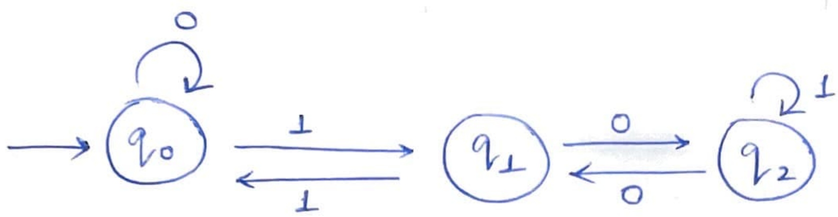
Ques 1 :

Two FA are equivalent if they accept the same language.

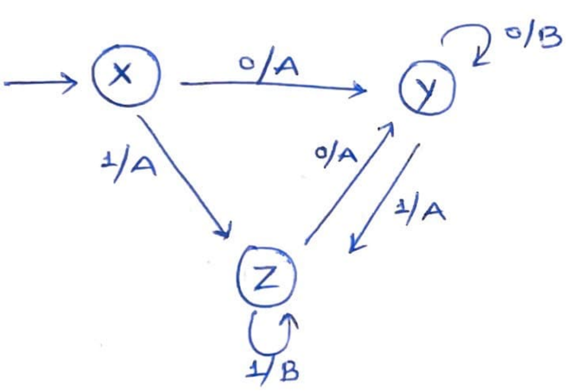
Example

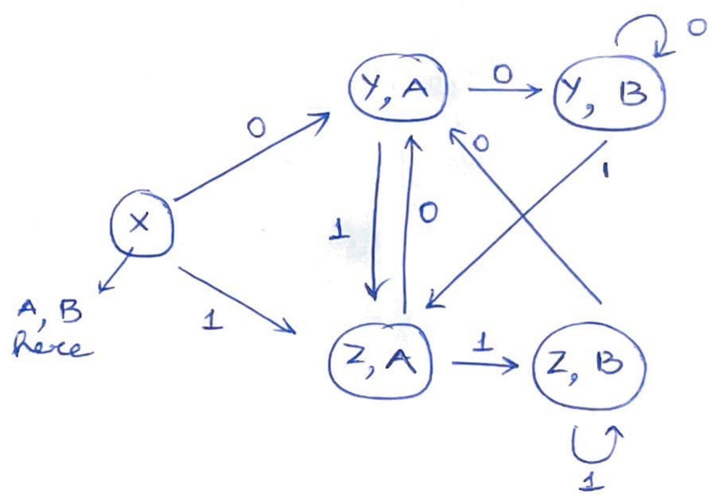


q_0: By 0 : Value doubles

Take cases : 11 , 10 , 100 , 101

Ques 2 :





Ques 3 :

Ardens Theorem :

Let P and Q be two regular expressions

If P doesnot contain null string then $R = Q + RP$ has a unique solution that is $R = QP^*$

$$A = Ca + \varepsilon \quad \text{——} \quad (1)$$

$$B = Aa \quad \text{——} \quad (2)$$

$$C = Da + Eb \quad \text{——} \quad (3)$$

$$D = Ab + Bb + Eb \quad \text{——} \quad (4)$$

$$E = Ca \quad \text{——} \quad (5)$$

Put (4) and (5) in (3)

$$C = Da + Eb$$

$$C = (Ab + Bb + Eb)a + Eb$$

$$C = Aba + Bba + Eba + Eb$$

$$C = Aba + Bba + Eb(a+1)$$

$$C = Aba + Bba + Eb$$

$$C = Aba + Aaba + Eb$$

$$\underbrace{C}_{R} = \underbrace{Aba + Aaba}_{Q} + \underbrace{C}_{R}\underbrace{ab}_{P}$$

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

$$C = (Aba + Aaba)(ab)^*$$

$$A = Ca + \varepsilon \quad \text{——} \quad (\text{from Eq}^n\ 1)$$

$$A = (Aba + Aaba)(ab)^* a + \varepsilon$$

$$\underbrace{A}_{R} = \underbrace{A}_{R}\underbrace{(ba + aba)(ab)^* a}_{P} + \underbrace{\varepsilon}_{Q}$$

$$A = ((ba + aba)(ab)^* a)^* \quad ✓$$

$$B = Aa \quad (\text{Eq}^n\ 2)$$

$$B = ((ba + aba)(ab)^* a)^* a \quad ✓$$

Ques 4:

- Unrestricted Grammar (Type 0)
- Context Sensitive Grammar (Type 1)
- Context Free Grammar (Type 2)
- Regular Grammar (Type 3)

CFG for $L = \{0^i 1^j 0^k \mid j > i+k\}$

$S \to ABC$

$A \to 0A1 \mid \varepsilon$

$B \to 1B \mid 1$

$C \to 0C1 \mid \varepsilon$

Ques 5:

If A is a regular language then A has a pumping length 'p' such that any string 's' where $|S| \geq P$ may be divided into 3 parts $S = xyz$ such that:

1. $xy^iz \in A$ for every $i \geq 0$
2. $|y| > 0$
3. $|xy| \leq P$

~~Let~~ Prove that $L = \{0^i 1^i \mid i \geq 1\}$ is not regular.

$S = 0^p 1^p$ $\quad S = 00000001111111$

Case 1: (all 0's in y) $\quad \underbrace{000}_{x}\underbrace{0000}_{y}\underbrace{1111111}_{z}$

$xy^iz \quad xy^2z$

000 0000 0000 1111111

11 0's 7 1's. $\quad 11 \neq 7$

Case 2: (all 1's in y) $\quad \underbrace{000000011111}_{x}\underbrace{11}_{y}\underbrace{1}_{z}$

000000011 111111 11 $\quad 7 \neq 10$

Case 3: $\quad \underbrace{000}_{x}\underbrace{0000111}_{y}\underbrace{1111}_{z}$

000 0000111 0000111 1111

not in 0^p1^p format.