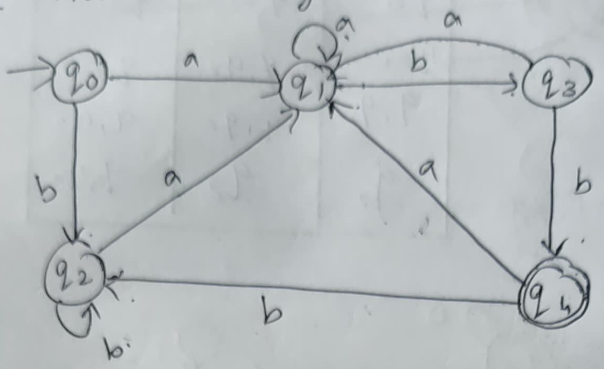
11	14/3/24	Minimize the DFA
12	14/3/24	Identify the language by RE
13	14/3/24	Construct NFA with ε-moves.
14.	14/3/24	Construct RE from DFA.
15	14/3/24	Prove the language (RE or not)

14/3/24

Day - 2

Experiment - 11

11) Minimize the DFA given below:



Aim: To minimize the given DFA

DFA: From each state for each input there will be exactly one transition.

Procedure:

1. Five tuples for DFA $M = (Q, \Sigma, \delta, q_0, F)$

$Q = \{q_0, q_1, q_2, q_3, q_4\}$ $\Sigma = \{a, b\}$ $q_0 = q_0$ $F = q_4$

2. Transition table for given DFA.

States	a	b
q0	q1	q2
q1	q1	q3
q2	q1	q2
q3	q1	q4
q4	q1	q2

3. Find 0 - equivalence

$\{q_0, q_1, q_2, q_3\}$ $\{q_4\}$

4. Find 1 - equivalence

$\{q_0, q_1, q_2\}$ $\{q_3\}$ $\{q_4\}$

5. find 2 - equivalence
{q0, q2} {q1} {q3} {q4}

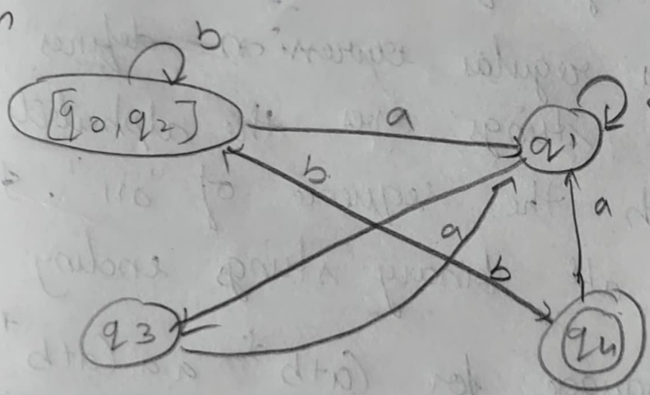
6. Find 3 - equivalence
{q0, q2} {q1} {q3} {q4}

7. 2 - equivalence & 3 - equivalence
so, stop finding equivalences.

8. Draw transitions table to take from last found equivalence.

States	a	b.
q0,q2	q1	q2
q1	q1	q3
q3	q1	q4
q4	q1	q2.

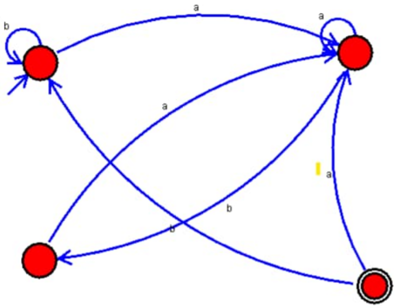
Diagram



Result: Thus, the given DFA is minimize successfully

Automaton Simulator

File Help



b	a	b	a	b	b	b	a	a

Experiment - 12

12) Identify the language defined by the re
i) $(0+1)^*$ (ii) $(0+1)^* 011$ iii) $(a+b)^* aa (a+b)^*$

Aim: To identify the language defined by the given regular expressions.

Regular expressions:
The languages accepted by Finite automata are described by simple expression called "RE"

Procedure:
1. Language for $(0+1)^*$
This regular expression defines the language of all strings over the alphabet $\{0,1\}$ including the empty string. It represents the set of all binary strings.

2. Language for $(0+1)^* 011$
This regular expression defines the language of all the strings over the alphabets $\{0,1\}$ that end with the sequence of "011". It represents the set of all binary strings ending with "011".

