ourse Name: Theory of Computation

structor: Dr. Samar Hesham

Date: 04-04-2024

Duration: 1 hour

Total marks: 20

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uestion 1: *Regular Expressions* and Finite Automata

a. **Give a regular expression that generates the language over the alphabet *{a, b}* where each a in the string is followed by exactly one or three b's (so €, bbb, and bab, bababbb are in the language but abbabbb is not)[1 Mark].**

$(bbb)^* + b^*(a(b+bbb))$ } $b^*(a(b+bbb))^*$

b. **List 8 different strings of the language expressed by the regular expression**

(b * aa(aa)* b) (a + ba + baaa)*.[1 Mark]

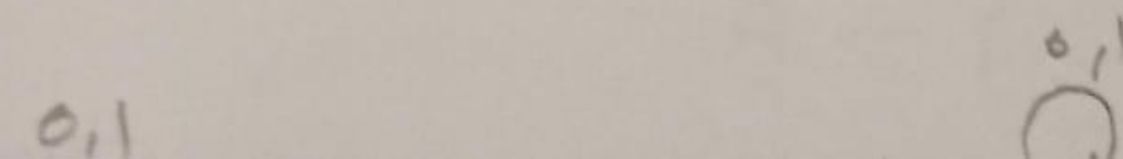
L={ baaba, aabba, bbaaaaab baaa, baaaaaaaba, bbbaabba, aaba, aaaabbaa bbaabba }

c. **Write a regular expression that represents all binary strings with an odd number of 1's.[1 mark]**

$1((11)^*0 + 01(11)^*$

d. **Draw the <u>transition diagram (FSA) [2 marks]</u> corresponding to the following language and Write <u>its automaton description</u> [2 Marks]:**

{ w ∈ (0,1) | Σ* w contains 101 as a substring}.



Draw the transition diagram (FSA) corresponding to the following description[3 marks]

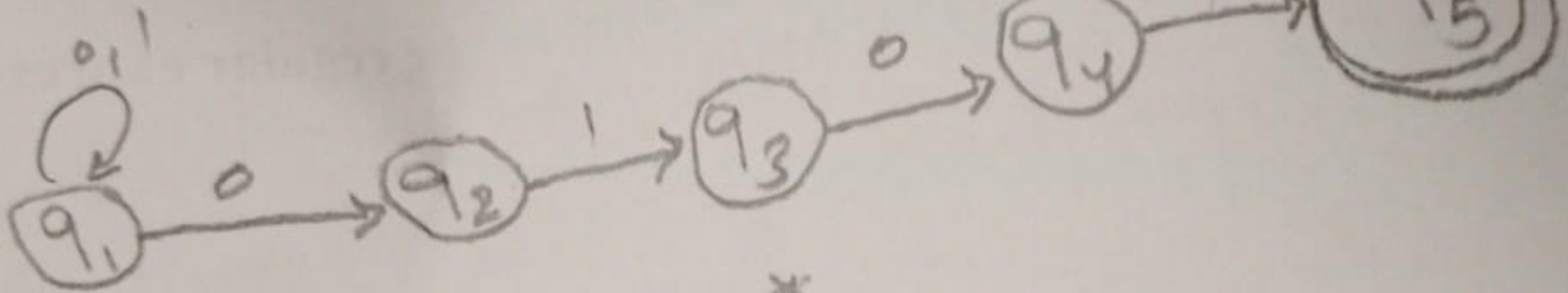
M = ({q1, q2, q3,q4,q5}, {0,1}, δ, q0, {q5})

where δ is

δ(q1, 0) = q1 δ(q1, 0) = q2 δ(q3, 0) = q4 δ(q5, 1) = q5

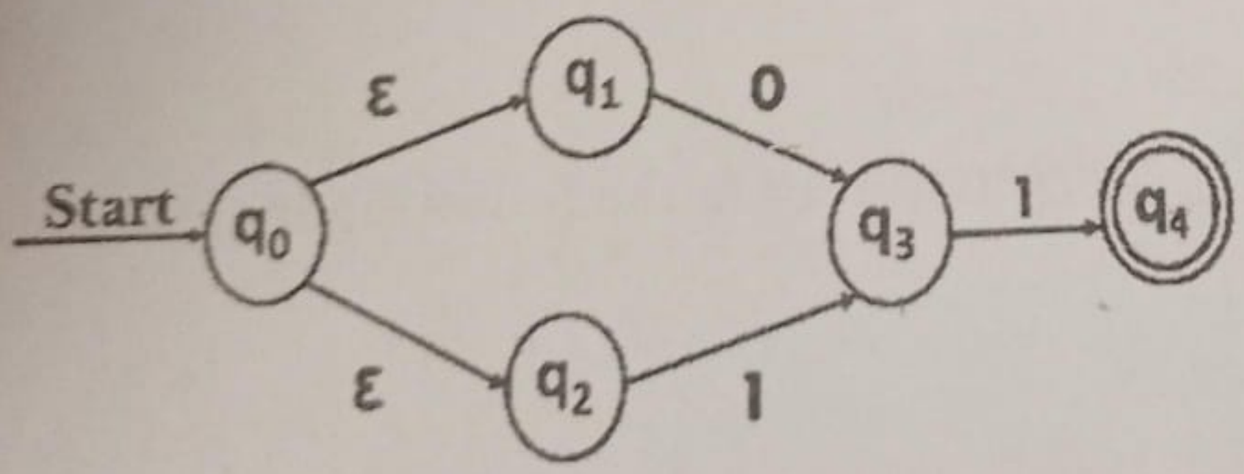
δ(q1, 1) = q1 δ(q2, 1) = q3 δ(q4, 1) = q5 δ(q5, 0) = q5

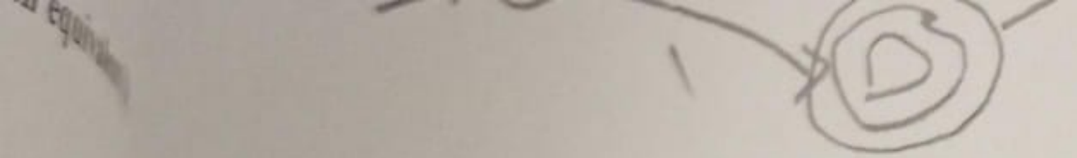
What language do you think this diagram accepts??



NFA $\Sigma^* 0101 \Sigma^*$

f. Use the epsilon closure method to convert the following NFA N into an equivalen marks]





g. Draw DFA and write the corresponding RE for the complement of the following regular language[3 Marks]

L(a*b)

$\overline{L}$=

h. **Briefly compare between NFA and DFA. [3 Marks]**