

Assignment - I

1. Construct a DFA start with 'AB', fourth element will be 'b', String 'abb' and ends with 'ba'.

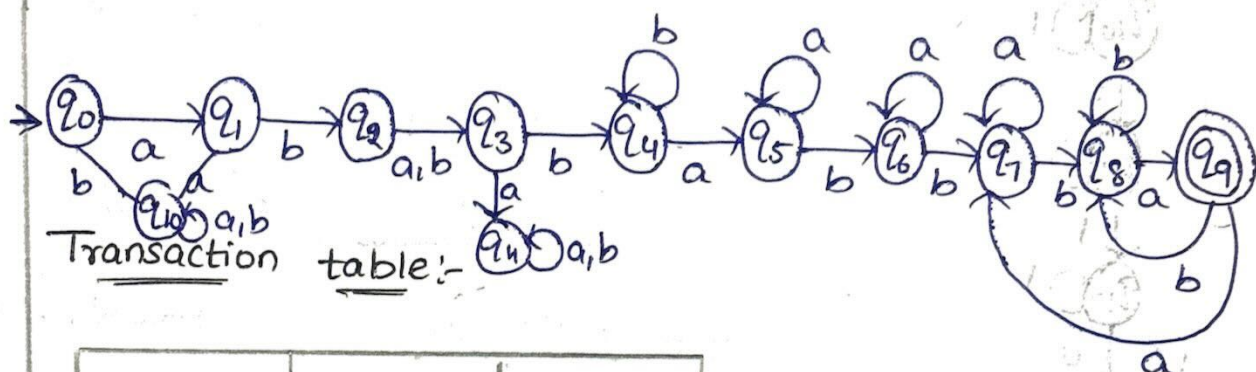
Conditions:-

Starts with - ab

fourth element - b

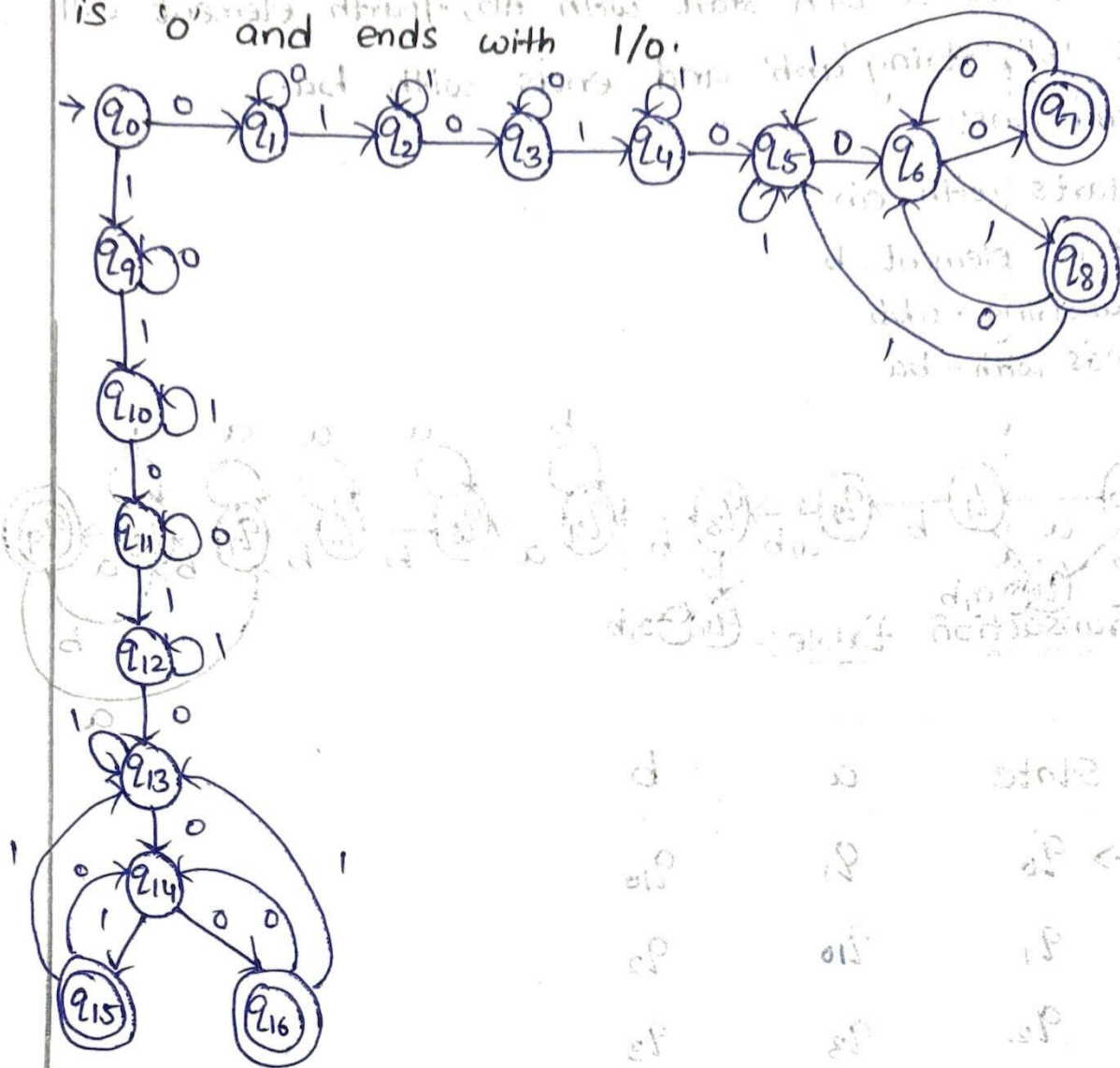
substring - abb

ends with - ba



State	a	b
→ q ₀	q ₁	q ₁₀
q ₁	q ₁₀	q ₂
q ₂	q ₃	q ₃
q ₃	q ₄	q ₄
q ₄	q ₅	q ₄
q ₅	q ₅	q ₆
q ₆	q ₆	q ₇
q ₇	q ₇	q ₈
q ₈	q ₉	q ₈
* q ₉	q ₇	q ₈
q ₁₀	q ₁₀	q ₁₀
q ₁₁	q ₁₁	q ₁₁

