UNIT-IV

TURING MACHINE

↳ Infinite Size tape
↳ Accept recursive enumerable lang.
↳ Same set of rules repeating with set of elements

PDA → stack
TM → TAPE
↳ It can move both directions & does not accept ε

↳ It is a mathematical model consist of infinite tape divided into cells on which i/p is given.
↳ It consist of a head which reads the i/p tape.
↳ A state register store the state of TM.
↳ After reading i/p symbol it is replaced with another symbol, its internal state is changed & it move from one cell to the right (or) left.
↳ If the TM reaches the final state the i/p string accepted, otherwise rejected

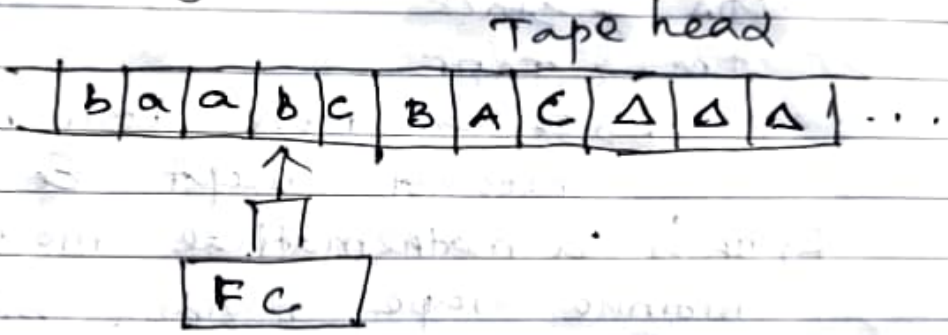
Basic Model of TM:

① The i/p tape is having an infinite no. of cells, each cell consisting i/p symbols. The empty tape is filled by blank symbols.

(2) The finite control and the tape head which is responsible for the current i/p symbol. The tape head can move to left (or) Right

(3) A finite set of states through within m/c has to undergo.

(4) Finite set of symbols called external symbols, which are used in writing the langs of TM.



Δ → blank symbol special symbol
Δ ∉ Σ
↳ It is used to fill the infinite tape.

Defn:
A TM can be formally described as 7 tuples

$$[Q, X, \Sigma, \delta, q_0, B, F]$$

Q → Finite set of state
X → It is alphapet
Σ → It is i/p alphapet
δ → Transition fnctn
$\delta = Q \times X \to Q \times X \times L, R$

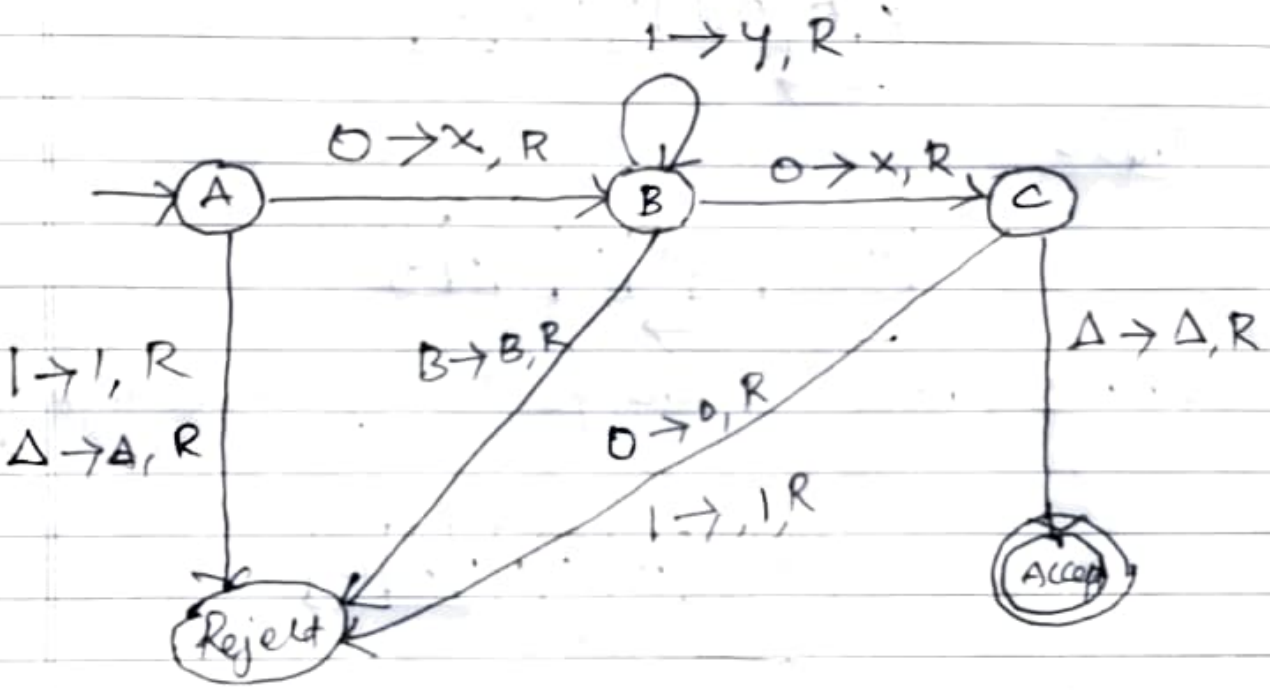
q_0 → Start State
B → Blank Symbol
F → Set of Final States

