Student Name : Bazgha Razi

College Name : DGIT

Roll Number : 191380214

Subject Name : Formal Languages and Automata

Subject Code : PCC-CSE-305G

Course : B. Tech

Semester : 5

No. of pages : 9

Student Signature : Bazgha Razi

Date of Examination : 15/12/2021

Name: Bazgha Page No: 1 Date: 15/12/21 Signature: Bazgha Rafi

Ans 1a) Diff b/w DFA and NFA

DFA	NFA
i) It stands for deterministic finite automata.	i) It stands for nondeterministic finite automata.
ii) In DFA, next possible state is set.	ii) In NFA, each pair of state have many next states possible.
iii) DFA is difficult to construct	iii) NFA is easy to construct as compare to DFA.
iv) It requires more space.	iv) It requires less space.
v) It cannot use empty string transition.	v) It can use empty string transition.

Ans 1b) Diff b/w L^+ and L^*

L^+ : The set of all strings which can be constructed using L excluding λ. It is also known as positive closure.

L^* : The set of all strings which can be constructed using L including λ. It is also known as kleen closure.

Ans 1 c) Mealy Machine

Mealy machine is a finite state machine whose output depends on the present state as well as the present input. It is 6-tuple $(Q, \Sigma, O, \delta, \lambda, q_0)$ where all the symbols are:

$Q \rightarrow$ finite set of states

$\Sigma \rightarrow$ Input alphabet

$O \rightarrow$ output alphabet

$\delta \rightarrow$ transition function $\Sigma \times Q$ into Q

$\lambda \rightarrow$ output function mapping $\Sigma \times Q$ into O

$q_0 \rightarrow$ Initial State.

Ans 1d) Regular Expression

Language accepted by finite automata are called regular language and these regular language can be described by algebraic expression are called regular expression.

Regular expression is said to be valid iff it can be derive from the primitive regular expression by a finite number of application of the rule $r^*, r+, r_1 \cdot r_2, r_1 + r_2$

Properties of regular expression:

- $r + r = r$
- $r^* r^* = r^*$
- $r r^* = r^* r = r+$
- $(r^*)^* = r$
- $\epsilon + r r^* = r^* = \epsilon + r^* r$
- $\phi + r = r$

Name : Bazgha Page No: 4 Date : 15/12/21 Signature : Bazgha Razi

Ans 2a) Construct DFA accepting all strings over {a,b} ending with 'ba'

Step 1 : A DFA is quintuple i.e.,

(Q, q_0, Σ, f, S)

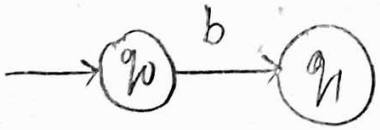
Where, $Q = \{q_0, q_1, q_2, q_3\}$

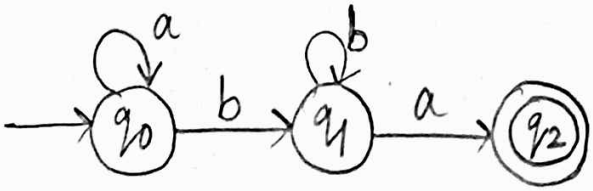
$q_0 = q_0$

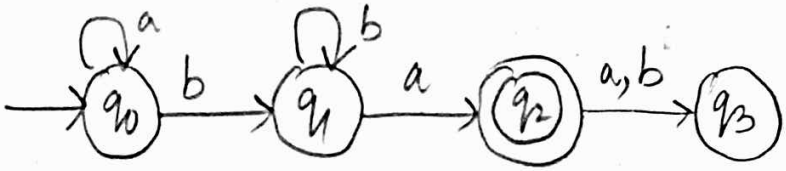
$F = q_2$

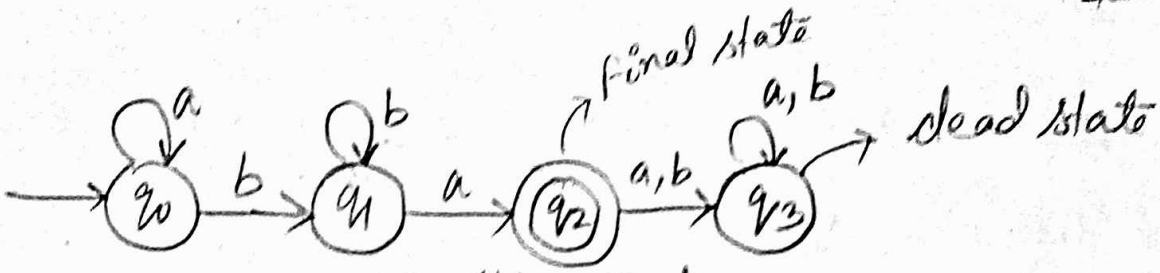
$\Sigma = \{a, b\}$

Step 2 :