2. Design a DFA that starts with '0' or '1' and having string '1010' and the last before element is 0 and ends with 1/0.

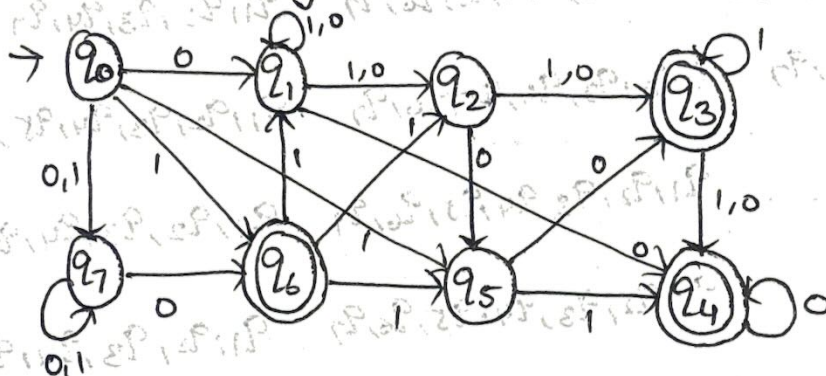


Transition table:-

State	0	1
→ q ₀	q ₁	q ₉
q ₁	q ₁	q ₂
q ₂	q ₃	q ₂
q ₃	q ₃	q ₄
q ₄	q ₅	q ₄
q ₅	q ₆	q ₅
q ₆	q ₇	q ₈
* q ₇	q ₆	q ₅

*q ₈	q ₆	q ₅
q ₉	q ₉	q ₁₀
q ₁₀	q ₁₁	q ₁₀
q ₁₁	q ₁₁	q ₁₂
q ₁₂	q ₁₃	q ₁₂
q ₁₃	q ₁₄	q ₁₃
q ₁₄	q ₁₆	q ₁₅
*q ₁₅	q ₁₄	q ₁₃
*q ₁₆	q ₁₄	q ₁₃

3. Convert the given NFA into DFA?



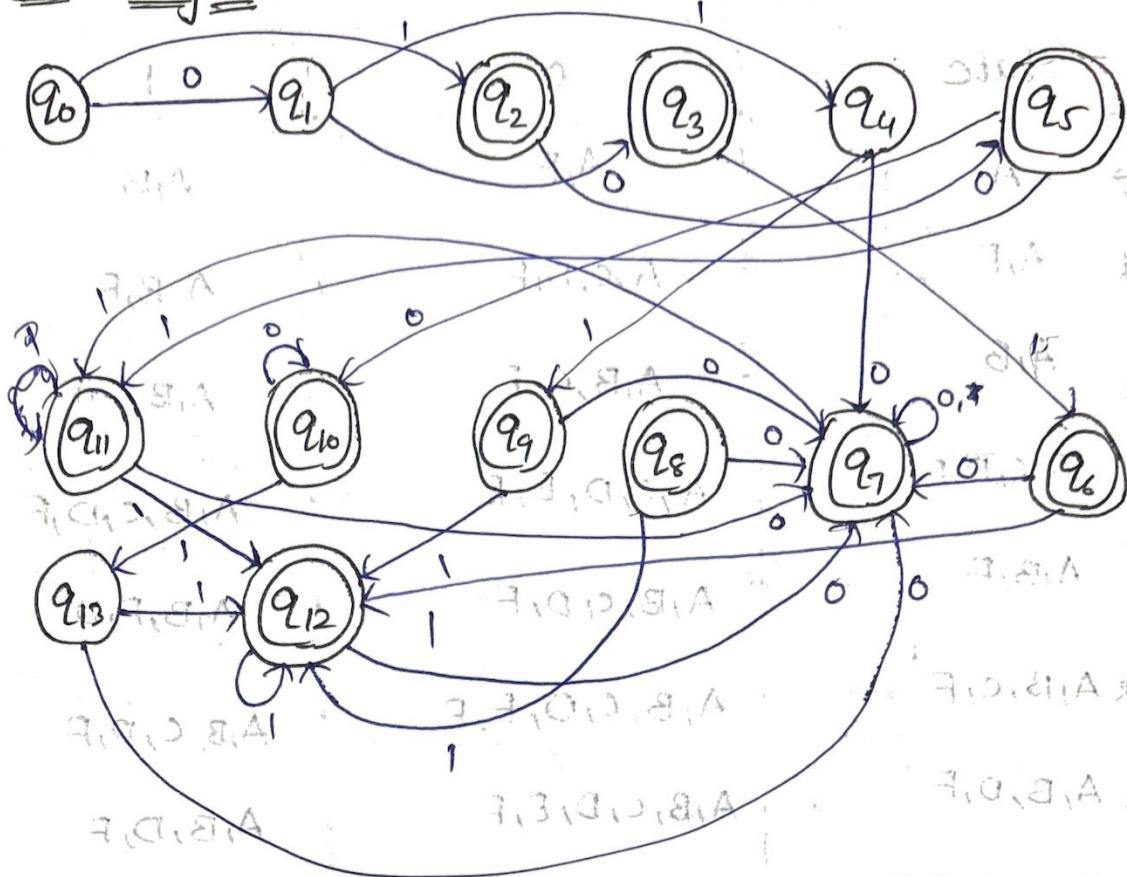
NFA Transition table:-

State	0	1
→ q ₀	q ₁ , q ₇	q ₆ , q ₅ , q ₇
q ₁	q ₁ , q ₂ , q ₄	q ₁ , q ₂ ,
q ₂	q ₃ , q ₅	q ₃
* q ₃	q ₄	q ₃ , q ₄
* q ₄	q ₄	ε
q ₅	q ₃	q ₄
* q ₆	ε	q ₁ , q ₂ , q ₅
q ₇	q ₆ , q ₇	q ₇

