

# CS & DA

## 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  $\Sigma = \{0,1\}$  start state 0, final state 0 and transition function  $\delta(q, i) = |q^2 - i| \bmod 5$   $q \in Q$ , Input alphabets are {0,1}.

The above DFA, M accepts all binary strings containing

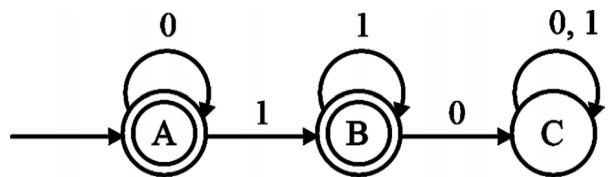
- (A) Even number of 1's
- (B) Odd number of 1's
- (C) Even number of 0's
- (D) Odd number of 0's

**Q5** Consider the DFA ,M with states  $Q = \{0,1,2,3,4\}$ , input alphabet  $\Sigma = \{0,1\}$  start state 0, final state 0 and transition function  $\delta(q, i) = |q^2 - i| \bmod 5$   $q \in Q$ , 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)  $(a + b + \epsilon)^n$
- (D) None of the above

**Q9** Which of the following pair of regular expressions are not equal

- (A)  $(r^*)^*$  and  $(r^*)^*$
- (B)  $(r + \epsilon)^*$  and  $r^*$
- (C)  $(rr + \epsilon)^*$  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



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- (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



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## Answer Key

Q1 64  
Q2 20  
Q3 20  
Q4 (A)  
Q5 (B)  
Q6 (C)

Q7 (B)  
Q8 (C)  
Q9 (C)  
Q10 (A)  
Q11 (A)



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# 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.

$$\text{Total DFA} = 4 * 16 = 64$$

**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.

$$\text{Total DFAs} = 16 + 4 = 20$$

**Q3 Text Solution:**

$$\text{Total DFAs} = 20$$

**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:**

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

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

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

**Q8 Text Solution:**

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

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

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

**Q9 Text Solution:**

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

**Q10 Text Solution:**

$S = \text{Odd length}$

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.



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