CSE322
CONSTRUCTION OF FINITE AUTOMATA EQUIVALENT TO REGULAR EXPRESSION

Lecture #9

STEPS

The method we are going to give for constructing a finite automaton equivalent to a given regular expression is called the *subset method* which involves two steps.

Step 1 Construct a transition graph (transition system) equivalent to the given regular expression using Λ-moves. This is done by using Theorem 5.2.

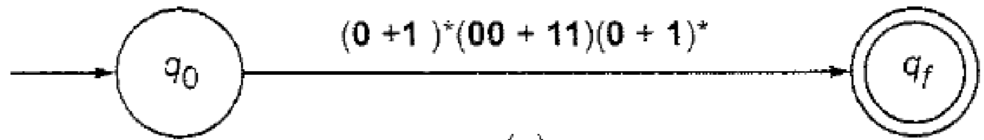
Step 2 Construct the transition table for the transition graph

PROBLEM

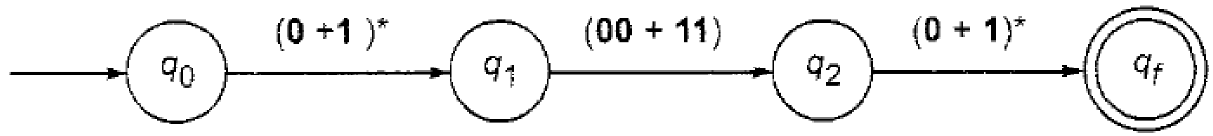
Construct the finite automaton equivalent to the regular expression

$$(0 + 1)^*(00 + 11)(0 + 1)^*$$

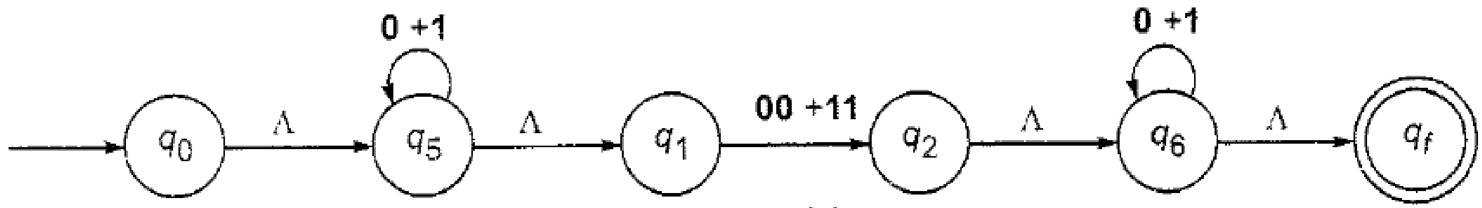
SOLUTION



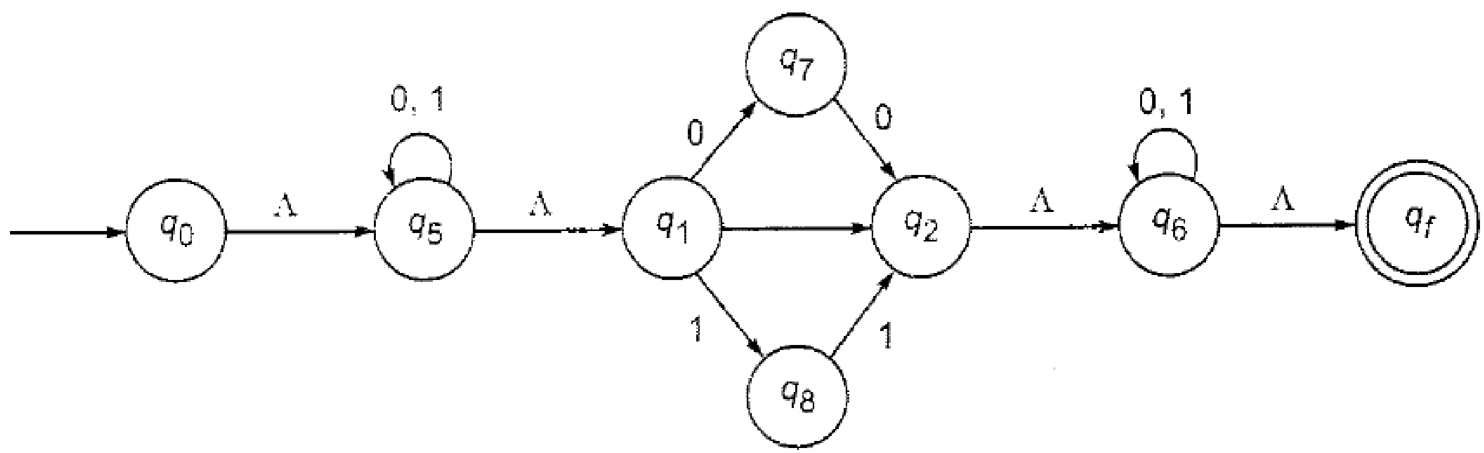
(a)