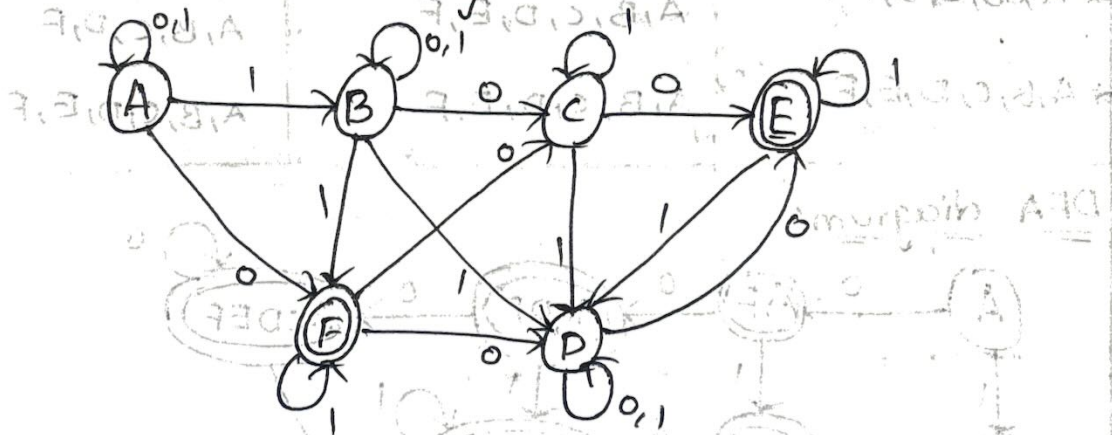
DFA Transaction table:-

State	0	1
→ $q_0 (q_0)$	q_1, q_7	q_5, q_6, q_7
$q_1, q_7 (q_1)$	q_1, q_2, q_4, q_6, q_7	q_1, q_2, q_7
* $q_5, q_6, q_7 (q_2)$	q_3, q_6, q_7	q_1, q_2, q_4, q_5, q_7
* $q_1, q_2, q_4, q_6, q_7 (q_3)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_5, q_7
$q_1, q_2, q_7 (q_4)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_7
* $q_3, q_6, q_7 (q_5)$	q_4, q_6, q_7	$q_1, q_2, q_5, q_7, q_4, q_3$
* $q_1, q_2, q_4, q_5, q_7 (q_6)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_4, q_7
* $q_1, q_2, q_3, q_4, q_5, q_6, q_7 (q_7)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	$q_1, q_2, q_3, q_4, q_5, q_7$
* $q_1, q_2, q_3, q_5, q_7 (q_8)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_4, q_7
* $q_1, q_2, q_3, q_7 (q_9)$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_4, q_7
* $q_4, q_6, q_7 (q_{10})$	q_4, q_6, q_7	q_1, q_2, q_5, q_7
* $q_1, q_2, q_3, q_4, q_5, q_7 (q_{11})$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	$q_1, q_2, q_3, q_4, q_5, q_7$
* $q_1, q_2, q_3, q_4, q_7 (q_{12})$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_4, q_7
$q_1, q_2, q_5, q_7 (q_{13})$	$q_1, q_2, q_3, q_4, q_5, q_6, q_7$	q_1, q_2, q_3, q_4, q_7

DFA diagram:-



4. Convert the following NFA into DFA:-



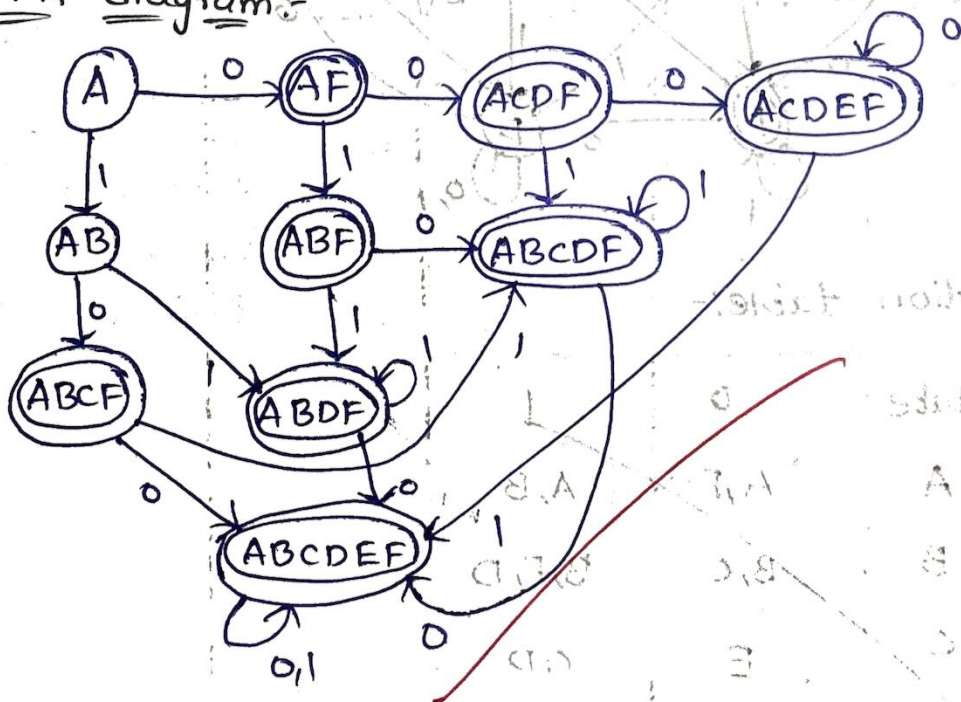
Transition table:-

State	0	1
A	A, F	A, B
B	B, C	B, F, D
C	E	C, D
D	D, E	D
E	E	D, E
F	D, C	F

DFA Transaction table:-

state	0	1
→ A	A, F	A, B
* A, F	A, C, D, F	A, B, F
A, B	A, B, C, F	A, B, D, F
* A, C, D, F	A, C, D, E, F	A, B, C, D, F
* A, B, F	A, B, C, D, F	A, B, F, D
* A, B, C, F	A, B, C, D, E, F	A, B, C, D, F
* A, B, D, F	A, B, C, D, E, F	A, B, D, F
* A, C, D, E, F	A, C, D, E, F	A, B, C, D, E, F
* A, B, C, D, F	A, B, C, D, E, F	A, B, C, D, F
* A, B, C, D, E, F	A, B, C, D, E, F	A, B, C, D, E, F

