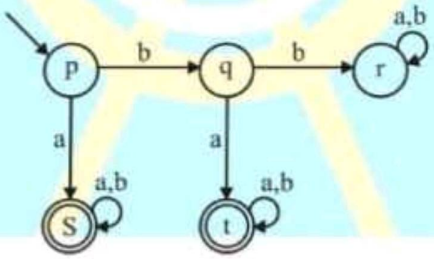
Theory of Computation

Q.1 Given the language L = {ab, aa, baa}, which of the following strings are in L*? **GATE 2012**

1. abaabaaabaa
2. aaaabaaaa
3. baaaaabaaaab
4. baaaaabaa

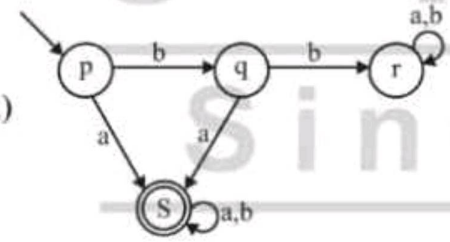
(A) 1, 2 and 3 (B) 2, 3 and 4 (C) 1, 2 and 4 (D) 1, 3 and 4

Q.2 A deterministic finite automation (DFA) D with alphabet $\Sigma = \{a, b\}$ is given below

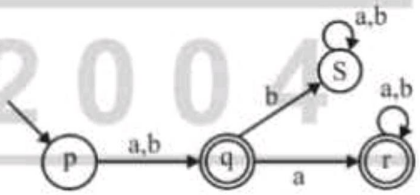


Which of the following finite state machine is a valid minimal DFA which accepts the same language as D? **GATE 2011**

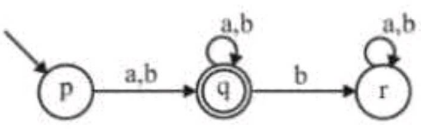
(A)



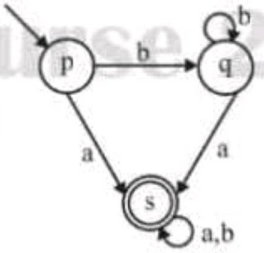
(B)



(C)



(D)



Q.3 Let w be any string of length n is {0,1}*. Let L be the set of all substrings of w. What is the minimum number of states in a non-deterministic finite automaton that accepts L? **GATE 2010**

