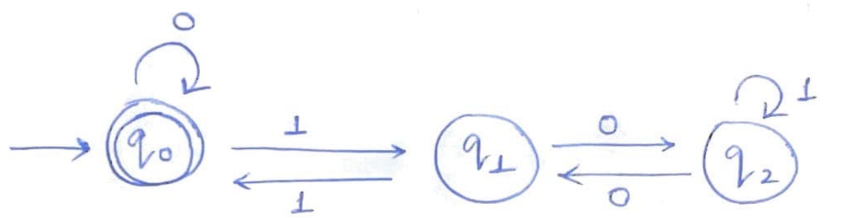
Ques 1 :

Two FA are equivalent if they accept the same language.

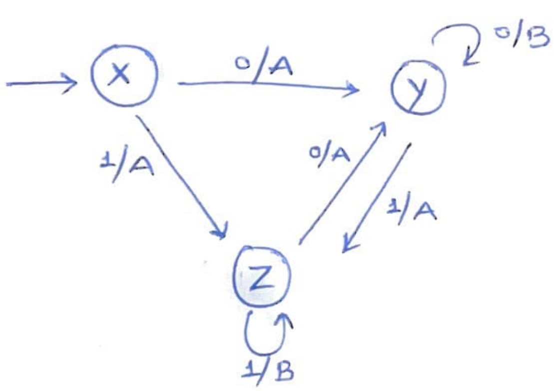
Example

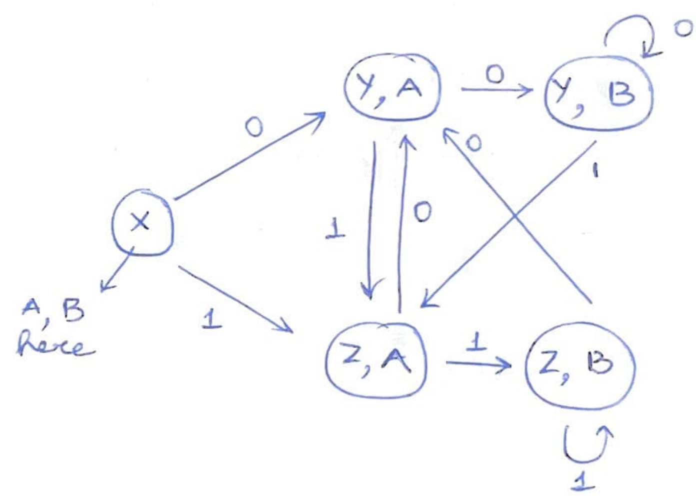


q_0: By 0 : Value doubles

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 $R = QP^*$

$A = Ca + \varepsilon$ —— 1

$B = Aa$ —— 2

$C = Da + Eb$ —— 3

$D = Ab + Bb + Eb$ —— 4

$E = Ca$ —— 5

Put 4 and 5 in 3

$C = Da + Eb$

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

$C = Aba + Bba + Eba + Eb$

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

$C = Aba + Bba + Eb$

$C = Aba + Aaba + Eb$

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

$R = Q + RP$

$R = QP^*$

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

$A = Ca + \varepsilon$ —— (from eq^n 1)

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

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

$A = ((ba + aba)(ab)^* a)^*$ ✓

$B = Aa$ (Eq^n 2)

$B = ((ba + aba)(ab)^* a)^* a$ ✓

Ques 4:

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

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

$S \rightarrow ABC$

$A \rightarrow 0A1 \mid \varepsilon$

$B \rightarrow 1B \mid 1$

$C \rightarrow 1C0 \mid \varepsilon$

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.

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

$xy^iz \quad xy^2z$

Case 1: (all 0's in y) $\underbrace{000}_{x}\underbrace{0000}_{y}\underbrace{01111111}_{z}$

$\underline{000}\ \underline{00000000}\ \underline{1111111}$

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

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

$\underline{000000011}\ \underline{111111}\ \underline{11}$ $\quad 7 \neq 10$

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

$\underline{000}\ \underline{0000111\ 0000111}\ \underline{1111}$

not in $0^p 1^p$ format.