Assignment # 1(Theory Of Automata)

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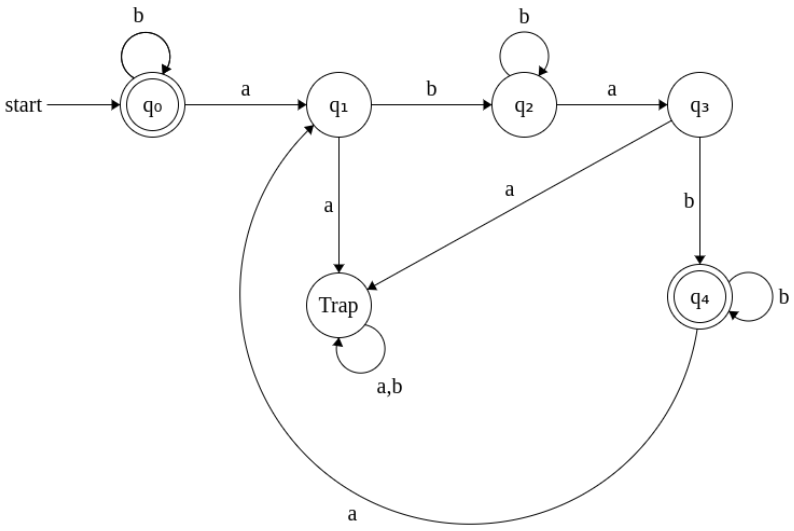
Contents

1 Problem 1

1.1 L1

L1: The language of all strings containing even number of a's and each a is followed by at least one b.

1.1.1 L1 solution



1.2 L4

The language of all strings containing no more than one occurrence of the string aa. (the string aaa should be viewed as containing 2 occurrences of aa)

Let L is the string which contains occurance of aa more than once
Solution by complement
Now $L4 = L - L'$

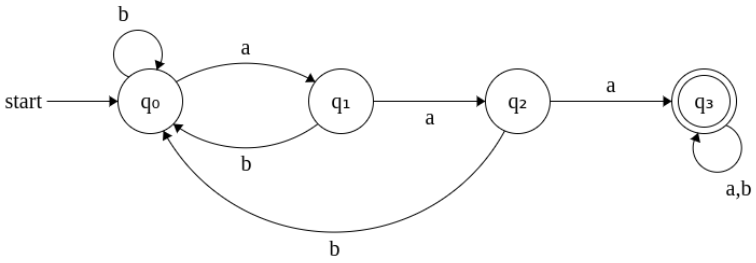
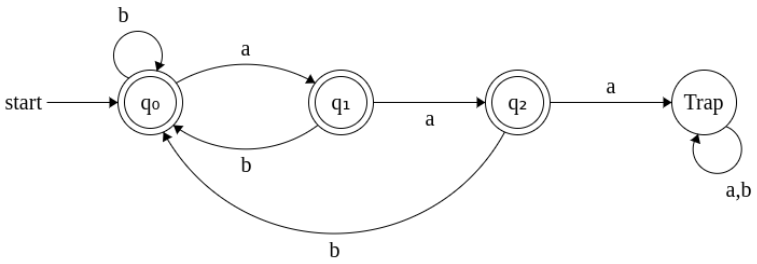


Figure 1: DFA of Complement

1.2.1 L4 solution

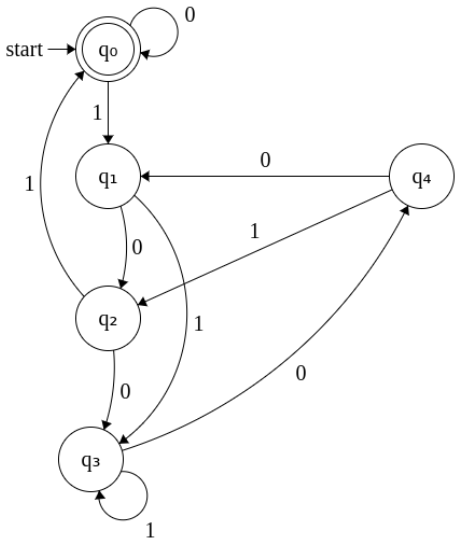


2 Problem 2

2.1 2b/L1

strings over {0,1} such that their decimal equivalent is multiple of 5 Eg: {0, 101,1010.....}