(A) n-1 (B) N (C) n+1 (D) 2n-1

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TOC

1⇒ $L = \{ab, aa, baa\}$

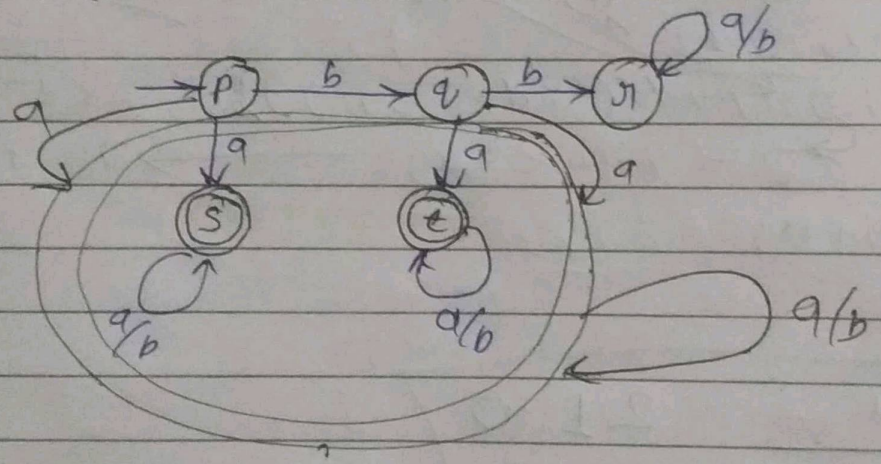
$L^* = ?$

1- abaabaaabaa ✓
2 aaaabaaaa ✓
3 baaaaabaaaab ✗
4 baaaaabaa ✓

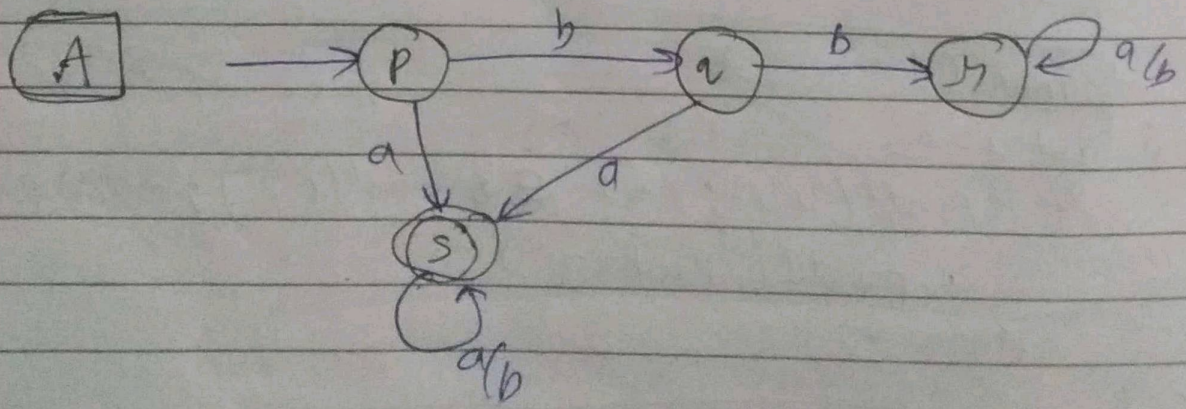
C 1, 2, 4 Ans

2⇒ $\Sigma = \{a, b\}$

A



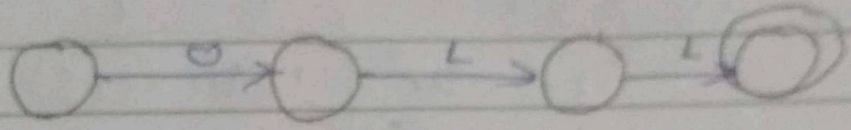
A



3 → $\Sigma = (0,1)^*$, NFA

C

Let 011



if $|w| = 3$
then state $= 4$

if $|w| = n$
then state $\rightarrow (n+1)$

C Ans

Q.4 Which one of the following languages over the alphabet {0,1} is described by the regular expression: (0+1)*0(0+1)*0(0+1)*? **GATE 2009**

(A) The set of all strings containing the substring 00.

(B) The set of all strings containing at most two 0's.

(C) The set of all strings containing at least two 0's.

(D) The set of all strings that begin and end with either 0 or 1.

Q.5 Which of the following statements is false? **GATE 2008**

(A) Every NFA can be converted to an equivalent DFA

(B) Every non-deterministic Turing machine can be converted to an equivalent deterministic Turing machine

(C) Every regular language is also a context-free language

(D) Every subset of a recursively enumerable set is recursive

Q.6 Given below are two finite state automata (→ indicates the start state and F indicates a final state)

Y :

	a	**b**
→1	1	2
2(F)	2	1

Z :

	a	**b**
→1	2	2
2(F)	1	1

Which of the following represents the product automaton Z × Y? **GATE 2008**

(A)

	a	**b**
→P	S	R
Q	R	S
R(F)	Q	P
S	Q	P

(B)

	a	**b**
→P	S	Q
Q	R	S
R(F)	Q	P
S	P	Q

(C)

	a	**b**
→P	Q	S
Q	R	S
R(F)	Q	P
S	Q	P

(D)

	a	**b**
→P	S	Q
Q	S	R
R(F)	Q	P
S	Q	P

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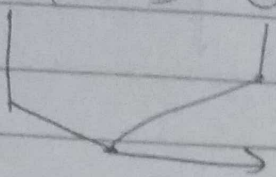
4⇒ RE: $(0+1)^*0(0+1)^*0(0+1)^*$



must 2 0's

[C] Set of all string containing atleast 2 0's.

5⇒ Which on false -

[D]

(1) Every subset of recursively enumerable set is recusive.

Teacher's Signature .....

6⇒

A

Y:	a	b
→1	1	2
(2)	2	1

Z:	a	b
→1	2	2
(2)	1	1

XY:		a	b
11	→P	12(Q)	22(S)
12	S	11(P)	21(R)
21	Q	22(S)	12(Q)
22	R	21(R)	11(P)

A

		0	1
→	P	S	R
	Q	R	S
	(R)	Q	P
	S	Q	P

		a	b
11	→P	12	22
12	S	11	21
21	Q	22	12
22	(R)	21	11

Q.8 Which of the following is TRUE? **GATE 2007**

(A) Every subset of a regular set is regular.

