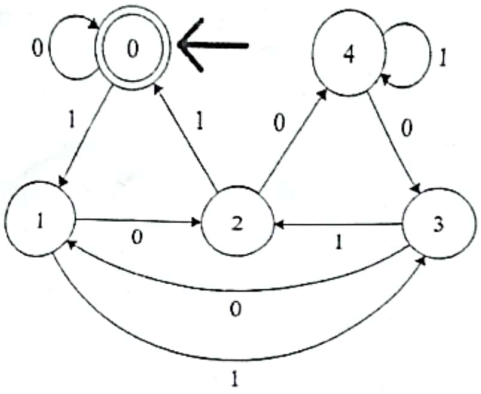
CLO #:2 *differentiate and manipulate formal descriptions of languages, automata and grammars...*

Question 2: Your task is to modify a given finite state machine that currently accepts binary strings divisible by 5 in 5 states. You need to modify the machine to accept strings whose reverse is divisible by 5 from the range 0 to 30, Once you've identified these strings, you should modify the machine so that it accepts all strings within the range from 0 to 30 where the reverse of the string is divisible by 5.

Hint: Specifically, In the range from 0 to 30, there is only one unique string that you need to identify within the range from 0 to 30 (both inclusive) whose reverse is not divisible by 5 but the string itself is divisible by 5. $\sum = \{0,1\}^*$

Note: Marks will not be awarded for exceeding five states. [2+8marks]



