Converting Your FA into RE

Arden's Theorem

$R = QP^*$

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

$\underbrace{R, Q, P}$ → are Regular Expressions

$R = Q + RP$ — (1)

↳ solution → $R = QP^*$ — (2)

$$R = QP^* \quad \text{--- (1)}$$

$$R = Q + RP \quad \text{--- (2)}$$

Put (1) in (2)

$$R = Q + QP^*P$$

$$= Q\underbrace{(\Lambda + P^*P)}_{P^*}$$

$$QP^*$$

$$R = Q + RP$$

$$R = Q + \boxed{R}P$$

$$= Q + (Q + RP)P$$

$$= Q + QP + RPP$$

$$= Q + QP + (Q + RP)PP$$

$$= Q + QP + QP^2 + RP^3$$

$$= (Q + QP + QP^2 - - - QP^n) + RP^{n+1}$$

$R = Q + RP \rightarrow QP^{*}$

$R = Q + QP + QP^2 - - - - QP^n + RP^{n+1}$

$= Q + QP + QP^2 - - - QP^n + QP^{*}P^{n+1}$

$= Q(\Lambda + P + P^2 - - - P^n + P^{*}P^{n+1})$

Any no of $P^{\prime}s$

QP^{*}

$= QP^{*}$

Simple tricks to convert FA into RE

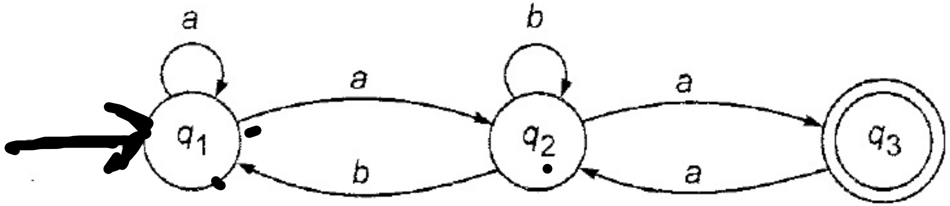
1) Treat final state to find Answer of RE

2) Treat state as RE_n " " " state in RE

Imp 3) Find all incoming transitions to form equations

Target q_3

q_1, q_2, q_3



how state is getting reached.

Put ③ in ②

$$q_1 = \Lambda + q_1 a + q_2 b \quad \text{— (1)}$$

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

$$\boxed{q_3} = q_2 a \quad \text{— (3)}$$

$$q_3 = q_2 a$$

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

$$\underbrace{q_2}_{R} = \underbrace{q_1 a}_{Q} + \underbrace{q_2}_{R} \underbrace{(b + aa)}_{P}$$

$$R = Q + R P$$

$$R = Q P^*$$

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

Put (4) in (1)

$R = Q + RP$

$q_2 = q_1 a(b+aa)^* \quad (4)$

$q_1 = \underbrace{(a + a(b+aa)^* b)^*}$

$q_1 = \Lambda + q_1 a + q_2 b \quad (1)$

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

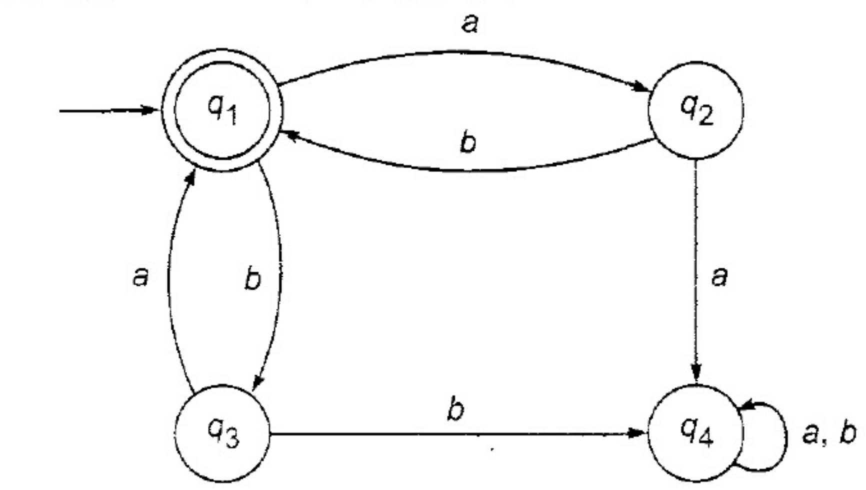
$q_1 = \Lambda + q_1 a + q_1 a(b+aa)^* b$

$q_3 = q_2 a$

$\underbrace{q_1}_{R} = \underbrace{\Lambda}_{Q} + \underbrace{q_1}_{R} \underbrace{(a + a(b+aa)^* b)}_{}$

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

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



Put ② & ③ in ①

$q_1 = \Lambda + q_2 b + q_3 a$ → Target ①

$q_2 = q_1 a$ — 2

$q_3 = q_1 b$ — 3

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

Target is q_1

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

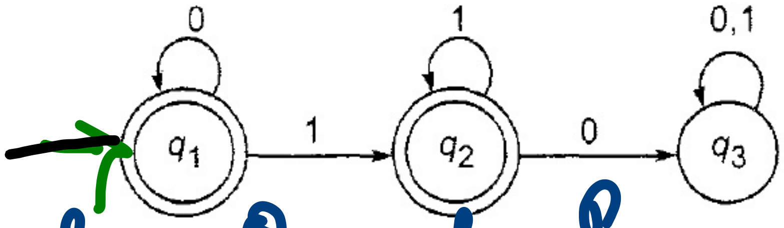
$$q_1 = \underbrace{\Lambda}_{R=Q} + \underbrace{q_1}_{R} \underbrace{(ab + ba)}_{P}$$

$$\overbrace{q_1}^{R} = \overbrace{\Lambda}^{Q} + \overbrace{q_1}^{R}\,\overbrace{(ab+ba)}^{P}$$

$$= QP^*$$

$$= \Lambda(ab+ba)^*$$

$$\boxed{q_1 = (ab+ba)^*} \rightarrow \text{final ans}$$



Target $\underbrace{q_1, q_2}_{}$ → final state.

$$\overbrace{q_1}^{R} = \overbrace{\Lambda}^{Q} + \overbrace{q_1}^{R}\,\overbrace{0}^{P} \quad -(1)$$

$$q_2 = \underbrace{q_1}_{} 1 + q_2 1 \quad -(2)$$

$$q_3 = q_2 0 + q_3 0 + q_3 1 \quad -(3)$$

$$q_1 = \underbrace{\Lambda}_{Q} + \underbrace{q_1}_{R}\ \underbrace{0}_{P}$$

$$\boxed{q_1 = \Lambda 0^*}$$

$$q_1 = 0^* \quad -(4)$$

Put (4) in (2)

$$q_2 = \underbrace{0^* 1}_{Q} + \underbrace{q_2}_{R}\ \underbrace{1}_{P}$$

$$q_2 = \underbrace{0^* 1}_{Q} + \underbrace{q_2}_{R} \underbrace{1}_{P}$$

$$R = QP^*$$

$$= QP^*$$

$$q_2 = 0^* 1 1^*$$

$$q_1 = 0^*$$

$$q_2 = 0^* 1 1^*$$

$$q_1 + q_2$$

$$0^* + 0^* 1 1^*$$

$$0^* (\underbrace{\Lambda + 1 1^*})$$

$0^* 1^* =$ final Answer.