DFA diagram:-

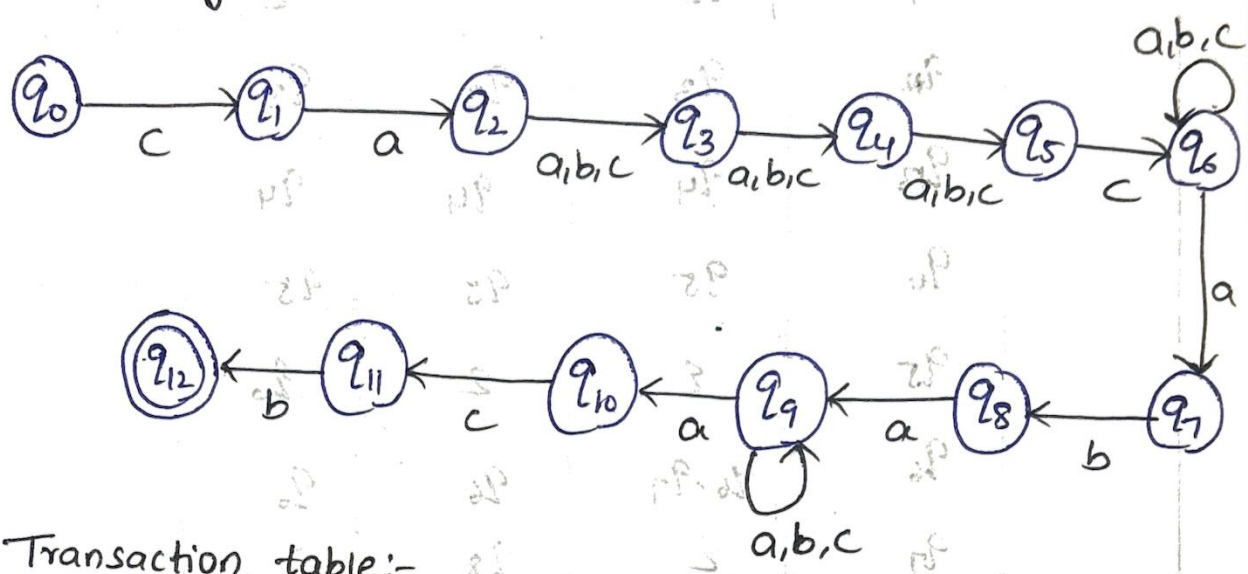


5. Construct a NFA over alphabet a, b, c starts with 'ca', ends with 'acb', contains string 'aba' and 6th element is 'c'.

Conditions:-

- Starts with -ca
- ends with -acb
- string -aba
- 6th element -c

NFA diagram:-



Transition table:-

state	a	b	c
q ₀	ε	ε	q ₁
q ₁	q ₂	ε	ε
q ₂	q ₃	q ₃	q ₃
q ₃	q ₄	q ₄	q ₄
q ₄	q ₅	q ₅	q ₅
q ₅	ε	ε	q ₆
q ₆	q ₆ , q ₇	q ₆	q ₆
q ₇	ε	q ₈	ε
q ₈	q ₉	ε	ε
q ₉	q ₉ , q ₁₀	q ₉	q ₉

q_{10}	ϵ	ϵ	q_{11}
q_{11}	ϵ	q_{12}	ϵ
q_{12}	ϵ	ϵ	ϵ

6. Check whether the following language satisfy the transaction table.

state	a	b	c
q_0	ϵ	ϵ	q_1
q_1	q_2	ϵ	ϵ
q_2	q_3	q_3	q_3
q_3	q_4	q_4	q_4
q_4	q_5	q_5	q_5
q_5	ϵ	ϵ	q_6
q_6	q_6, q_7	q_6	q_6
q_7	ϵ	q_8	ϵ
q_8	q_9	ϵ	ϵ
q_9	q_9, q_{10}	q_9	q_9
q_{10}	ϵ	ϵ	q_{11}
q_{11}	ϵ	q_{12}	ϵ
q_{12}	ϵ	ϵ	ϵ

i) CABABACACB

ii) cacabaccacb

iii) cacabababbca

iv) cababababcbacb

v) caacab

6) i) cababacab

$$\delta(q_0, c) = \{q_1\}$$

$$\delta(q_0, ca) = \{\delta(q_0, c), a\}$$

$$= \{(q_1), a\}$$

$$\neq \{q_1\}$$

$$= \{q_1, a\}$$

$$= \{q_2\}$$

$$\delta(q_0, cab) = \{\delta(q_0, ca), b\}$$

$$= \{(q_2), b\}$$

$$= \{q_3\}$$

$$\delta(q_0, caba) = \{\delta(q_0, cab), a\}$$

$$= \{q_3, a\}$$

$$= \{q_4\}$$

$$\delta(q_0, cabab) = \{\delta(q_0, caba), b\}$$

$$= \{q_4, b\}$$

$$= \{q_5\}$$

$$\delta(q_0, cababa) = \{\delta(q_0, cabab), a\}$$

$$= \{q_5, a\}$$

~~$q_5 \rightarrow a$ has dead state. The language rejected.~~

~~The string is rejected.~~

ii) cacabaccacb

$$\delta(q_0, c) = \{q_1\}$$

$$\delta(q_0, ca) = \{\delta(q_0, c), a\}$$

$$= \{q_1, a\}$$

$$= \{q_2\}$$

$$\delta(q_0, cac) = \{\delta(q_0, ca), c\}$$

$$= \{q_2, c\}$$

$$= \{q_3\}$$

$$\delta(q_0, caca) = \{\delta(q_0, cac), a\}$$

$$= \{q_3, a\}$$

$$= \{q_4\}$$

$$\delta(q_0, cacab) = \{\delta(q_0, caca), b\}$$

$$\delta(q_0, cacab) = \{\delta(q_0, caca), b\}$$

$$= \{q_4, b\}$$

$$= \{q_5\}$$

$$\delta(q_0, cacaba) = \{\delta(q_0, cacab), a\}$$

$$= \{q_5, a\}$$

$$= \epsilon$$

$q_5 \rightarrow a$ has dead state. The language rejected.