(b)

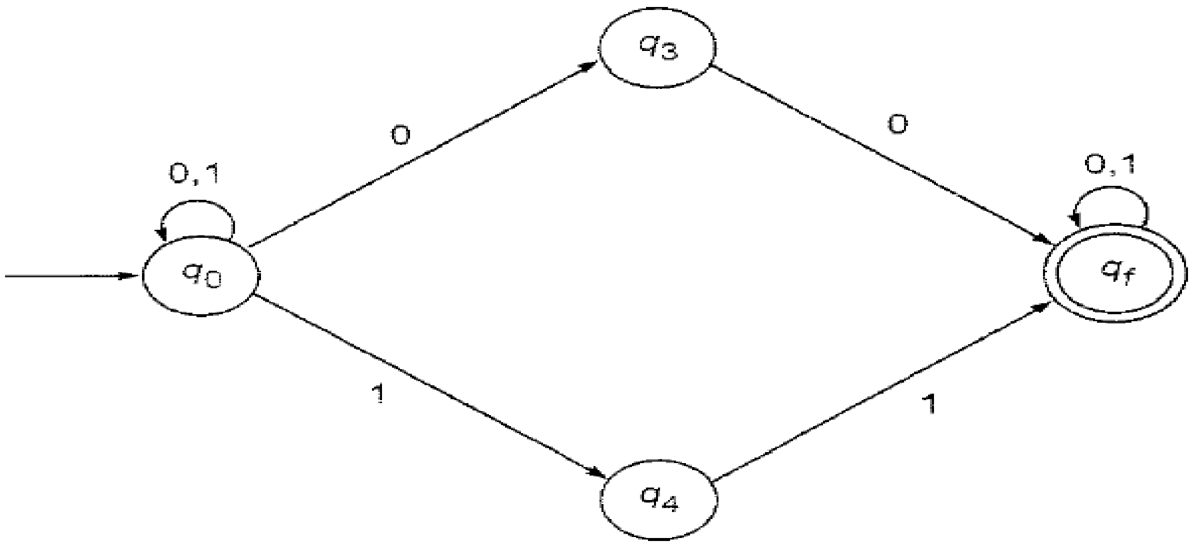


(c)



(d)