3. Language for $(a+b)^* aa (a+b)^*$
This regular expression defines the language of all strings over the alphabet $\{a, b\}$ that contain the substring "aa". It represents the set of all strings containing atleast one occurance of "aa".

Result: Thus the language for given regular expression is identified successfully.

Experiment 13

13) Construct NFA with ε-moves equivalent to the RE given below. i) $(a^* + b^*)^*$ ii) $(01+10)^*$ (iii) ab^*a

Aim: To construct NFA with ε-moves equivalent to the given RE.

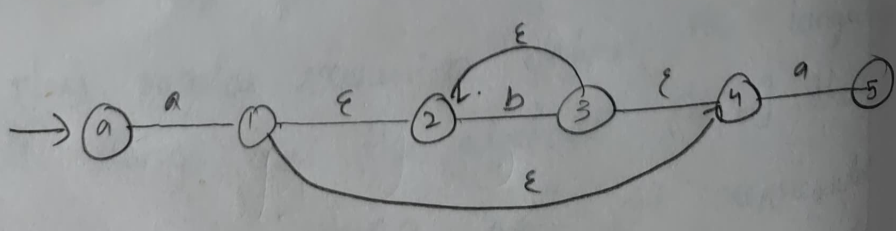
NFA: From each state for every input we can have 0 or more transitions.

Procedure:

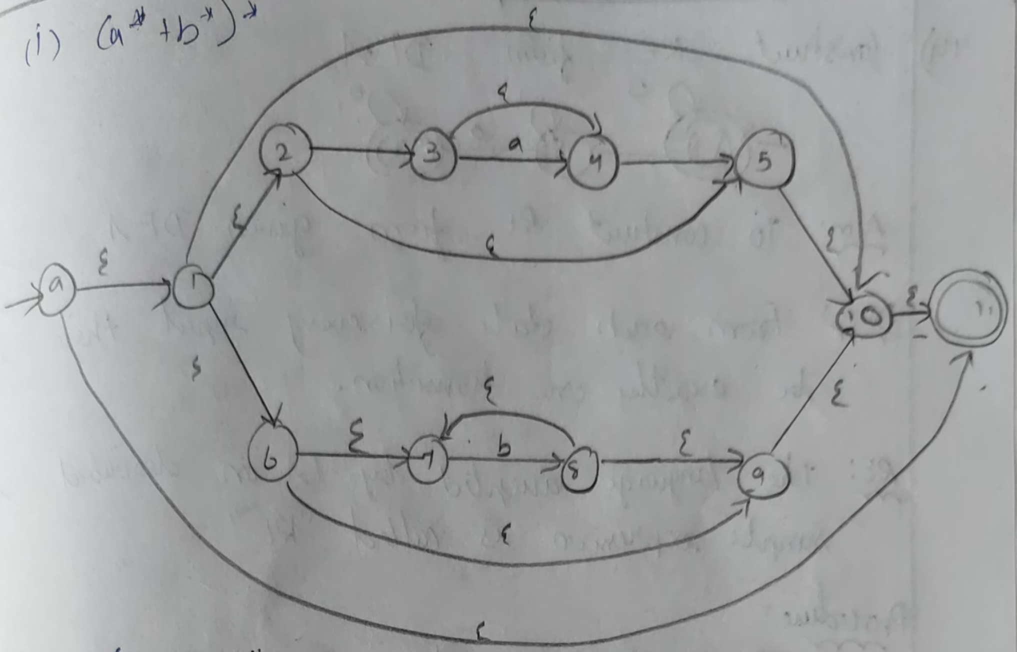
1) Construct finite Automata for a^* & b^*
2) Combine these two Automata's according to "+" i.e., Automata concatenation
3) Then construct for $(a^* + b^*)^*$
4) For second question, construct Automata for 01 and 10.
5) Add these two Automata's according to "+" & then construct FA for $(01+10)^*$
6) for third question, construct Automata for ab^* & then ab^*a.