The string is rejected.

iii) cacababbbca

$$\delta(q_0, c) = \{q_1\}$$

$$\delta(q_0, ca) = \{\delta(q_0, c), a\}$$

$$= \{q_1, a\}$$

$$= \{q_2\}$$

$$\delta(q_0, cac) = \{\delta(q_0, ca), c\}$$

$$= \{q_2, c\}$$

$$= \{q_3\}$$

$$\delta(q_0, caca) = \{\delta(q_0, cac), a\}$$

$$= \{q_3, a\}$$

$$= \{q_4\}$$

$$\delta(q_0, cacab) = \{\delta(q_0, caca), b\}$$

$$= \{q_4, b\}$$

$$= \{q_5\}$$

$$\delta(q_0, cacaba) = \{\delta(q_0, cacab), a\}$$

$$= \{q_5, a\}$$

$$= \epsilon$$

$q_5 \rightarrow a$ has dead state. The language is rejected.

The string is rejected

iv) cababababcab

$$\delta(q_0, c) = \{q_1\}$$

$$\delta(q_0, ca) = \{\delta(q_0, c), a\}$$

$$= \{q_1, a\}$$

$$= \{q_2\}$$

$$\delta(q_0, cab) = \{\delta(q_0, ca), b\}$$

$$= \{q_2, b\}$$

$$= \{q_3\}$$

$$\delta(q_0, caba) = \{\delta(q_0, cab), a\}$$

$$= \{q_3, a\}$$

$$= \{q_4\}$$

$$\delta(q_0, cabab) = \{\delta(q_0, caba), b\}$$

$$= \{q_4, b\}$$

$$= \{q_5\}$$

$$\delta(q_0, cababa) = \{\delta(q_0, cabab), a\}$$

$$= \{q_5, a\}$$

$$= \epsilon$$

$q_5 \rightarrow a$ has dead state.

language rejected.

v) caacab

$$\delta(q_0, c) = \{q_1\}$$

$$\delta(q_0, ca) = \{\delta(q_0, c), a\}$$

$$= \{q_1, a\}$$

$$= \{q_2\}$$

$$\delta(q_0, caa) = \{\delta(q_0, ca), a\}$$

$$= \{q_2, a\}$$

$$= \{q_3\}$$

$$\delta(q_0, caac) = \{\delta(q_0, caa), c\}$$

$$= \{q_3, c\}$$

$$= \{q_4\}$$

$$\delta(q_0, caaca) = \{\delta(q_0, caac), a\}$$

$$= \{q_4, a\}$$

$$= \{q_5\}$$

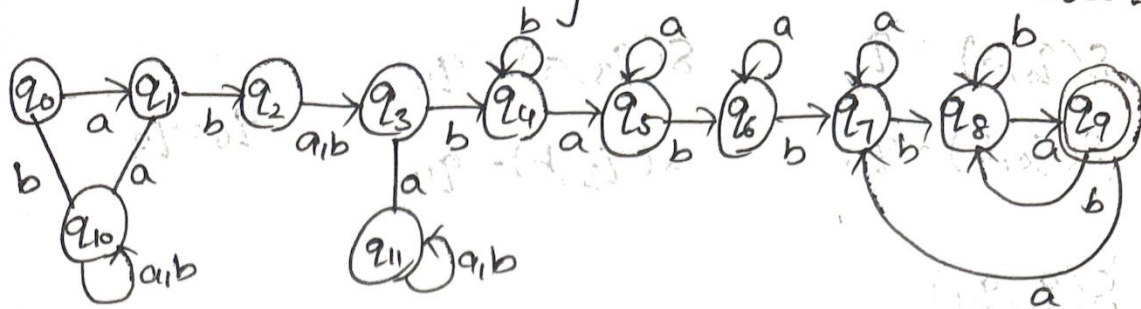
$$\delta(q_0, caacab) = \{\delta(q_0, caaca), b\}$$

$$= \{q_5, b\}$$

$$= \epsilon$$

$q_5 \rightarrow a$ has dead state. Language rejected.

7. Minimize the following a finite autometa?



Transaction table:-

state	a	b
→ q ₀	q ₁	q ₁₀
q ₁	q ₁₀	q ₂
q ₂	q ₃	q ₃
q ₃	q ₁₁	q ₄
q ₄	q ₅	q ₄
q ₅	q ₅	q ₆
q ₆	q ₆	q ₇
q ₇	q ₇	q ₈
q ₈	q ₉	q ₈
* q ₉	q ₇	q ₈
q ₁₀	q ₁₀	q ₁₀
q ₁₁	q ₁₁	q ₁₁

0-equivalence:-

{q₀, q₁, q₂, q₃, q₄, q₅, q₆, q₇, q₈, q₁₀, q₁₁} {q₉}

1-equivalence:-

S(q₀, q₁)

S(q₀, a) = q₁

S(q₀, b) = q₁₀

S(q₁, a) = q₁₀

S(q₁, b) = q₂

S(q₀, q₂)