SOLUTION

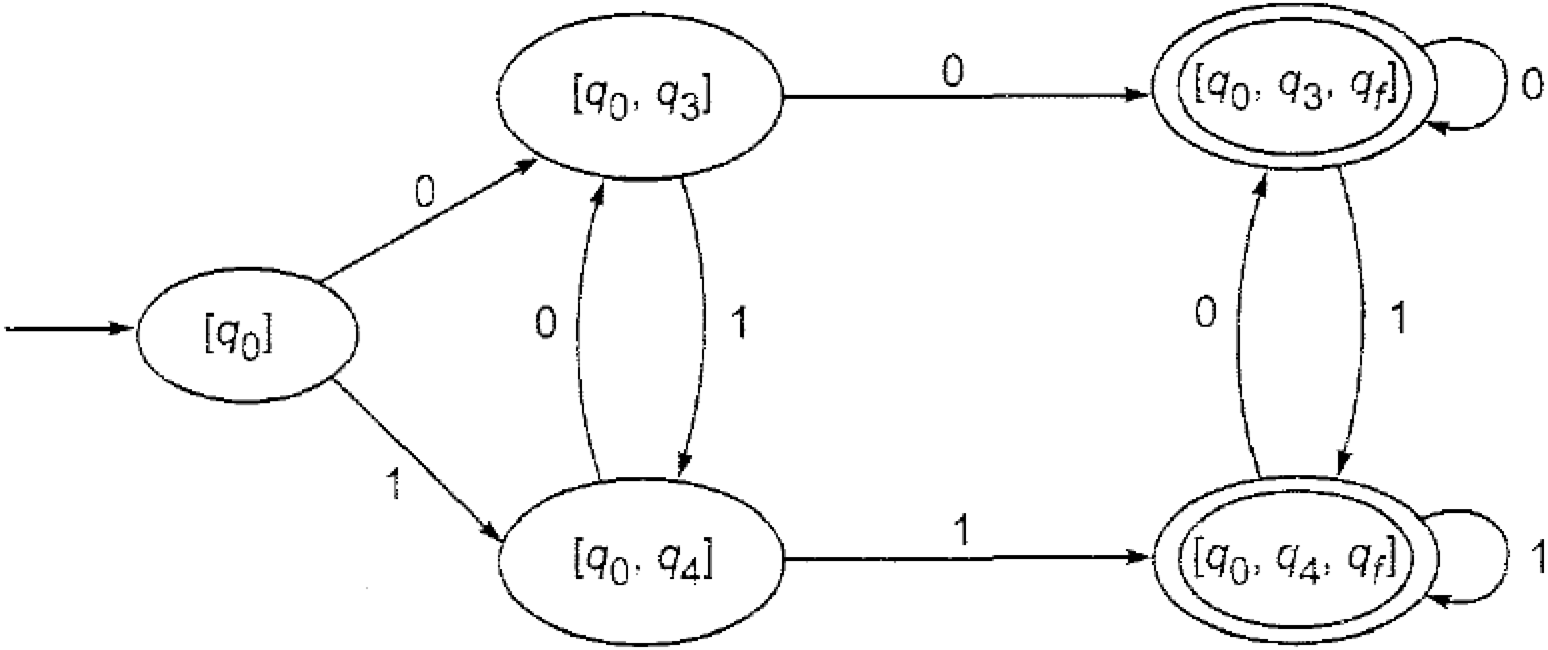


(e)

State/Σ	0	1
$\rightarrow q_0$	q_0, q_3	q_0, q_4
q_3	q_f	
q_4		q_f
q_f	q_f	q_f

SOLUTION

Q	Q_0	Q_1
$\rightarrow [q_0]$	$[q_0, q_3]$	$[q_0, q_4]$
$[q_0, q_3]$	$[q_0, q_3, q_f]$	$[q_0, q_4]$
$[q_0, q_4]$	$[q_0, q_3]$	$[q_0, q_4, q_f]$
$[q_0, q_3, q_f]$	$[q_0, q_3, q_f]$	$[q_0, q_4, q_f]$
$[q_0, q_4, q_f]$	$[q_0, q_3, q_f]$	$[q_0, q_4, q_f]$



CSE322
EQUIVALENCE OF TWO FINITE AUTOMATA AND REGULAR EXPRESSION

Lecture #9

EQUIVALENCE OF TWO FINITE AUTOMATA

- Two finite automata are over∑ are equivalent if they accept the same set of string over input ∑.
- When two finite automata are not equivalent ,there is some string w over ∑ satisfying the following: one automaton reaches a final state on application of w, whereas other automaton reaches a non final state.

CASES

Case 1   If we reach a pair (q, q') such that q is a final state of M, and q' is a nonfinal state of M' or vice versa, we terminate the construction and conclude that M and M' are not equivalent.

Case 2   Here the construction is terminated when no new element appears in the second and subsequent columns which are not in the first column (i.e. when all the elements in the second and subsequent columns appear in the first column). In this case we conclude that M and M' are equivalent.

PROBLEM

Consider the following two DFAs M and M' over {0, 1} given in Fig. 5.23. Determine whether M and M' are equivalent.

