GATE

Computer Science & Information Technology

Theory Of Computation

DPP: 01

Regular Expression

Q1 The possible number of DFA with 2 states X,Y over the alphabet {a, b} where X is always initial state ?

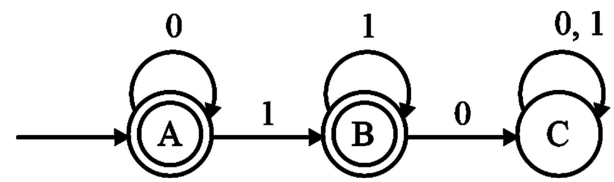
Q2 The possible number of DFA with 2 states X,Y over the alphabet {a, b} where X is always initial state , that accepts empty language?

Q3 The possible number of DFA with 2 states X,Y over the alphabet {a, b} where X is always initial state , that accepts complete language?

Q4 Consider the DFA ,M with states Q = {0,1,2,3,4}, input alphabet Σ = {0,1} start state 0, final state 0 and transition function $\delta(q, i) = |q^2 - i| \bmod 5$ q $\mathcal{E}$ Q, Input alphabets are {0,1}.
The above DFA, M accepts all binary strings containing
(A) Even number of 1's
(B) Odd number of 1's
(C) Even number of 0's
(D) Odd number of 0's

Q5 Consider the DFA ,M with states Q = {0,1,2,3,4}, input alphabet Σ = {0,1} start state 0, final state 0 and transition function $\delta(q, i) = |q^2 - I| \bmod 5$ q $\mathcal{E}$ Q, Input alphabets are {0,1}
The number of states in the minimal finite automata ,which is equivalent to M is
(A) 1 (B) 2
(C) 3 (D) 4

Q6 The regular expression for the language recognized by the following finite automata is?



(A) $(0 + 1)^*$ (B) $0(0 + 1)^*1$
(C) 0^*1^* (D) $0^*(0 + 1)^*1^*$

Q7 Choose the regular language from the following given options
(A) L = $\{x / x \in (a + b)^*\}$ and x is even length palindrome
(B) L = $\{a^n / n \geq 1\}$
(C) L = $\{a^n b^{2n} / n \geq 1\}$
(D) None

Q8 Which of the following regular expression represents all strings of a's and b's where the length of the string is at most 'n' is
(A) $(a + b)^n$
(B) $(a + b)^n (a + b)^*$
(C) $(a + b + \mathcal{E})^n$
(D) None of the above

Q9 Which of the following pair of regular expressions are not equal
(A) $(r^*)^*$ and $(r^*)^*$
(B) $(r + \mathcal{E})^*$ and r^*
(C) $(rr + \mathcal{E})^*$ and r^*
(D) None of the above

Q10 Consider the language S*, where S is all strings of a's and b's with odd length. The other description of this language is.
(A) All strings of a's and b's

(B) All even length strings of a's and b's

(C) All odd length strings of a's and b's

(D) None of the above

Q11 Let $r = (1 + 0)^*$, $s = 11{}^*0$ and $t = 1^*0$ be three regular expressions. Which one of the following is true?

(A) $L(s) \subset L(r)$ and $L(s) \subset L(t)$

(B) $L(r) \subset L(s)$ and $L(s) \subset L(t)$

(C) $L(t) \subset L(s)$ and $L(s) \subset L(r)$

(D) None of the above

Answer Key

Q1	64
Q2	20
Q3	20
Q4	(A)
Q5	(B)
Q6	(C)
Q7	(B)
Q8	(C)
Q9	(C)
Q10	(A)
Q11	(A)

Hints & Solutions

Q1 Text Solution:

Total DFA possibilities for final and non-final states(With 2 states DFA) = 4

For Each DFA 16 different DFAs are possible because of transitions.

Total DFA = 4 * 16 = 64

Q2 Text Solution:

Both the states must be non - finals

For DFA 16 different DFAs are possible because of transitions.

There are 4 different DFAs also exist when Y is final state and Do the reverse transitions.

TOtal DFAs = 16 + 4 = 20

Q3 Text Solution:

Total DFAs = 20

Q4 Text Solution:

Correct design of the DFA will be Even number of 1's.

Q5 Text Solution:

The number of states in the minimal finite automata= 2

Q6 Text Solution:

The regular expression = 0^*1^*

Q7 Text Solution:

$L = \{x/x \in (a + b)^*\}$ and x is even length palindrome = CFL

$L = \{a^n / n \geq 1\}$ = Regular

$L = \{a^n b^{2n} / n \geq 1\}$ = CFL

Q8 Text Solution:

$(a + b)^n$ Produce exactly n length string.

$(a + b)^n (a + b)^*$ Produce atleast n length string.

$(a + b + \varepsilon)^n$ Produce atmost n length string.

Q9 Text Solution:

$(rr + \varepsilon)^*$ and r^* Both are different because $(rr + \varepsilon)^*$ it will generate even length r and r^* can generate all length.

Q10 Text Solution:

S = Odd length

Odd length expression = $(a+b)\,[(a+b)^2]^*$

$S^* = [(a+b)\,[(a+b)^2]^*]^*$ is same as $(a+b)^*$ which will generate all the a's and b's.

Q11 Text Solution:

$r = (1 + 0)^*$

$s = 11^*0$

$t = 1^*0$

$L(s) \subset L(r)$ and $L(s) \subset L(t)$

Therefore, Option (a) is correct.