Transition Diagram

Step 3: Transition Table

States	Alphabets	
	a	b
→q0	q0	q1
q1	q2	q1
(q2)	q3	q3
q3	q3	q3

Step 4: A string "aba" is accepted by this DFA or not

using δ:

$\delta(q_0, a) = q_0$

$\delta(q_0, b) = q_1$

$\delta(q_1, a) = q_2$

So, final transition state is q_2 and in transition diagram also q_2 is final state. Hence, the string aba is accepted by DFA.

Step5: A string "abaa" is not accepted by this DFA.

using δ :

$$\delta(q_0, a) = q_0$$
$$\delta(q_0, b) = q_1$$
$$\delta(q_1, a) = q_2$$
$$\delta(q_2, a) = q_3$$

So, final transition state is q_3 here but in transition diagram q_2 is final state. Hence, the string abaa is not accepted by DFA because the string not ends with "ba".

Name: Bazgha Page No: 7 Date: 15/12/21 Signature: Bazgha Razi

Ans 3a) DFA over the alphabets {0, 1} such that every string consists of even number of 0's and odd number of 1's.

Step 1: A DFA is quintuple i.e.,

$(Q, q_0, \Sigma, F, \delta)$

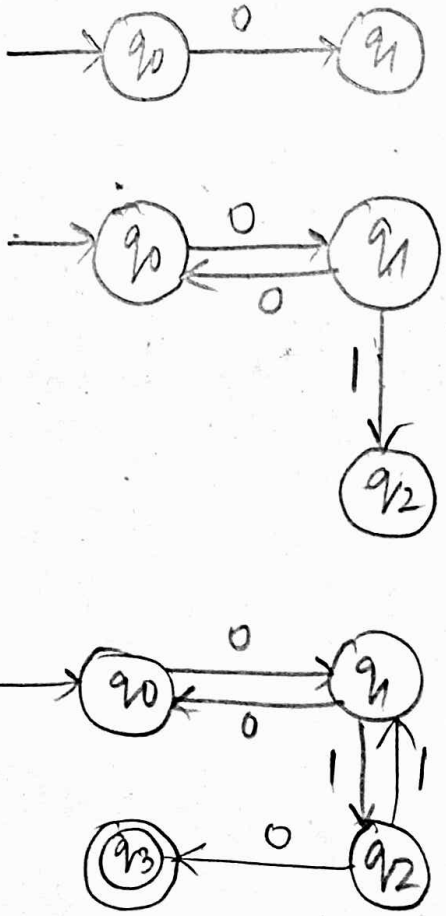
where, Q =

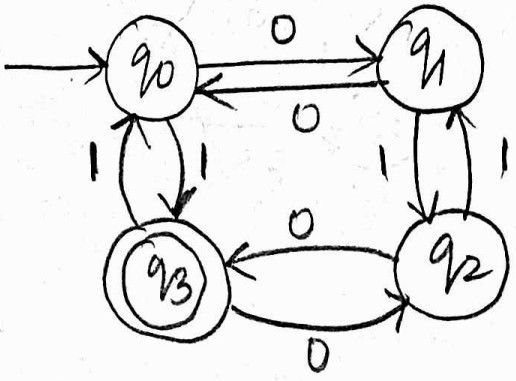
$q_0 = q_0$

F =

$\Sigma = \{0, 1\}$

Step 2:





Transition Diagram

Step 3: Transition Table

States	Alphabets	
	0	1
→q0	q1	q3
q1	q0	q2
q2	q3	q1
(q3)	q2	q0

Step 4: A string "100" is accepted by this DFA or not.

Using δ:

$$\delta(q_0, 1) = q_3$$

$$\delta(q_3, 0) = q_2$$

$$\delta(q_2, 0) = q_3$$

So, final transition state is q_3 and in transition diagram also q_3 is final state. Hence, the string "100" is accepted by DFA.

Step5: A string "0110" is not accepted by this DFA

using δ:

$$\delta(q_0, 0) = q_1$$

$$\delta(q_1, 1) = q_2$$

$$\delta(q_2, 1) = q_1$$

$$\delta(q_1, 0) = q_0$$

So, final transition state is q_0 and in transition diagram q_3 is final state. Hence, the string is not accepted by DFA. It is also because we have even no. of 0's and even no. of 1's in the string "0110". Hence it is not accepted by this DFA. Because this DFA is constructed to accept even no of 0's and odd no. of 1's.