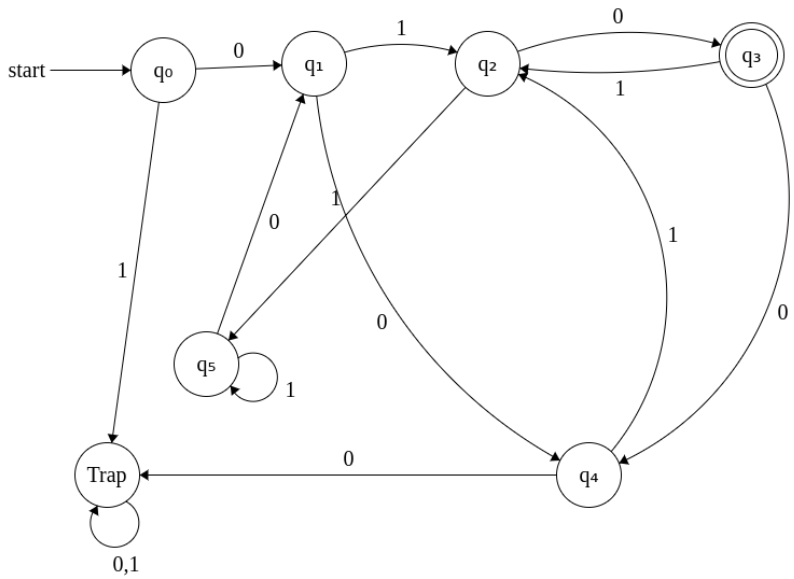
2.1.1 2b/L1 Solution



2.2 2b/L2

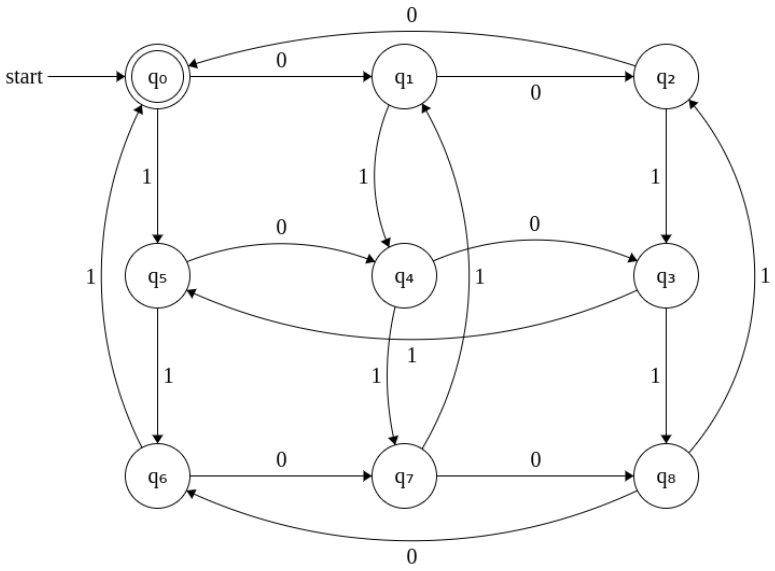
all strings over {0,1} that start with 0 and end with 010 and do not have 000 as part of a string.

2.2.1 2b/L2 Solution



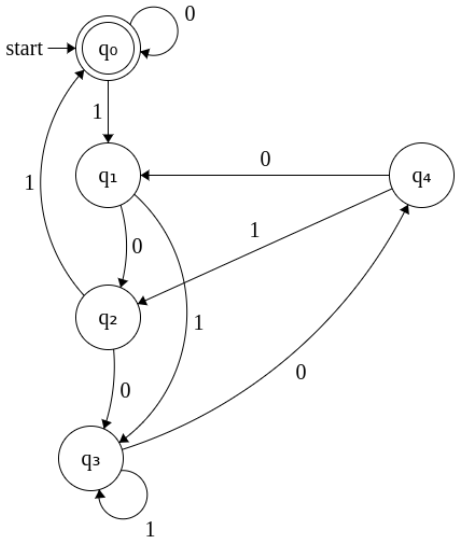
2.3 2b/L4

all the string x in which n_0 (x)%3=0 and n_1 (x)%3=0



2.4 Run DFA

Run DFA of L1 of problem 2 for following strings, and answer which ones are accepted and which are rejected {000111, 101000, 10110100,0000100000}



