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UG Mid Sem Examination, 2021

Branch: CSE

Sch. Id. : 1912160

Subject : Theory of Computation

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Q. 1.

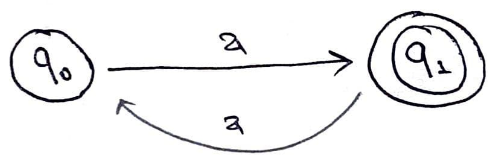
Soln:- Ans (d)

Given, α is string over alphabet Σ

odd (α) = a_1, a_3, a_5 ....

Strings formed = a, aaa, aaaaa, ...

Constructing DFA,



If L is regular, odd (L) is regular, it is clear.

for language L in Σ^*,

odd (α) : $\alpha \in L$

Σ^*, n = 0, 1, 2 ....

for odd, n = 1, 3, 5 ....

∴ The progression / String formation can go upto infinity.

∴ odd(L) is infinite (even if L was irregular).

This gives us the conclusion,

odd(L) is infinite and also regular when L is regular.

Q. 4.

Soln:- "All languages can be generated by context-free grammar." This statement is false.

Ans d

It is known that all regular languages can be generated by context free grammar, however not all non-regular languages can be generated by context free grammar, this is because non-regular languages cannot be generated by regular expressions.

Q. 3.

Soln:- Given, $L \subseteq \Sigma^*$

Ans (d)

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

By hit and trial, we come to think,

$L = \{a^m b^n : n, m \geq 1\}$ is regular.

Proof:

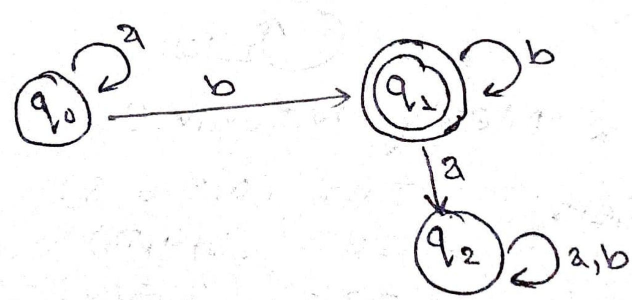
Clearly the language is infinite.

Also, it is a possibility $m=n$, $m>n$, $n>m$.

Possible string formations = ab, aab, aabb...

meaning b must be followed after a.

DFA:



Hence, it is regular.

$\therefore L = \{a^m b^n : n, m \geq 1\}$ is regular.

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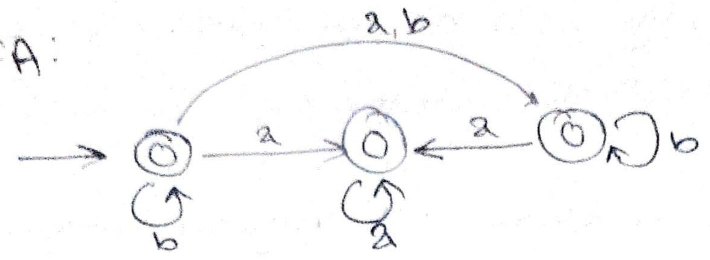
Q.5.

Soln:- NFA:

Ans. (d)



for, $b^* a b^* a a^* b (a+b)^*$

for $n = 1$,

String formed = babaaba , babaabb

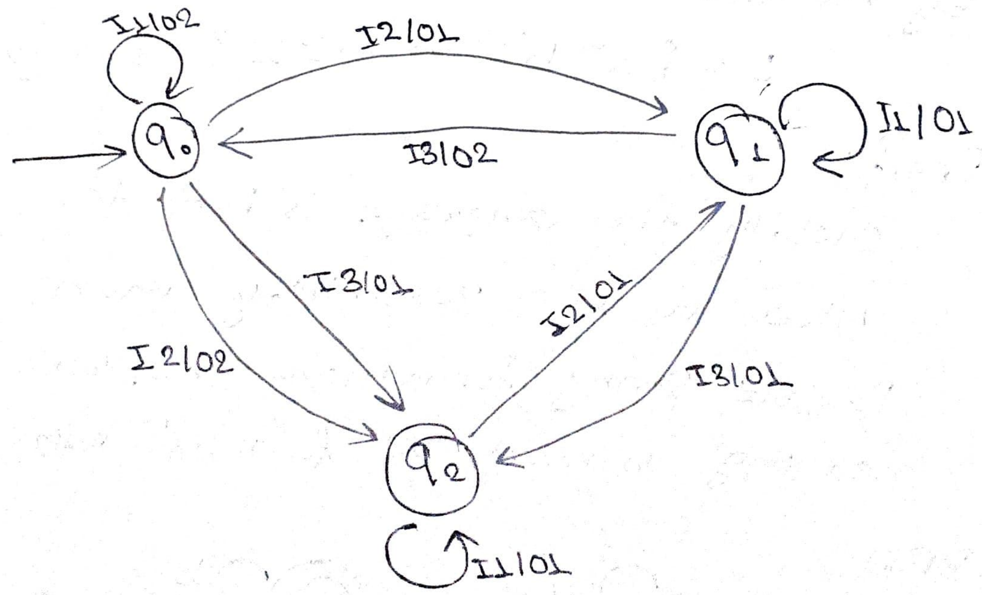
both strings are accepted by the NFA when ran through it.

When the similar process is run for other string with varied values of n, NFA is not satisfied.

Q.2.

Soln:-

Ans (c)



This is a Mealy Machine.

Inputs Sets: I1 = (0,3,6,9)

I2 = (1,4,7)

I3 = (2,5,8)

Output Sets: O1 = 0

O2 = 1

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$Me = \{ Q, \Sigma, \Delta, \delta, \lambda, q_0 \}$

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

$\Sigma = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$

Transition table, δ,

	I1 (rem 0)	I2 (rem 1)	I3 (rem 2)
$\rightarrow q_0^*$	q_0	q_1	q_2
q_1	q_1	q_2	q_0
q_2	q_2	q_0	q_1

Final state $= q_0$

from transition table, we have,

They represent zero-remainder state,
one-remainder state and
two-remainder state.