S(q₀, a) = q₁

S(q₂, a) = q₃

S(q₀, b) = q₁₀

S(q₂, b) = q₃

q₀ = q₂

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, a) = q_{11}$$

$$S(q_3, b) = q_4$$

$$q_0 = q_3$$

$$S(q_0, q_4)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_4, a) = q_5$$

$$S(q_4, b) = q_4$$

$$q_0 = q_4$$

$$S(q_0, q_5)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_5, a) = q_5$$

$$S(q_5, b) = q_6$$

$$q_0 = q_5$$

$$S(q_0, q_6)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_6, a) = q_6$$

$$S(q_6, b) = q_7$$

$$q_0 = q_6$$

$$S(q_0, q_7)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_7, a) = q_7$$

$$S(q_7, b) = q_8$$

$$q_0 = q_7$$

$$S(q_0, q_8)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_8, a) = q_9$$

$$S(q_8, b) = q_8$$

$$q_0 \neq q_8$$

$$S(q_0, q_9)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_9, a) = q_7$$

$$S(q_9, b) = q_8$$

$$q_0 = q_9$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 = q_{11}$$

$$\{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}\} \{q_8\} \{q_9\}$$

2-equivalence:-

$$S(q_0, q_1)$$

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_1, a) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_1, b) = q_2$$

$$q_1 = q_2$$

$$S(q_0, q_2)$$

$$S(q_0, a) = q_1$$

$$S(q_2, a) = q_3$$

$$S(q_0, b) = q_{10}$$

$$S(q_2, b) = q_3$$

$$q_0 = q_2$$

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_3, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, b) = q_4$$

$$q_0 = q_3$$

$$S(q_0, q_4)$$

$$S(q_0, a) = q_1$$

$$S(q_4, a) = q_5$$

$$S(q_0, b) = q_{10}$$

$$S(q_4, b) = q_4$$

$$q_0 = q_4$$

$$S(q_0, q_5)$$

$$S(q_0, a) = q_1$$

$$S(q_5, a) = q_5$$

$$S(q_0, b) = q_{10}$$

$$S(q_5, b) = q_6$$

$$q_0 = q_5$$

$$S(q_0, q_6)$$

$$S(q_0, a) = q_1$$

$$S(q_6, a) = q_6$$

$$S(q_6, b) = q_{10}$$

$$S(q_6, b) = q_7$$

$$q_0 = q_6$$

$$S(q_0, q_7)$$

$$S(q_0, a) = q_1$$

$$S(q_7, a) = q_7$$

$$S(q_0, b) = q_{10}$$

$$S(q_7, b) = q_8$$

$$q_0 \neq q_7$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 \neq q_{11}$$

$$\{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_{10}, q_{11}\} \{q_7\} \{q_8\} \{q_9\}$$

3-equivalence :-

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_1, a) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_1, b) = q_2$$

$$q_0 = q_1$$

$$S(q_0, q_2)$$

$$S(q_0, a) = q_1$$

$$S(q_2, a) = q_3$$

$$S(q_0, b) = q_{10}$$

$$S(q_2, b) = q_3$$

$$q_0 = q_2$$

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_3, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, b) = q_4$$

$$q_0 \neq q_3$$

$$\delta(q_0, q_4)$$

$$\delta(q_0, a) = q_1 \quad \delta(q_0, b) = q_{10}$$

$$\delta(q_4, a) = q_5 \quad \delta(q_4, b) = q_4$$

$$q_0 = q_4$$

$$\delta(q_0, q_5)$$

$$\delta(q_0, a) = q_1 \quad \delta(q_0, b) = q_{10}$$

$$\delta(q_5, a) = q_5 \quad \delta(q_5, b) = q_6$$

$$q_0 = q_5$$

$$\delta(q_0, q_6)$$

$$\delta(q_0, a) = q_1 \quad \delta(q_0, b) = q_{10}$$

$$\delta(q_6, a) = q_6 \quad \delta(q_6, b) = q_7$$

$$q_0 \neq q_6$$

$$\delta(q_0, q_{10})$$

$$\delta(q_0, a) = q_1 \quad \delta(q_0, b) = q_{10}$$

$$\delta(q_{10}, a) = q_{10} \quad \delta(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$\delta(q_0, q_{11})$$

$$\delta(q_0, a) = q_1 \quad \delta(q_0, b) = q_{10}$$

$$\delta(q_{11}, a) = q_{11} \quad \delta(q_{11}, b) = q_{11}$$

$$q_0 \neq q_{11}$$

$\{q_0, q_1, q_2, q_3, q_4, q_5, q_{10}, q_{11}\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$

4 - equivalence

$$\delta(q_0, q_1)$$

$$\delta(q_0, a) = q_1$$

$$\delta(q_0, b) = q_{10}$$

$$\delta(q_1, a) = q_{10}$$

$$\delta(q_1, b) = q_2$$

$$q_0 = q_1$$

$$\delta(q_0, q_2)$$

$$\delta(q_0, a) = q_1$$

$$\delta(q_0, b) = q_{10}$$

$$\delta(q_2, a) = q_3$$

$$\delta(q_2, b) = q_3$$

$$q_0 = q_2$$

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_3, a) = q_{11}$$

$$S(q_0, q_4)$$

$$S(q_0, a) = q_1$$

$$S(q_4, a) = q_5$$

$$S(q_0, q_5)$$

$$S(q_0, a) = q_1$$

$$S(q_5, a) = q_5$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_{11}, a) = q_{11}$$

$$\{q_0, q_1, q_2, q_3, q_4, q_{10}, q_{11}\} \{q_5\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$$

5-equivalence:-

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_1, a) = q_{10}$$

$$S(q_0, q_2)$$

$$S(q_0, a) = q_1$$

$$S(q_2, a) = q_3$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, b) = q_4$$

$$S(q_0, b) = q_{10}$$

$$S(q_4, b) = q_4$$

$$S(q_0, b) = q_{10}$$

$$S(q_5, b) = q_6$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, b) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_1, b) = q_2$$

$$S(q_0, b) = q_{10}$$

$$S(q_2, b) = q_3$$

$$q_0 = q_3$$

$$q_0 = q_4$$

$$q_0 \neq q_5$$

$$q_0 = q_{10}$$

$$q_0 = q_{11}$$

$$q_0 = q_1$$

$$q_0 = q_2$$

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_3, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, b) = q_4$$

$$q_0 \neq q_3$$

$$S(q_0, q_4)$$

$$S(q_0, a) = q_1$$

$$S(q_4, a) = q_5$$

$$S(q_0, b) = q_{10}$$

$$S(q_4, b) = q_4$$

$$q_0 \neq q_4$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 \neq q_{11}$$

$$\{q_0, q_1, q_2, q_3, q_{10}, q_{11}\} \{q_4\} \{q_5\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$$