(B) Every finite subset of a non-regular set is regular.

(C) The union of two non-regular sets is not regular.

(D) Infinite union of finite sets is regular.

Q.9 A minimum state deterministic finite automaton accepting the language **GATE 2007**

$L=\{w \mid w \varepsilon \{0,1\}^*$, number of 0s and 1s in w are divisible by 3 and 5, respectively$\}$ has

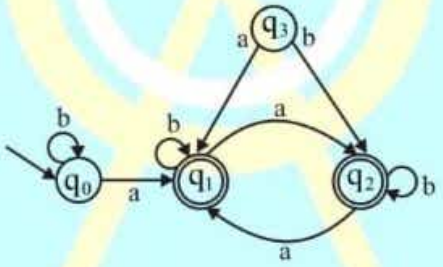
(A) 15 states (B) 11 states (C) 10 states (D) 9 states

Q.10 Which of the following languages is regular? **GATE 2007**

(A) $\{ww^R \mid w \in \{0,1\}^+\}$ (B) $\{ww^R x \mid x, w \in \{0,1\}^+\}$

(C) $\{wxw^R \mid x, w \in \{0,1\}^+\}$ (D) $\{xww^R \mid x, w \in \{0,1\}^+\}$

Q.11 Consider the following finite state automaton **GATE 2007**



The language accepted by this automaton is given by the regular expression

(A) $b^*ab^*ab^*ab^*$ (B) $(a+b)^*$ (C) $b^*a(a+b)^*$ (D) $b^*ab^*ab^*$

Q.12 Consider the automata given in previous question. The minimum state automaton equivalent to the above FSA has the following number of states **GATE 2007**

(A) 1 (B) 2 (C) 3 (D) 4

8 ⇒ True - }

B

B The ~~union of two~~ finite subset of non-regular sets is regular.

→ Set is always Regular if it is finite

Teacher's Signature .....

9 ⇒ $N(0) \% 3 = 0$

$N(1) \% 5 = 0$

Remider

(0, 1, 2)

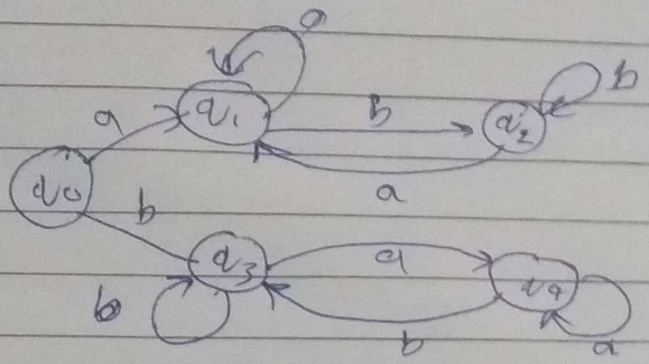
(0, 1, 2, 3, 4)

$3 \times 5 =$ (15 State)

A

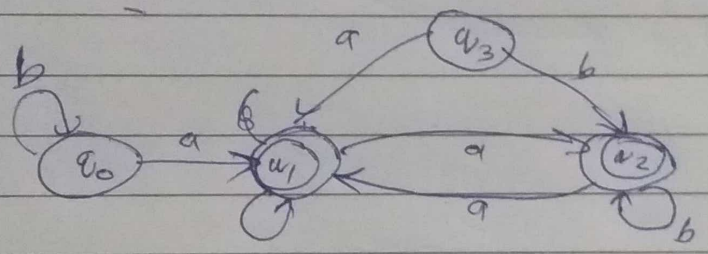
10 ⇒ C

C



$\{w \times w^R / x, w \in (a,b)^*\}$

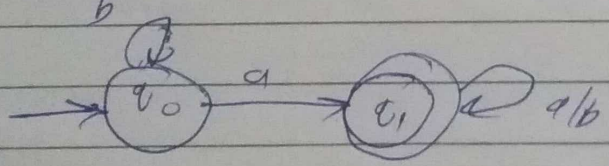
11 ⇒ C



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

C

12 ⇒ b



(b) 2 state

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