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Multiple of 5

0 0 0 0
0 1 0 1
1 0 1 0
1 1 1 1
1 0 1 0 0
1 1 0 0 1
Unique String 1 1 1 1 0

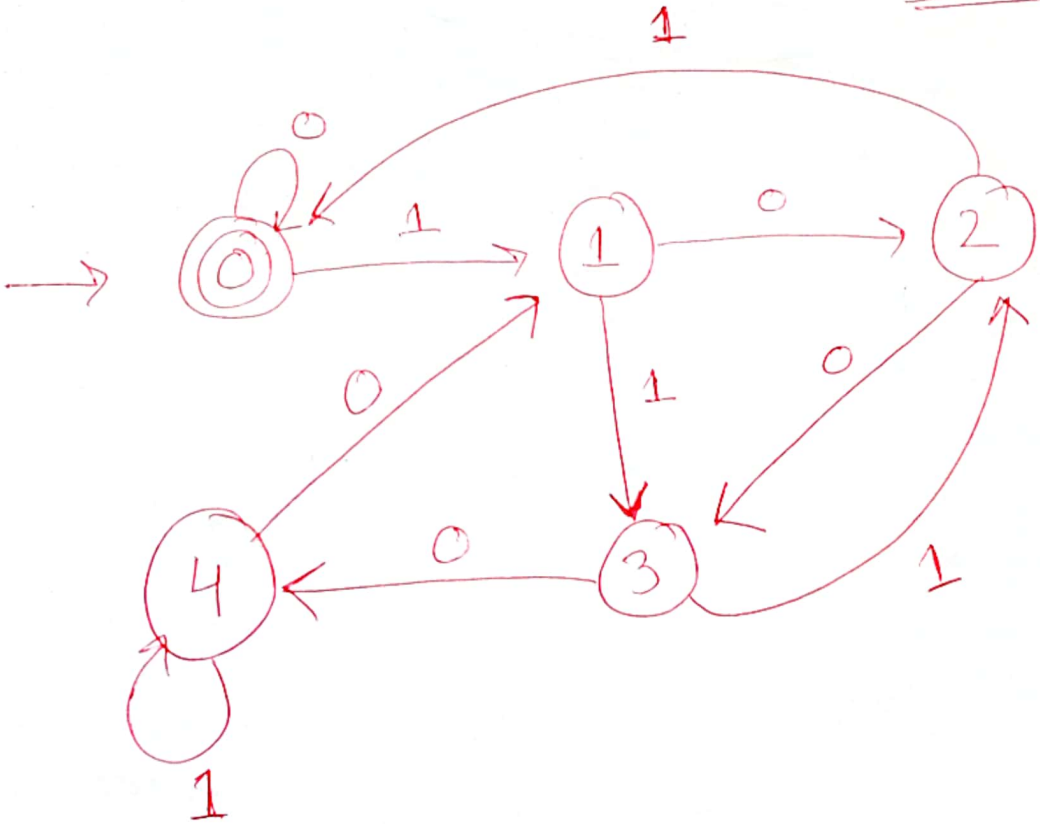
Reverse

0 0 0 0
1 0 1 0
0 1 0 1
1 1 1 1
0 0 1 0 1
1 0 0 1 1
0 1 1 1 1

NEED TO DESIGN MACHINE FOR THIS

~~Final DFA:~~

UNIQUE=
10011



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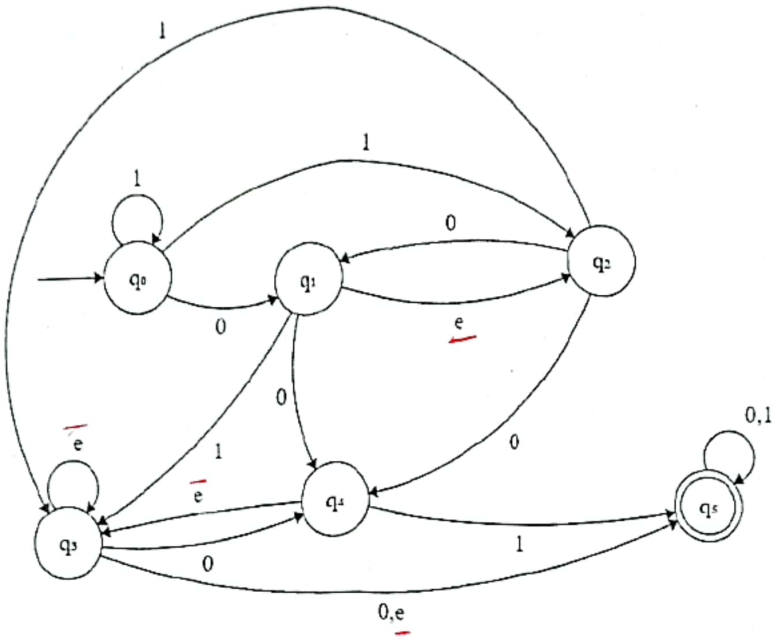
Question 3: Transform the provided NFA-epsilon language into an NFA. ∑= {0,1} *
Show Complete Working [8 marks]



	ε-closure
q_0	$\{q_0\}$
q_1	$\{q_1, q_2\}$
q_2	$\{q_2\}$
* q_3	$\{q_3, q_5\}$
* q_4	$\{q_4, q_3, q_5\}$
* q_5	$\{q_5\}$

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Transition table For NFA

		0	1
→	q_0	q_1, q_2	$q_0\ q_2$
	q_1	q_1, q_2, q_3, q_4, q_5	$q_3\ q_5$
	q_2	$q_1\ q_2\ q_3\ q_4\ q_5$	$q_3\ q_5$
*	q_3	q_3, q_4, q_5	q_5
*	q_4	$q_3\ q_4\ q_5$	q_5
*	q_5	q_5	q_5

④ q_3q_5 q_4q_5 $q_3q_4q_5$
q_3q_5 q_5 q_5

q_4 $q_3q_4q_5$ q_4q_5
~~q_4~~ q_5 q_5

① $q_0 \to q_1 \to q_1q_2$

$q_0q_2 \to q_0q_2$

② 0 → q_1q_2 q_4q_1 $q_3q_4q_5q_1q_2$
1 → q_1q_2 q_3 ~~q_4~~ → q_3q_5 ~~q_4~~

③ 0 → q_2 q_1q_4 $q_1q_2q_3q_4q_5$
1 → q_2 q_3 q_3q_5

Good luck!