Diagram:

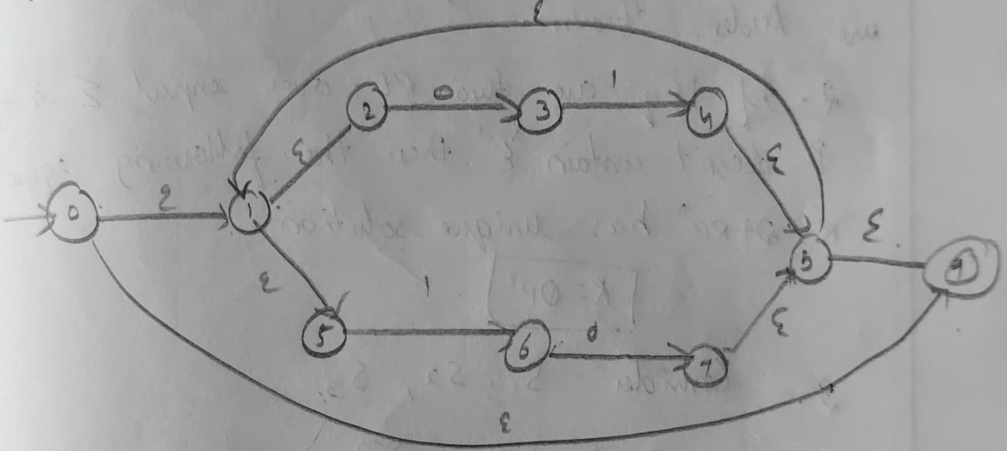
(iii) ab^*a.



(i) $(a^* + b^*)^*$



(ii) $(01 + 10)^*$

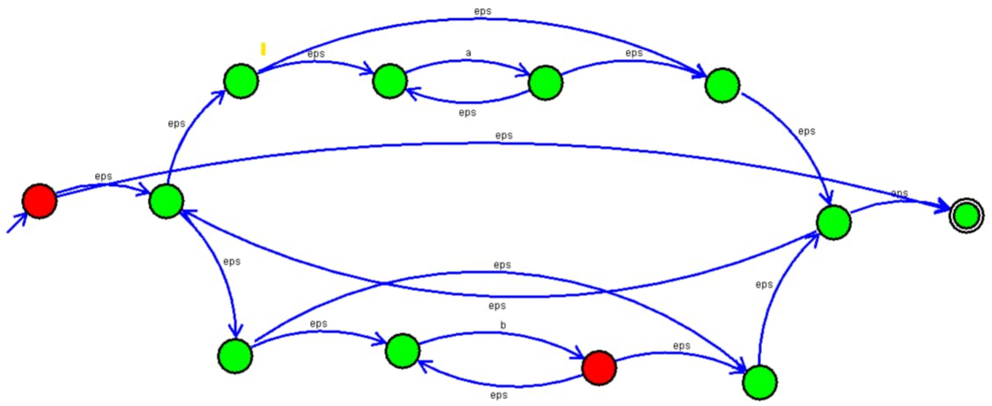


Result:

Thus the NFA with ε-moves for given RE is constructed successfully.