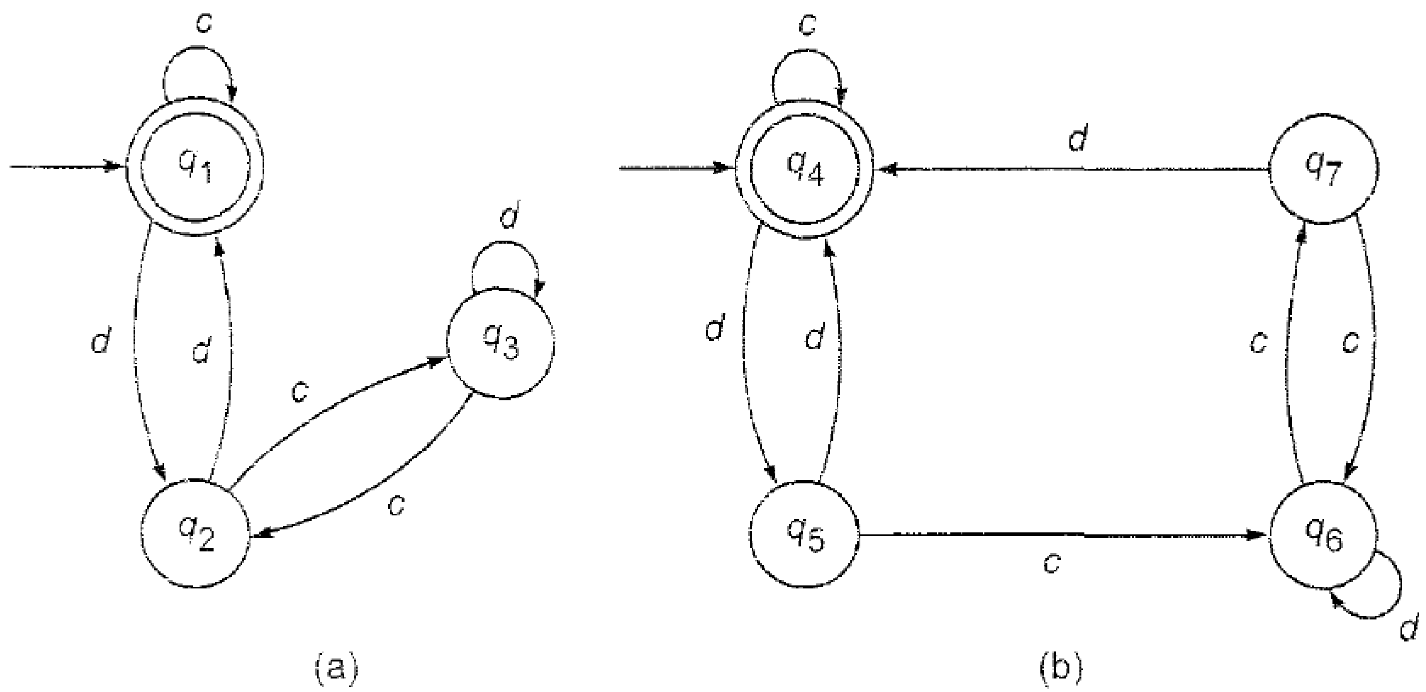


Fig. 5.23 (a) Automaton M and (b) automaton M'.

SOLUTION

(q, q')	(q_c, q'_c)	(q_d, q'_d)
(q_1, q_4)	(q_1, q_4)	(q_2, q_5)
(q_2, q_5)	(q_3, q_6)	(q_1, q_4)
(q_3, q_6)	(q_2, q_7)	(q_3, q_6)
(q_2, q_7)	(q_3, q_6)	(q_1, q_4)

As we do not get a pair (q, q'), where q is a final state and q' is a nonfinal state (or vice versa) at every row, we proceed until all the elements in the second and third columns are also in the first column. Therefore, M and M' are equivalent.

EQUIVALENCE OF TWO REGULAR EXPRESSION

- The regular expressions P and Q are equivalent iff they represent the same set. Also, P and Q are equivalent iff the corresponding finite automata are equivalent.