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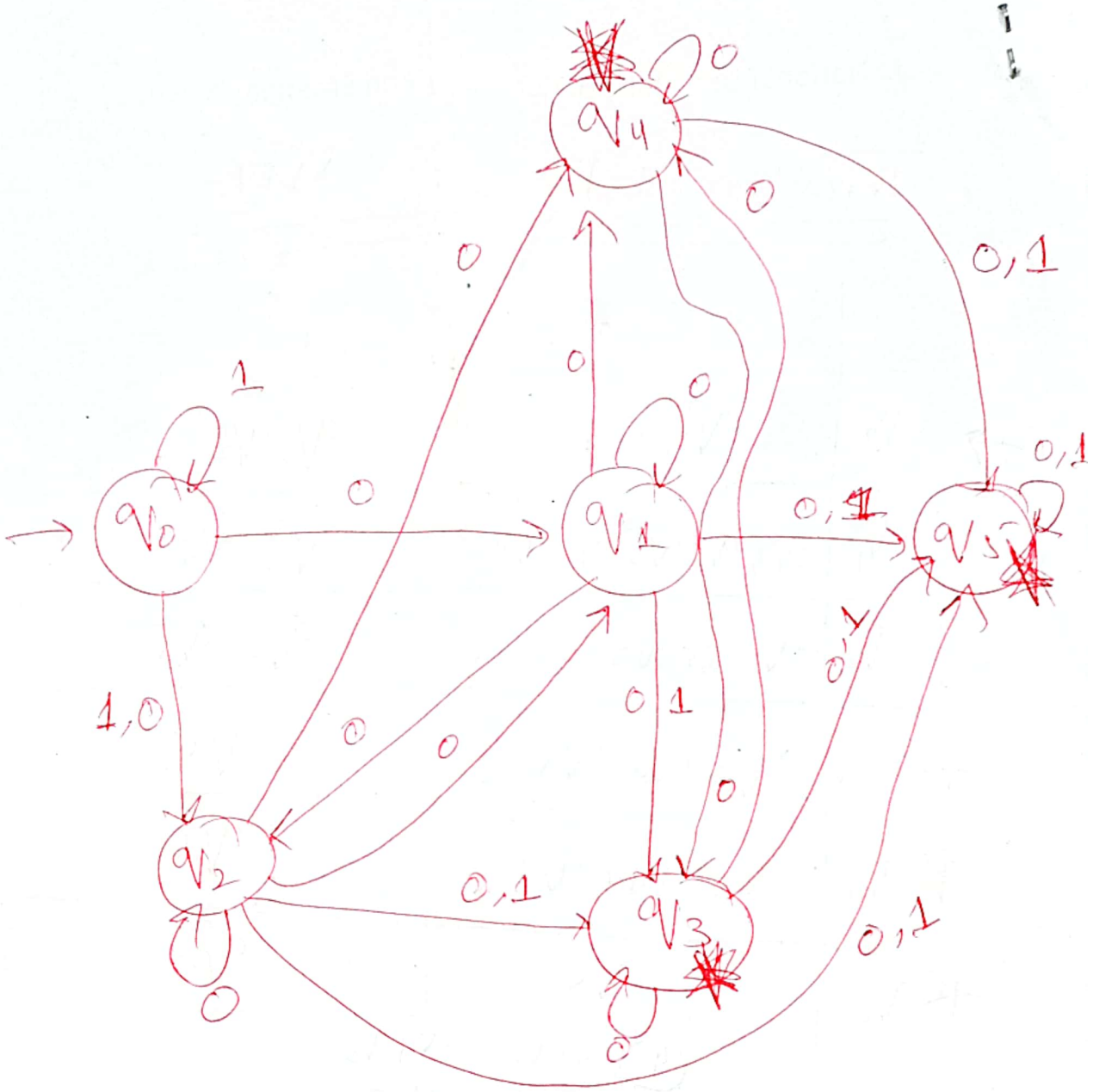
q_0
q_1
q_2
q_3
q_4
q_5
1
0
1,0
0,1