6-equivalence:-

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_1, a) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_1, b) = q_2$$

$$q_0 = q_1$$

$$S(q_0, q_2)$$

$$S(q_0, a) = q_1$$

$$S(q_2, a) = q_3$$

$$S(q_0, b) = q_{10}$$

$$S(q_2, b) = q_3$$

$$q_0 = q_2$$

$$S(q_0, q_3)$$

$$S(q_0, a) = q_1$$

$$S(q_3, a) = q_{11}$$

$$S(q_0, b) = q_{10}$$

$$S(q_3, b) = q_4$$

$$q_0 \neq q_3$$

$$S(q_0, q_0)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 = q_{11}$$

$$\{q_0, q_1, q_2, q_{10}, q_{11}\} \{q_3\} \{q_4\} \{q_5\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$$

7-equivalence :-

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_1, a) = q_{10}$$

$$S(q_1, b) = q_2$$

$$q_0 = q_1$$

$$S(q_0, q_2)$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_2, a) = q_3$$

$$S(q_2, b) = q_3$$

$$q_0 \neq q_2$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 = q_{11}$$

$$\{q_0, q_1, q_{10}, q_{11}\} \{q_2\} \{q_3\} \{q_4\} \{q_5\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$$

8-equivalence :-

$$S(q_0, q_1)$$

$$S(q_0, a) = q_1$$

$$S(q_1, a) = q_{10}$$

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$S(q_0, q_{11})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{11}, a) = q_{11}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 = q_{11}$$

$\{q_0, q_{10}, q_{11}\} \{q_1\} \{q_2\} \{q_3\} \{q_4\} \{q_5\} \{q_6\} \{q_7\} \{q_8\} \{q_9\}$

q-equivalence:-

$$S(q_0, q_{10})$$

$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

$$S(q_{10}, a) = q_{10}$$

$$S(q_{10}, b) = q_{10}$$

$$q_0 \neq q_{10}$$

$$S(q_0, q_{11})$$

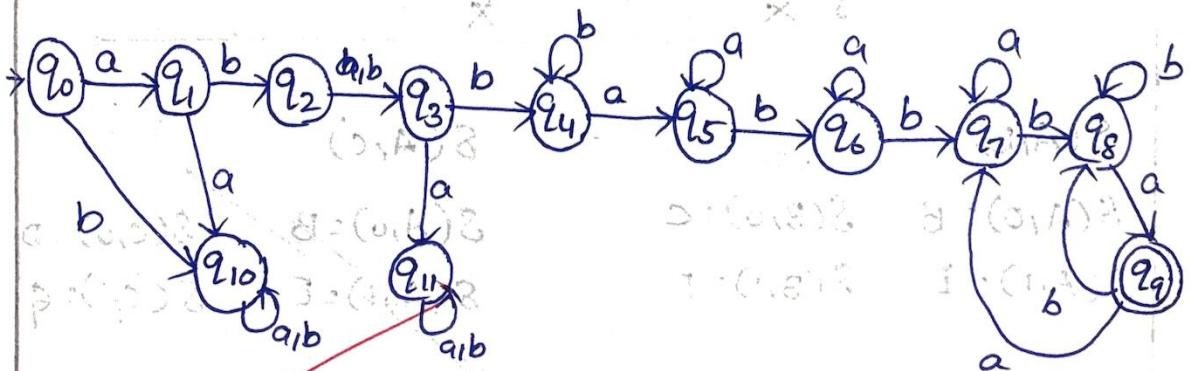
$$S(q_0, a) = q_1$$

$$S(q_0, b) = q_{10}$$

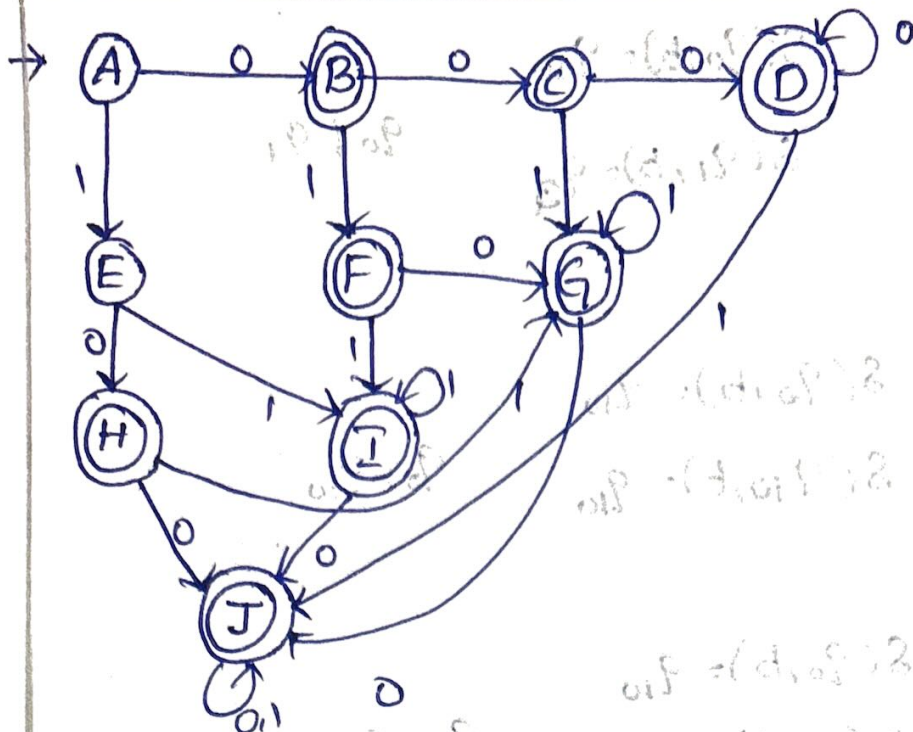
$$S(q_{11}, a) = q_{11}$$

$$S(q_{11}, b) = q_{11}$$

$$q_0 \neq q_{11}$$



8. Minimize the following finite automata using tabular method.



	A	B	C	D	E	F	G	H	I	J
A										
B	X									
C	X									
D	X									
E	X	X	X	X						
F	X				X					
G	X				X					
H	X				X					
I	X				X					
J	X				X					

