Conversion FA to RE

Part 4.

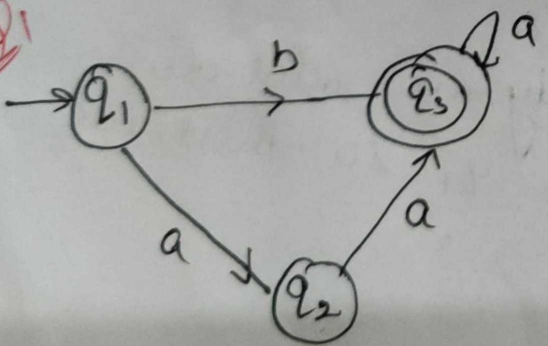
Input → FA
Output → RE

→ Arden's Method $R = Q + RP$ then $R = QP^*$
→ State Eleminating method.

→ 1. Write down equation for each state based incoming edges. Add ε to the equation of initial state
→ 2. Simplify the equation using Arden's theorm & find RE for final state.

Condition
→ FA should not contain ε- Transition.
→ FA should have only one initial state.

Q1



$q_1 = \varepsilon$ — 1

$q_2 = q_1 a$ — 2

$q_3 = q_1 b + q_2 a + q_3 a$ — (3)

Apply (1) & (2) in 3.

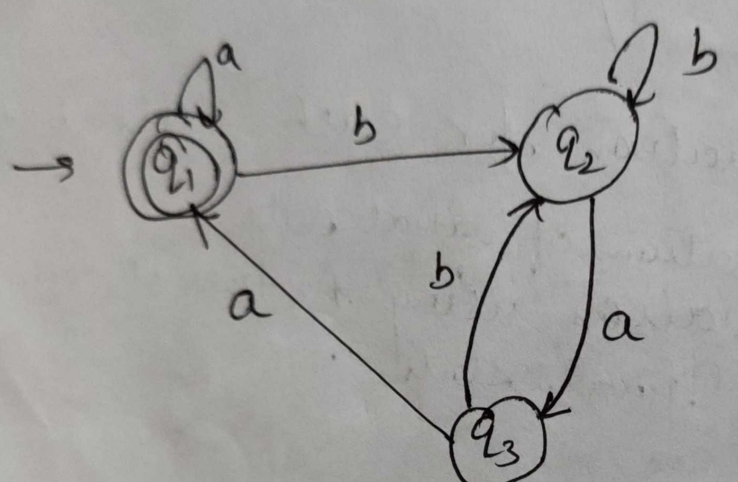
$q_3 = \varepsilon b + q_1 aa + q_3 a$
$= \varepsilon b + aa + q_3 a$
$= b + aa + q_3 a$

$$q_3 = (b+aa) + \underline{q_3}\, a$$

$$R = Q + RP \Rightarrow R = QP^*$$

$$q_3 = (b+aa)\, a^*$$

Q



$$q_1 = q_1 a + q_3 a + \epsilon \quad \text{—} (1)$$

$$q_2 = q_1 b + q_2 b + q_3 b \quad \text{—} (2)$$

$$q_3 = q_2 a \quad \text{—} (3)$$

final state is q_1 so finally we did do substitute the equation in q_1 so that we need to get the RE.

~~Eq~~ eq (3) in eq 1

$$\cancel{q_1 = q_1 a + q_2 a}.$$

$q_2 = q_1 b + q_2 b + q_2 ab.$

$q_2 = q_1 b + q_2(b+ab)$

by Arden's Theorm

$$\boxed{q_2 = q_1 b(b+ab)^*} \quad - 4$$

4 in eq (3)

$$q_3 = q_1 b(b+ab)^* a \quad —(5)$$

Put eq (5) in eq (1)

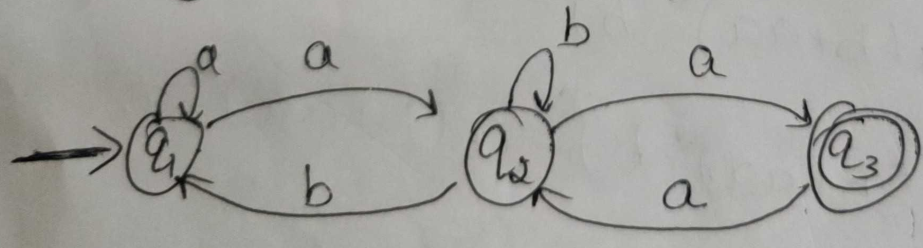
$$q_1 = q_1 a + q_1 b(b+ab)^* a + \varepsilon$$

$$q_1 = q_1 (a + b(b+ab)^* a) + \varepsilon$$ By Arden's theorm.

$$= \varepsilon (a + b(b+ab)^* a)^*$$

Q Prove strings recognized are

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



$q_1 = q_1 a + q_2 b + \Lambda$

$q_2 = q_1 a + q_2 b + q_3 a$

$q_3 = q_2 a$

Put (3) into (2)

$$q_2 = q_1 a + q_2 b + q_2 aa$$

$$q_2 = q_1 a + q_2 (b+aa)$$

ARDEN's Theorm $R = Q + RP$ $\boxed{R = QP^*}$

$$q_2 = q_1 a (b+aa)^* \quad \text{——} \quad (4)$$

Put (4) into (1)