Automaton Simulator: 11

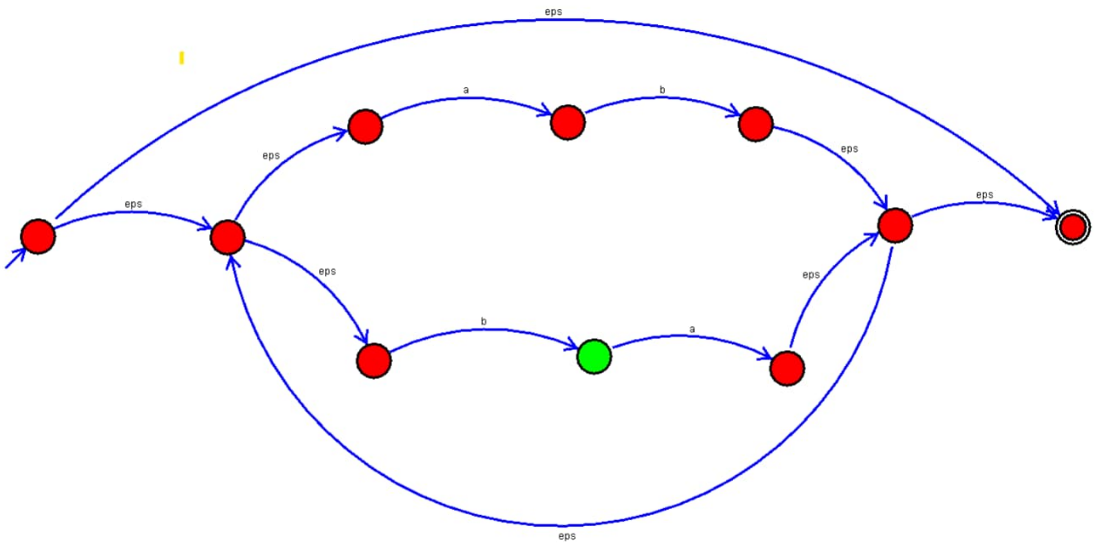
File Help



a	b	a	b	a	b	a	b	a	b	a

Automaton Simulator: 11

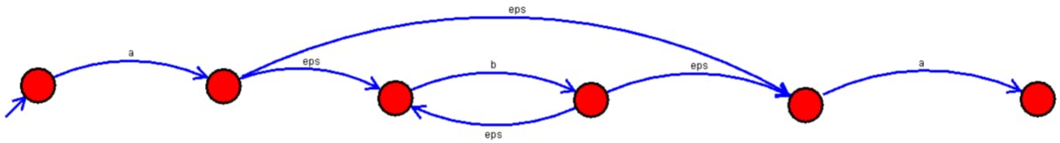
File Help



a	b	a	b	a	b	b	a	b	a	b

Automaton Simulator: 13(b)

File Help



a	b	a	b	a	b	a	b	a

Experiment 14.

14) Construct RE from DFA.

Aim: To construct RE from given DFA.

DFA: From each state for every input there will be exactly one transition.

RE: The language accepted by FA or described by simple expression is called "RE"

Procedure:

1. To construct RE from given DFA, we can use Arden's theorem.

2. If P & Q are two RE over input Σ & if P doesn't contain 'ε' then the following equation "$R = Q + RP$" has unique solution.

$$\boxed{R = QP^*}$$

3. Consider S_1, S_2, S_3

$S_1 = S_1 0 + \varepsilon \rightarrow (1)$

$S_2 = S_1 1 + S_2 1 \rightarrow (2)$

$S_3 = S_2 0 + S_3 (0+1) \rightarrow (3)$

4. Consider (1) & (3) only, because they are final states.

$S_1 = S_1 0 + \varepsilon \Rightarrow S_1 = \varepsilon + S_1 0$

$\quad R \quad Q \quad RP.$

$$\boxed{S_1 = 0^*} \rightarrow (4)$$

Now, $S_3 = S_2 0 + S_3 (0+1)$

$\quad R \quad Q \quad R \quad P.$

$$\boxed{S_3 = S_2 0 (0+1)^*} \rightarrow (5)$$

In S_3 equation we have S_2, So we have to find RE for S_2.

Now,

$$S_2 = S_1 1 + S_2 1$$

$$S_2 = 0^* 1 + S_2 1$$

R Q R P

$$\therefore \boxed{S_2 = 0^* 1 1^*} \rightarrow (6).$$

Now sub (6) in (5)

$$\therefore \boxed{S_3 = 0^* 1 1^* 0 (0+1)^*}$$

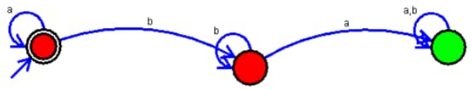
Regular expression = union of final states

$$\boxed{RE = 0^* + 0^* 0 1 1^* 0 (0+1)^*}$$

Result: Thus, the RE from DFA is constructed succesfully.

Automaton Simulator: 13(c)

File Help



a	b	a	b	a	b	

Experiment 15.

15) Prove that the language given below are not regular.

i) $L = \{0^{i^2} \mid i$ is an integer $\{i \geq 1\}$

ii) L = strings with equal no. of 0.s & 1s.

iii) $L = \{1^P \mid P$ is Prime $\}$

Aim: To prove the language are not regular.

Procedure:

i) $L = \{0^{i^2} \mid i \geq 1\}$

To prove its not regular, we can use pumping lemma assume L is a regular language let P be the pumping length let $S = 0^{P^2}$

where, $|S| > P$

$S = xyz$, $|xy| \leq P$

$|y| > 0$ & $\forall i \geq 0$, $xy^iz \notin L$

$\therefore L$ is not regular.

ii) L = Strings with equal no. of 0s & 1's To prove its not regular we can use pumping lemma

Assume L is a regular language let P be the Pumping length $S = 0^P 1^P$

where $|S| \geq P$

$S = xyz$, $|xy| \leq P$ $|y| > 0$

& $\forall i \geq 0$ $xy^iz \notin L$

$\therefore L$ is not regular.

iii) $L = \{1^P \mid P$ is prime $\}$

To prove it's not regular we go with Pumping lemma

Assume L is regular language

let p be the Pumping length - $S = 1^p$

where, $|S| = p$ & p is a Prime number.

when $|S| \geq p$ & p is a prime number.

$S = xyz$, $|xy| < p$, $|y| > 0$

& $\forall i \geq 0$ $xy^iz \in L$

$\therefore L$ is not regular.

Result: Thus the given language is not regular.