Regular Expression

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Regular expression or rational expression is a sequence of characters that define a search pattern.

Operations on Regular Language

1. Union If L & M are 2 regular languages then their union L ∪ M is also a union.

   $L \cup M = \{ s \mid s \text{ is in } L \text{ or } s \text{ is in } M \}$

2. Intersection: If L & M are 2 regular languages then their intersection is also an intersection.

   $L \cap M = \{ st \mid s \text{ is in } L \text{ and } t \text{ is in } M \}$

3. Kleen closure: If L is a regular language then its Kleen closure $L1^*$ will also be a regular language.

   L^* = zero or more occurence of language L.

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Q1. Write the regular expression for the language accepting all the string in which any number of a's is followed by any number of b's and c's

Ans. a's no. $= a^*$
b's " $= b^*$
c's " $= c^*$

$\therefore R = a^* b^* c^*$

Q2. Write the regular expression for the language over $\Sigma = \{0\}$ having even length of string.

Sol. The regular expression has to build the language

$L = \{00, 0000, 000000, \ldots\}$

$\therefore R = (00)^*$

Q3. Write the regular expression for the language having a string which should have at-least one 0 and at least one 1

Ans. $R = [(0+1)^* 0 (0+1)^* 1 (0+1)^*] + [(0+1)^* 1 (0+1)^* 0 (0+1)^*]$

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Q4. Describe the language denoted by following regular expression

$$R = (b^*(aaa)^* b^*)^*$$

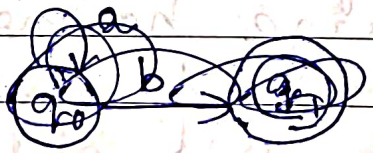
Sol. $R = ((\text{Any combination of } b\text{'s})(aaa)^*)^*$

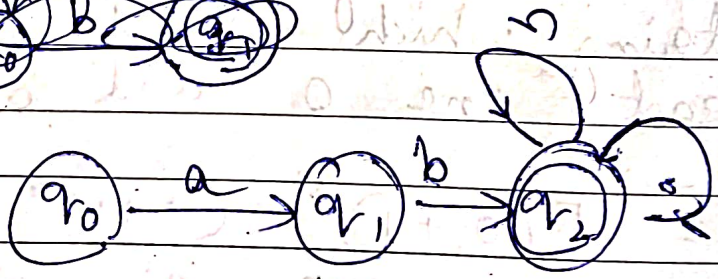
Q5. Write the regular expression for the language containing the string in which every 0 is immediately followed by 11.

Soln. $R = (011 + 1)^*$

Q. Draw a DFA that accepts ab $(a+b)^*$

ab, ab(a+b), ab(a+b)(a+b) . . .

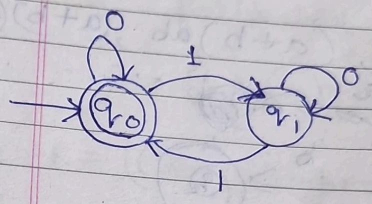




Example of DFA

Ex1. $L1 = \{ w \in \{0, 1\}^* \mid$ w has an even no. of 1.

(such that)



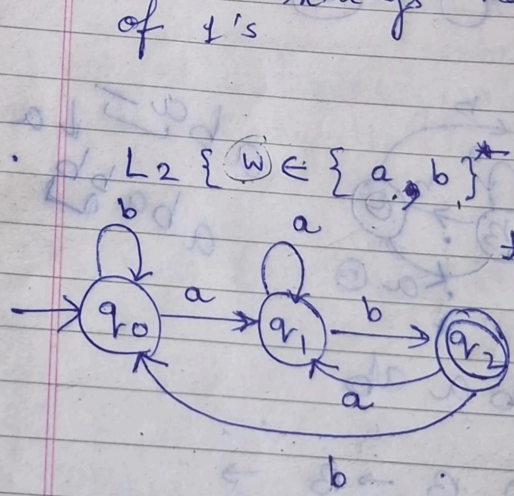
01, 01 01, 1101

$q_0 \rightarrow$ all strings having an even no of 1's

$q_1 \rightarrow$ all strings having an odd n

of 1's

Ex2. $L2 \{ w \in \{a, b\}^* \mid$ w ends with the substring



$W = \{$ a ab, abab, baabab, baaabab, baabaaab, ... $\}$

Example of DFA

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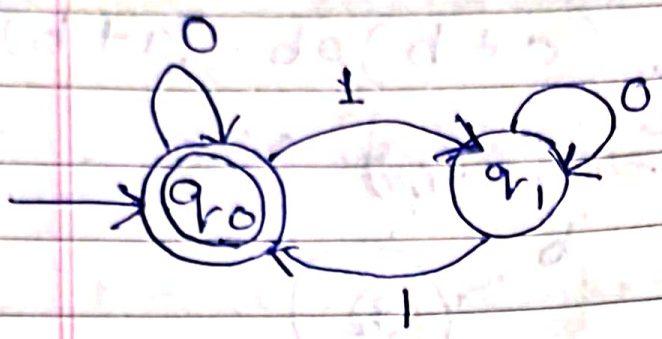
Ex 1. $L1 = \{ w \in \{0,1\}^* \mid w \text{ has an even no. of } 1's \text{ such that} \}$



01, 0101, 1101, 11

$q_0 \rightarrow$ all strings having an even no. of 1's

$q_1 \rightarrow$ all strings having an odd no. of 1's

Ex 2. $L2 \{ w \in \{a,b\}^* \mid w \text{ ends with the substring ab} \}$