PROBLEM

- PROVE

  $(a+b)^*=a^*(ba^*)^*$

SOLUTION

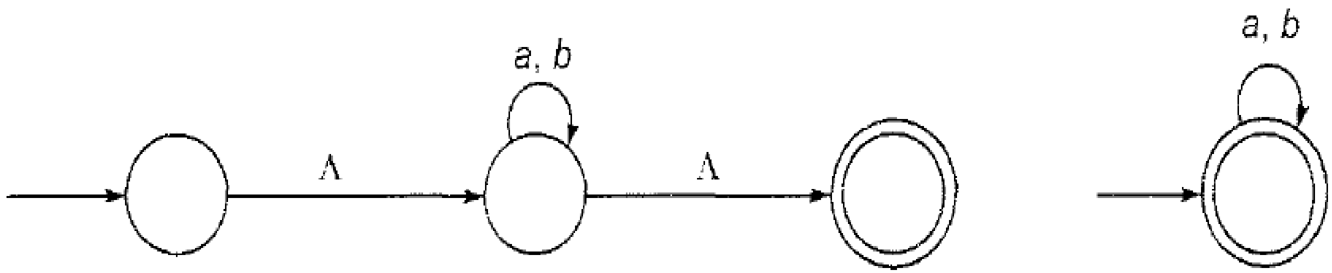


Fig. 5.25 Transition system for (**a** + **b**)*.

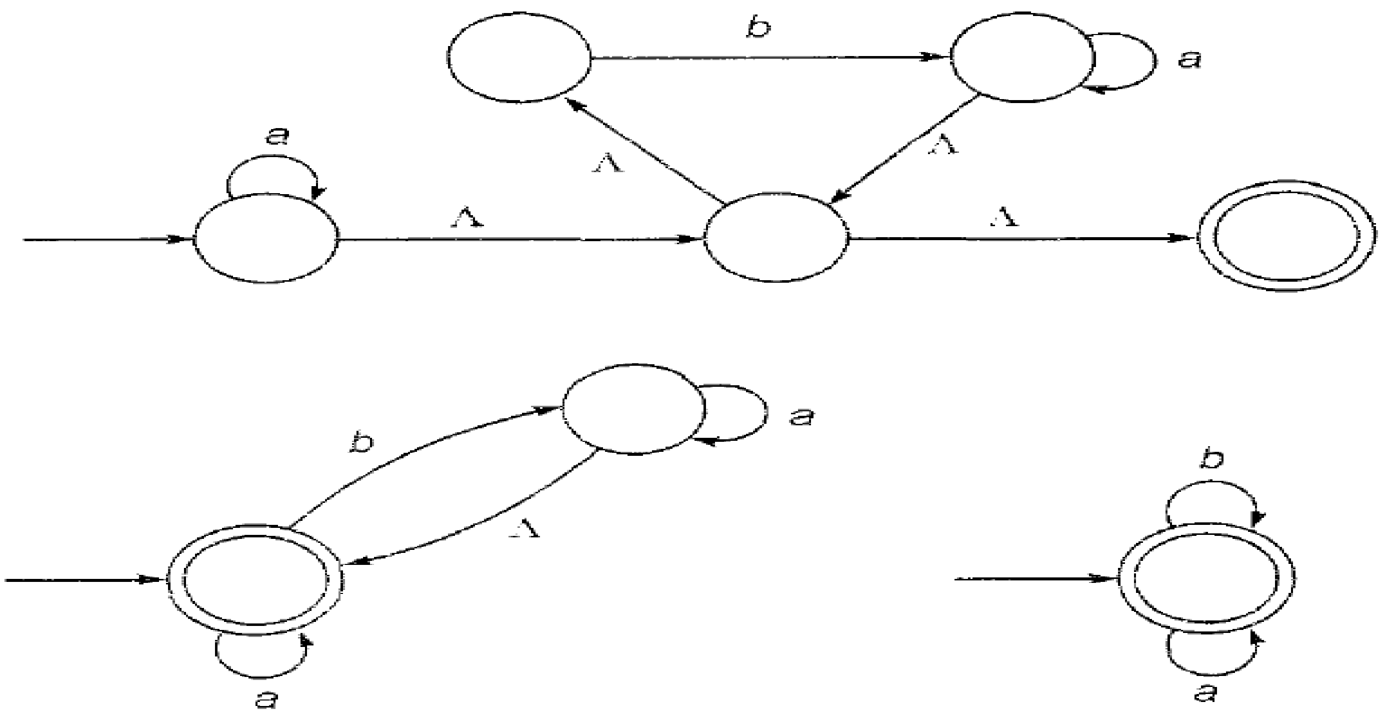


Fig. 5.26 Transition system for **a*(ba*)***.

Closure properties of Regular set

- Set Union
- Concatenation
- Closure(iteration)
- Transpose
- Set intersection
- Complementation