



PES UNIVERSITY, Bangalore
(Established under Karnataka Act No. 16 of 2013)
Department of Computer Science & Engineering

Automata Formal Languages & Logic

Homework - Regular Expressions

Regular Expression

- 1) Write regular expression for the following language over the alphabet $\Sigma = \{a, b\}$
All strings that contain at most one b
- 2) Write regular expression for the following language over the alphabet $\Sigma = \{0,1\}$
All strings that contain even number of 0's
- 3) Write a regular expression denoting the set of all strings of a's and b's such that every a is immediately preceded by at least three consecutive b's
- 4) Write a regular expression to match binary string having exactly one pair of consecutive 0's
- 5) Write a regular expression to match all the strings with even number of a's followed by odd number of b's

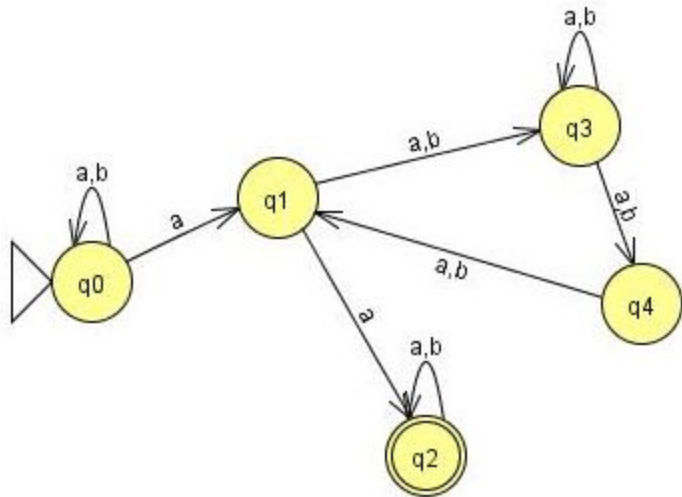
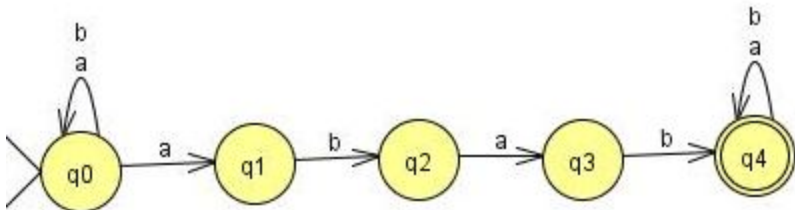
Regular Expression to Finite Automata

- 1) Convert the following regular expression to finite automata
 - a) a^*b^*
 - b) $(a+b)^* a (a+b)^* b (a+b)^*$
 - c) $(0+1)^*1$
 - d) $(0+1)^+(0+2)^+(1+2)^+$
 - e) $10(0+1)^*01$

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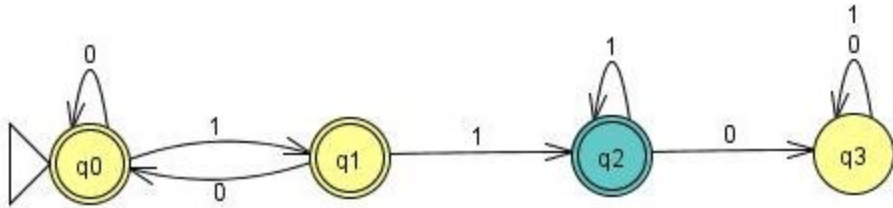
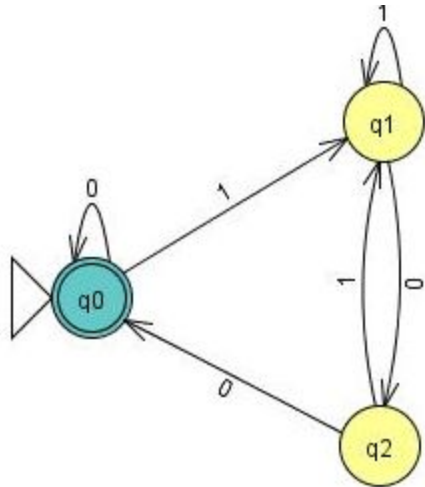
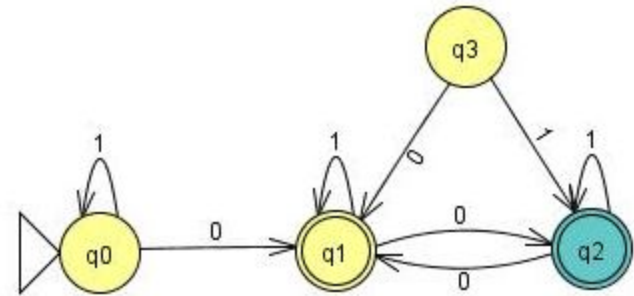
Finite Automata to regular expression

