

# ASSIGNMENT

Q1.

Sol

$$\text{eq of } q_1 = E + q_2 b + q_3 a \quad \text{--- (1)}$$

$$\text{eq of } q_2 = q_1 a \quad \text{--- (2)}$$

$$\text{eq of } q_3 = q_1 b \quad \text{--- (3)}$$

$$\text{eq of } q_4 = q_2 a + q_3 b + q_4 a + q_4 b \quad \text{--- (4)}$$

taking equation (1)

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

and substituting values from eq (2) and (3)

$$q_1 = E + q_1 a b + q_1 b a$$

$$Q_1 = \epsilon + Q_1 (ab + ba)$$

Here, it looks like the expression  
 $R = Q + RP$  which according to Arden's theorem  
 can be written as  $R = QP^*$

$$\therefore Q_1 = \epsilon (ab + ba)^* \quad \{ \epsilon R = R \}$$

$$\therefore \boxed{Q_1 = (ab + ba)^*}$$

↳ Required Expression.

Q2.

Sol eq of  $Q_1 = \epsilon + Q_1^0$  — (1)

eq of  $Q_2 = Q_1^1 + Q_2^1$  — (2)

eq of  $Q_3 = Q_2^0 + Q_3^0 + Q_3^1$  — (3)

Equation of final state  $q_1$

$$q_1 = \epsilon + q_1 0$$

$$q_1 = \epsilon \cdot 0^*$$

$$q_1 = 0^* \text{ --- (4)}$$

{ we know  $R = Q + RP$   
 $\therefore R = QP^*$  by  
Arden's Theorem }

$$\{ \epsilon, \epsilon R = R \}$$

Equation of final state  $q_2$

$$q_2 = q_1 1 + q_2 1$$

$$q_2 = 0^* 1 + q_2 1 \text{ from eq (4)}$$

$$q_2 = 0^* 1 (1)^* \text{ --- (5) using Arden's Theorem}$$

Taking Union of  $q_1$  and  $q_2$

$$(q_1) \cup (q_2)$$

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

$$= 0^* (E + 11^*) \quad \left\{ \begin{array}{l} \text{we know} \\ E + RR^* = R^* \end{array} \right\}$$

~~Q.E.D.~~

$$RE = 0^* 1^*$$

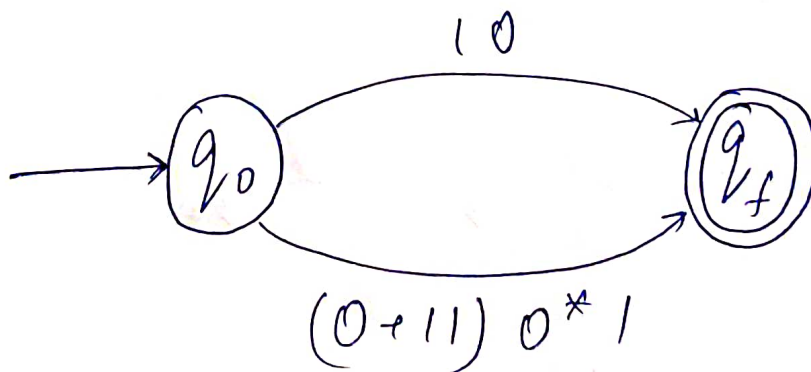
Q3.  
sol.

$$10 + (0 + 11)0^* 1$$

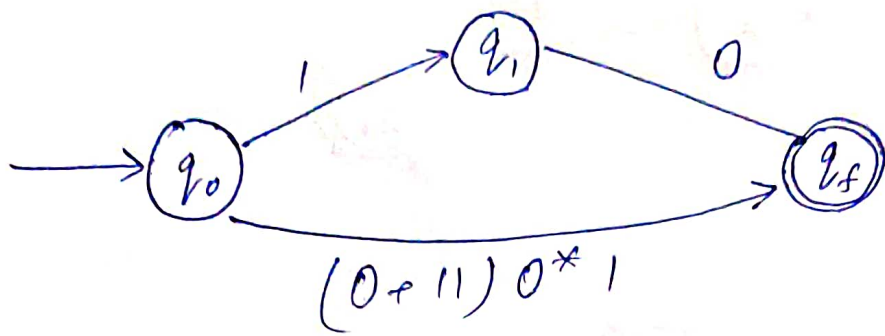
+ is treated as an OR  
x is treated as an AND