$S(B, C)$

$S(B, 0) = C$ $S(C, 0) = D$

$S(B, 1) = F$ $S(C, 1) = G$

$S(D, C)$

$S(D, 0) = D$ $S(C, 0) = D$

$S(D, 1) = J$ $S(C, 1) = G$

$S(F, B)$

$S(F, 0) = G$ $S(B, 0) = C$

$S(F, 1) = I$ $S(B, 1) = F$

$S(D, F)$

$S(D, 0) = D$ $S(F, 0) = G$

$S(D, 1) = J$ $S(F, 1) = I$

$S(G, C)$

$S(G, 0) = J$ $S(C, 0) = D$

$S(G, 1) = G$ $S(C, 1) = G$

$S(B, D)$

$S(B, 0) = C$ $S(D, 0) = D$

$S(B, 1) = F$ $S(D, 1) = J$

$S(A, E)$

$S(A, 0) = B$ $S(E, 0) = H$

$S(A, 1) = E$ $S(E, 1) = I$

$S(F, C)$

$S(F, 0) = G$ $S(C, 0) = D$

$S(F, 1) = I$ $S(C, 1) = G$

$S(G, B)$

$S(G, 0) = J$ $S(B, 0) = C$

$S(G, 1) = G$ $S(B, 1) = F$

$S(G, D)$

$S(G, 0) = J$ $S(D, 0) = D$

$S(G, 1) = G$ $S(D, 1) = J$

$S(G, F)$

$S(G, 0) = J$

$S(G, 1) = G$

$S(F, 0) = G$

$S(F, 1) = I$

$S(H, C)$

$S(H, 0) = J$

$S(H, 1) = G$

$S(C, 0) = D$

$S(C, 1) = G$

$S(H, E)$

$S(H, 0) = J$

$S(H, 1) = G$

$S(E, 0) = H$

$S(E, 1) = I$

$S(I, B)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(B, 0) = C$

$S(B, 1) = F$

$S(I, D)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(D, 0) = D$

$S(D, 1) = G$

$S(I, G)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(G, 0) = J$

$S(G, 1) = G$

$S(J, B)$

$S(J, 0) = J$

$S(J, 1) = J$

$S(B, 0) = C$

$S(B, 1) = F$

$S(J, D)$

$S(J, 0) = J$

$S(J, 1) = J$

$S(D, 0) = D$

$S(D, 1) = J$

$S(H, B)$

$S(H, 0) = J$

$S(H, 1) = G$

$S(B, 0) = C$

$S(B, 1) = F$

$S(H, D)$

$S(H, 0) = J$

$S(H, 1) = G$

$S(D, 0) = D$

$S(D, 1) = J$

$S(H, F)$

$S(H, 0) = J$

$S(H, 1) = G$

$S(F, 0) = G$

$S(F, 1) = I$

$S(I, C)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(C, 0) = D$

$S(C, 1) = G$

$S(I, F)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(F, 0) = G$

$S(F, 1) = I$

$S(I, H)$

$S(I, 0) = J$

$S(I, 1) = I$

$S(H, 0) = J$

$S(H, 1) = G$

$S(J, C)$

$S(J, 0) = J$

$S(J, 1) = J$

$S(C, 0) = D$

$S(C, 1) = G$

$S(J, F)$

$S(J, 0) = J$

$S(J, 1) = J$

$S(F, 0) = G$

$S(F, 1) = I$

$S(J, G)$

$S(J, I)$

$S(J, 0) = J$

$S(G, 0) = J$

$S(J, 0) = J$

$S(I, 0) = J$

$S(J, 1) = J$

$S(G, 1) = G$

$S(J, 1) = J$

$S(I, 1) = I$

$S(J, H)$

$S(J, 0) = J$

$S(H, 0) = J$

$S(J, 1) = J$

$S(H, 1) = G$

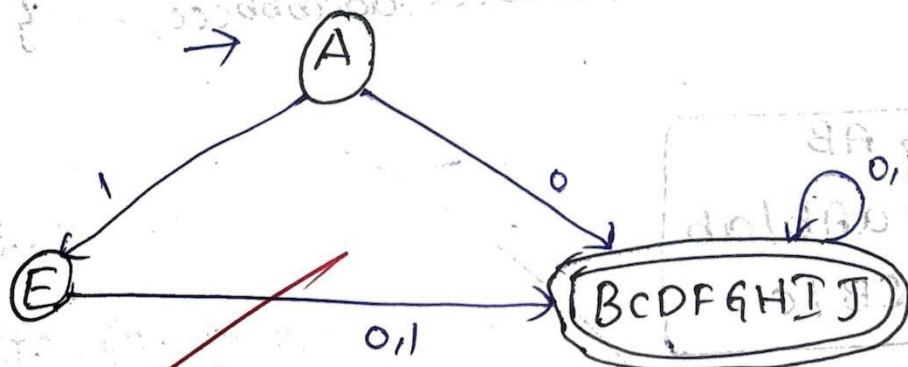
The minimized states are

$\{A\} \{E\} \{B, C\} \{B, D\} \{C, D\} \{B, F\} \{F, C\} \{F, D\} \{G, B\} \{G, C\}$

$\{G, D\} \{G, E\} \{H, B\} \{H, C\} \{H, D\} \{H, F\} \{H, G\} \{I, B\} \{I, C\} \{I, D\}$

$\{I, F\} \{I, G\} \{I, H\} \{J, B\} \{J, C\} \{J, D\} \{J, F\} \{J, G\} \{J, H\} \{J, I\}$

$= \{A\} \{E\} \{B, C, D, F, G, H, I, J\}$



8/28/8/25