$$q_1 = q_1 a + q_1 a (b+aa)^* b + \Lambda$$

$$q_1 = q_1 (a + a(b+aa)^* b) + \Lambda$$

Arden's Theorm $R = Q + RP = QP^*$

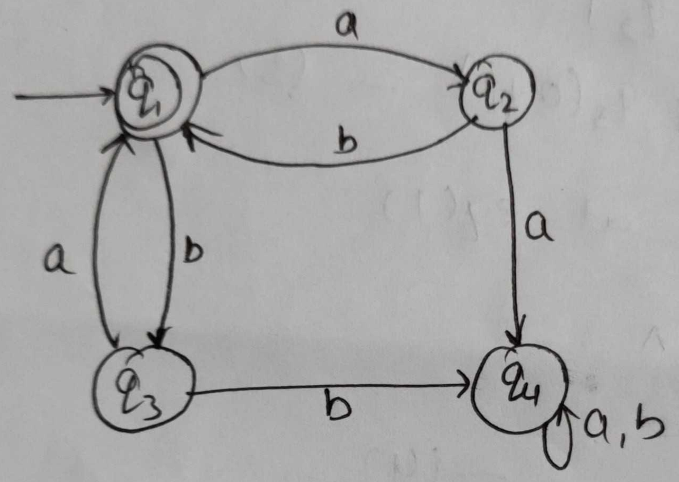
$$q_1 = \Lambda (a + a(b+aa)^* b)^*$$

$$q_1 = (a + a(b+aa)^* b)^*$$

$$q_2 = (a + a(b+aa)^* b)^* a (b+aa)^*$$

$$q_3 = (a + a(b+aa)^* b)^* a (b+aa)^* a$$

Prove that the finite automata whose transition diagram as shown in fig 5.14 accepts the set of all strings over an Alphabet $\{a, b\}$ with an equal number of a's & b's such that each prefix has at most one more a than the b's & at most one more b than the a's



$q_1 = q_2 b + q_3 a + \varepsilon$ —(1)

$q_2 = q_1 a$ —(2)

$q_3 = q_1 b$ —(3)

$q_4 = q_4 a + q_4 b + q_3 b + q_2 a$ —(4)

(2) & (3) put in (1)

$q_1 = q_1 ab + q_1 ba + \varepsilon$

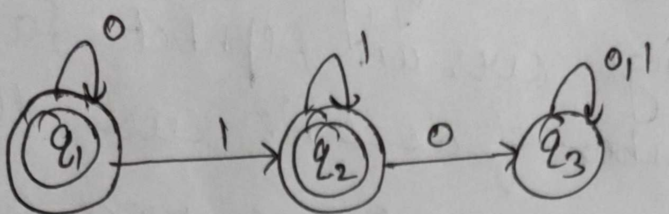
$q_1 = q_1(ab + ba) + \varepsilon$

$R = Q + RP \Rightarrow R = QP^*$

Arden's theorm

$q_1 = \varepsilon(ab + ba)^*$.

Q Describe in English the set accepted by the finite Automata whose transition dig. ...



$q_1 = q_1 0 + \wedge$ — (1)

$q_2 = q_1 1 + q_2 1$ — (2)

$q_3 = q_2 0 + q_3 (0+1)$ — (3)

Apply Arden's theorm at eq(1)

$q_1 = q_1 0 + \wedge$

$q_1 = 0^*$ — (4)

$q_2 = q_1 1 + q_2 1$

~~Apply~~ (4) in (2)

$q_2 = 0^* 1 + q_2 1$ Arden's theorm

$q_2 = (0^* 1) 1^*$ so.

As final state q_1 & q_2

$q_1 + q_2 = 0^* + (0^* 1) 1^*$

$= 0^* (\wedge + 1 1^*)$

$= 0^* 1^*$

$\boxed{\wedge + RR^* = R^*}$

$q_3 = q_2 0 + q_3 (0+1)$

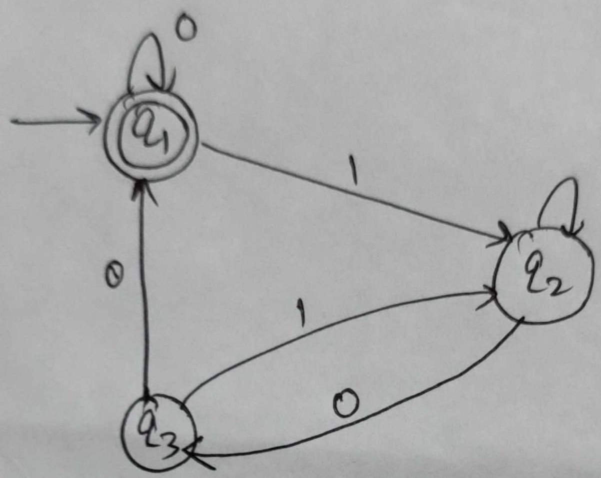
$q_3 = (0^* 1) 1^* 0 + q_3 (0+1)$

Apply Arden's theorm

$q_3 = (0^* 1) 1^* 0 (0+1)^*$

The string accepted by FA is the string of any number of 0's followed by a string of any number of 1's.

Q.



$q_1 = q_1 0 + q_3 0 + \Lambda$ —— (1)

$q_2 = q_1 1 + q_2 1 + q_3 1$ —— (2)

$q_3 = q_2 0$ —— (3)

so put eq (3) in (2)

$q_2 = q_1 1 + q_2 1 + q_2 01$

$= q_1 1 + q_2 (1 + 01)$ Arden's theorem.

$q_2 = q_1 1 (1 + 01)^*$

$q_1 = q_1 0 + q_2 00 + \Lambda$

$$= q_1 0 + q_1 1(1+01)^* 00 + \Lambda$$

$$q_1 = q_1(0 + 1(1+01)^* 00) + \Lambda$$

$$q_1 = \Lambda(0+1(1+01)^* 00)^*$$