2.4.1 Rules of Extended transitions

1: $\delta^*(q, \hat{}) -> q$
2: $\delta^*(q, xa) -> \delta(\delta^*(q, x), a)$
3: $\delta^*(q, xy) -> \delta^*(\delta^*(q, x), y)$

1. $\delta^*(q_0, 000111)$

   using rule 1

   $\delta(\delta^*(q_0, 00011), 1)$

   $\delta(\delta(\delta^*(q_0, 0001), 1), 1)$

   $\delta(\delta(\delta(\delta^*(q_0, 000), 1), 1), 1)$

   $\delta(\delta(\delta(\delta(\delta^*(q_0, 00), 0), 1), 1), 1)$

   $\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 0), 0), 0), 1), 1), 1)$

   $\delta(\delta(\delta(\delta(\delta(q_0, 0), 0), 1), 1), 1)$

   $\delta(\delta(\delta(\delta(q_0, 0), 1), 1), 1)$

   $\delta(\delta(\delta(q_0, 1), 1), 1)$

   $\delta(\delta(q_1, 1), 1)$

   $\delta(q_3, 1)$

q_3 is not final state (hence rejected)

2. $\delta^*(q_0, 101000)$

   using rule 1

   $\delta(\delta^*(q_0, 10100), 0)$

   $\delta(\delta(\delta^*(q_0, 1010), 0), 0)$

   $\delta(\delta(\delta(\delta^*(q_0, 101), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta^*(q_0, 10), 1), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 1), 0), 1), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(q_1, 0), 1), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(q_2, 1), 0), 0), 0)$

   $\delta(\delta(\delta(q_0, 0), 0), 0)$

   $\delta(\delta(q_0, 0), 0)$

   $\delta(q_0, 0)$

   q_0 is final state (hence accepted)

3. $\delta^*(q_0, 10110100)$

   using rule 1

   $\delta(\delta^*(q_0, 1011010), 0)$

   $\delta(\delta(\delta^*(q_0, 101101), 0), 0)$

   $\delta(\delta(\delta(\delta^*(q_0, 10110), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta^*(q_0, 1011), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 101), 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 10), 1), 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 1), 0), 1), 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(q_1, 0), 1), 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(q_2, 1), 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(q_0, 1), 0), 1), 0), 0)$

   $\delta(\delta(\delta(\delta(q_1, 0), 1), 0), 0)$

   $\delta(\delta(\delta(q_2, 1), 0), 0)$

   $\delta(\delta(q_2, 0), 0)$

   $\delta(q_0, 0)$

   q_0 is final state (hence accepted)

4. $\delta^*(q_0, 0000100000)$

   using rule 1

   $\delta(\delta^*(q_0, 000010000), 0)$

   $\delta(\delta(\delta^*(q_0, 00001000), 0), 0)$

   $\delta(\delta(\delta(\delta^*(q_0, 0000100), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta^*(q_0, 000010), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 00001), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 0000), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 000), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 00), 0), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta^*(q_0, 0), 0), 0), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(q_0, 0), 0), 0), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(\delta(q_0, 0), 0), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(\delta(q_0, 0), 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(\delta(q_0, 0), 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(q_0, 1), 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(\delta(q_1, 0), 0), 0), 0), 0)$

   $\delta(\delta(\delta(\delta(q2, 0), 0), 0), 0)$

   $\delta(\delta(\delta(q_3, 0), 0), 0)$

   $\delta(\delta(q_4, 0), 0)$

   $\delta(q1, 0)$

   q_2 is not final state, (hence rejected)

Table 1: Summary of Dry Run;

strings	status	Reason
000111	Rejected	q_3 is not final state
101000	Accepted	q_0 is final state
10110100	Accepted	q_0 is final state
0000100000	Rejected	q_2 is not final state