1) Write regular expression for the following Finite Automata

a	 <pre> graph LR start(()) --> q0((q0)) q0 -- "a,b" --> q0 q0 -- "a" --> q1((q1)) q1 -- "a,b" --> q3((q3)) q1 -- "a" --> q2(((q2))) q1 -- "a,b" --> q4((q4)) q3 -- "a,b" --> q3 q4 -- "a,b" --> q4 style start fill:none,stroke:none style q2 fill:none,stroke:none </pre>
b	 <pre> graph LR start(()) --> q0((q0)) q0 -- "b" --> q0 q0 -- "a" --> q1((q1)) q1 -- "b" --> q2((q2)) q2 -- "a" --> q3((q3)) q3 -- "b" --> q4(((q4))) q4 -- "a" --> q4 q4 -- "b" --> q4 style start fill:none,stroke:none style q4 fill:none,stroke:none </pre>

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c	 <p>Finite Automaton (FA) diagram for part c. It consists of four states: q0, q1, q2, and q3. q0 is the start state (indicated by a double circle) and q2 is the final state (indicated by a double circle). Transitions are as follows: q0 has a self-loop on input 0; q0 transitions to q1 on input 1; q1 transitions to q0 on input 0 and to q2 on input 1; q2 has a self-loop on input 1 and transitions to q3 on input 0; q3 has a self-loop on input 0 and transitions to q2 on input 1.</p>
d	 <p>Finite Automaton (FA) diagram for part d. It consists of three states: q0, q1, and q2. q0 is the start state (indicated by a double circle). Transitions are as follows: q0 has a self-loop on input 0; q0 transitions to q1 on input 1; q1 transitions to q2 on input 0 and to q1 on input 1; q2 transitions to q0 on input 0 and to q1 on input 1.</p>
e	 <p>Finite Automaton (FA) diagram for part e. It consists of four states: q0, q1, q2, and q3. q0 is the start state (indicated by a double circle) and q2 is the final state (indicated by a double circle). Transitions are as follows: q0 has a self-loop on input 1 and transitions to q1 on input 0; q1 has a self-loop on input 1 and transitions to q2 on input 0; q2 has a self-loop on input 1 and transitions to q1 on input 0; q3 is an unreachable state with no incoming transitions.</p>



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Equivalence of regular expression

- 1) Show that the following two regular expression are same
 - a) $(a + b)^*a(a + b)^*b(a + b)^*$ and $(a + b)^*ab(a + b)^*$
 - b) $0^*(10^*10^*)^*$ and $0^*(10^*1)^*0^*$
 - c) $(abba + ab)(ba)^*$ and $ab(ba)^*$

Regular expression in Practice

- 1) Write a regular expression for matching HTML tag that satisfies the following scenario
 - > The start tag must begin with < followed by one or more characters and end with >
 - > The end tag must start with </ followed by one or more characters and end with >
 - > must match the content inside a TAG element
- 2) Write a regular expression to validate a password that satisfies the following scenario
 - > 5 to 10 characters in length
 - > Must have at least two uppercase letter
 - > Must have at least one lower case letter
 - > Must have at least one digit
 - > Should contain other characters
- 3) Write a regular expression to validate a URL that satisfies the following scenario
 - > Must start with https or ftp followed by ://
 - > Must match a valid domain name
 - > Could contain a port specification (<http://www.xyz.com:8080>)
 - > Could contain digit, letter, dots, hyphens, forward slashes, multiple times



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Link: <https://www.sitepoint.com/demystifying-regex-with-practical-examples/>