Solving and separating each one step by step :-

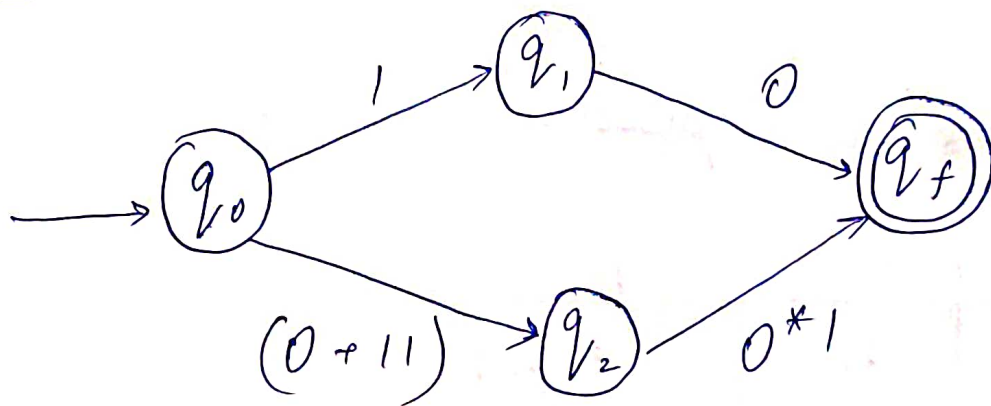
STEP 1



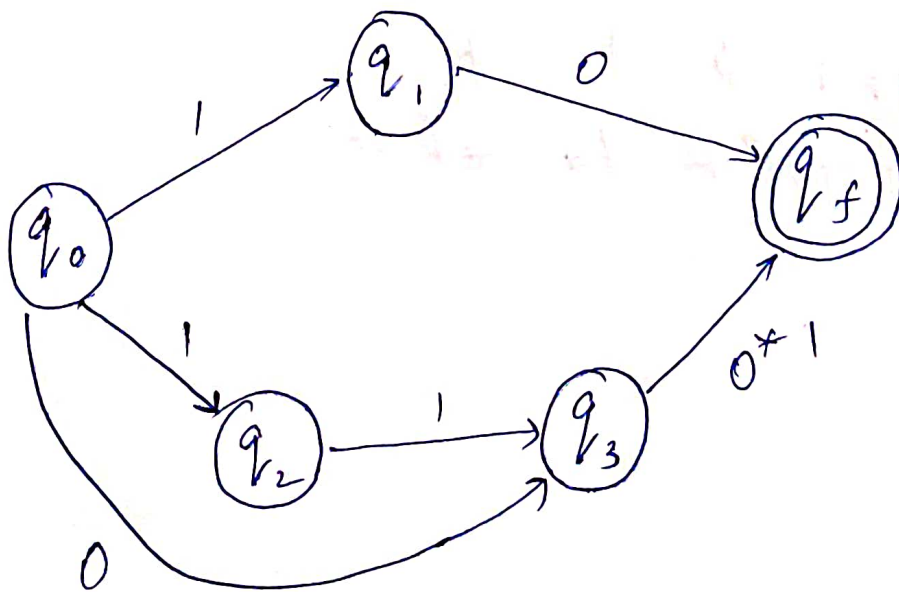
STEP-2 → separating 0 and 1



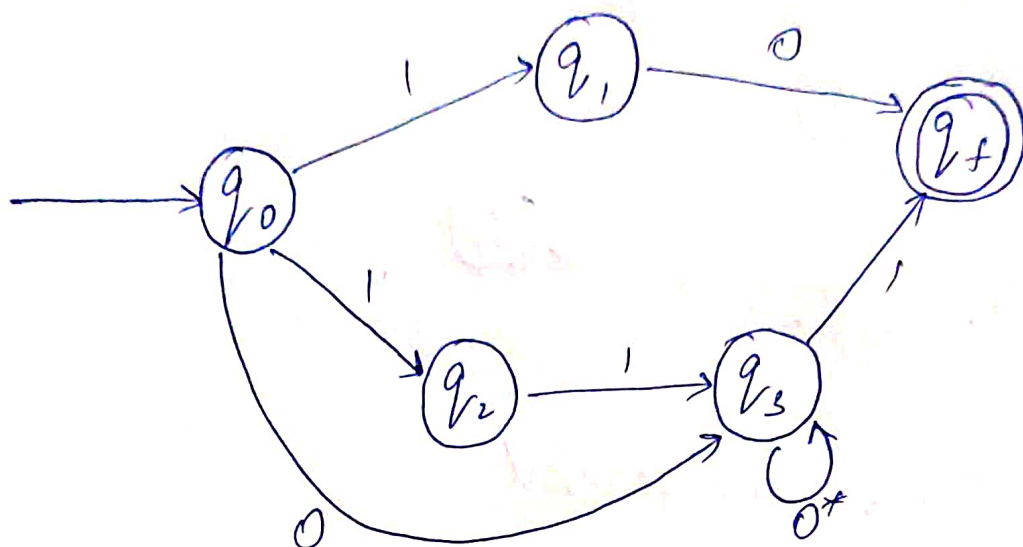
STEP-3 → Solving the Bracket



STEP-4 → Separating values of bracket



STEP-5  $\rightarrow$  Separating  $0^*$  and 1



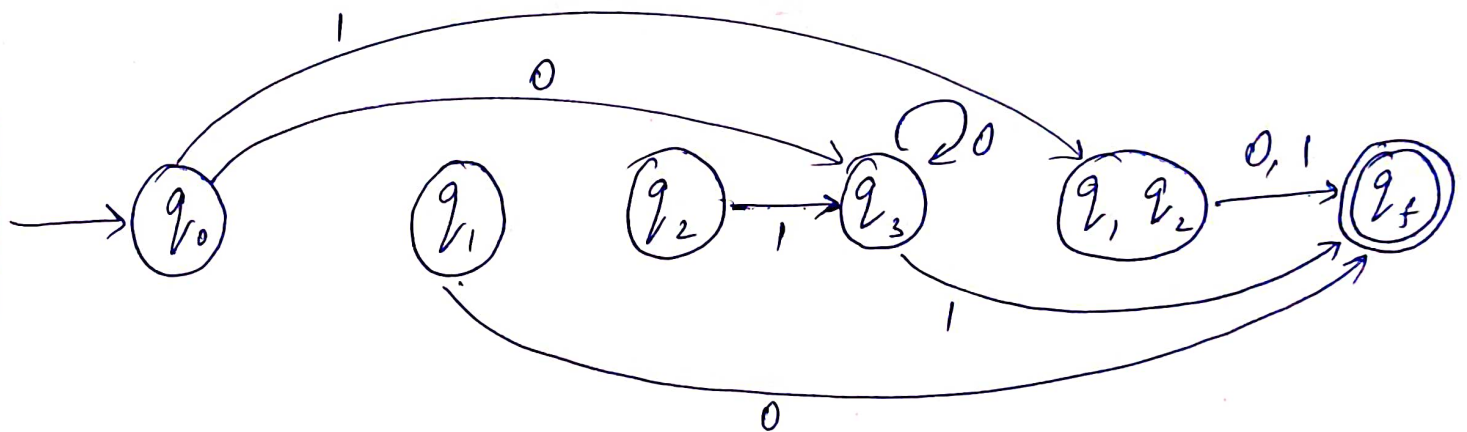
NFA Table for Expression

	0	1
$q_0$	$q_3$	$\{q_1, q_2\}$
$q_1$	$q_f$	$\emptyset$
$q_2$	$\emptyset$	$q_3$
$q_3$	$q_3$	$q_f$
$q_f$	$\emptyset$	$\emptyset$



# Converting NFA to DFA

	0	1
$q_0$	$q_3$	$\{q_1, q_2\}$
$q_1$	$q_f$	$\phi$
$q_2$	$\phi$	$q_3$
$q_3$	$q_3$	$q_f$
$\{q_1, q_2\}$	$q_f$	$q_f$
$*q_f$	$\phi$	$\phi$



Q4.  
Set.

a) for ~~any~~ string of 0 and 1

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

$$b) R\bar{E} = (0+1)^* \mid (0+1)^* \mid (0+1)^* \mid (0+1)^*$$

$$c) R\bar{E} = (0+1)(0+1)0(0+1)^*$$

$$d) R\bar{E} = 0((0+1)(0+1))^* + 1(0+1)((0+1)(0+1))^*$$