Ex 1

Design a TM which recognize the language:

$$L = 01^*0$$

Sol':



Ex:2

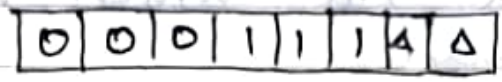
Design the TM which recognize the language

$$L = 0^N 1^N$$

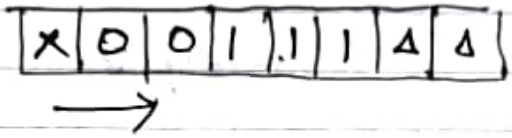
Algo:

* change 0 to "x"
* Move to right to first "1"
  If none reject
* change 1 to Y
* Move left to leftmost 0.
* Repeat the above steps until no more 0s.
* Make sure no more "1" remains

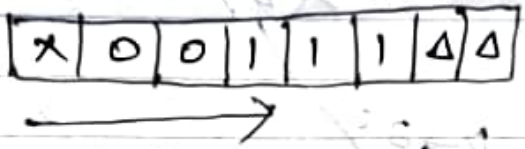
Step 1



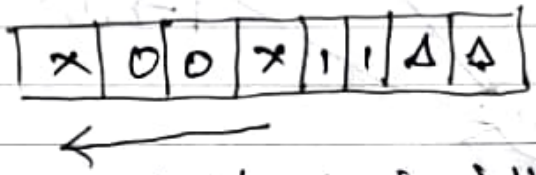
Step 2: 0 changed to x and move to right direct



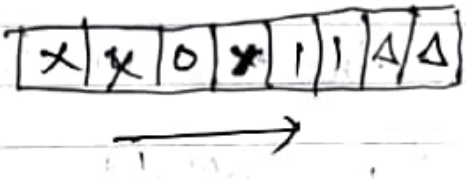
Step 3



Step 4 Now 1 change to y and move to left direct.

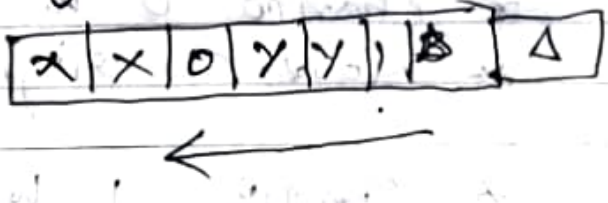


Step 5 once reach x it will move to right

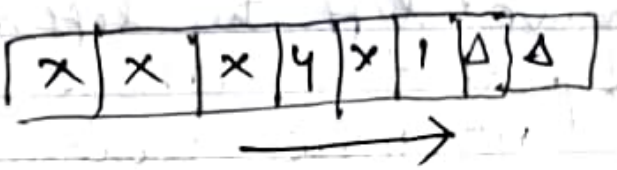


Step 6

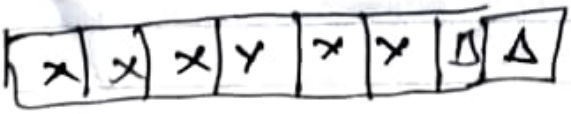
Now again search nexct 1 in cell

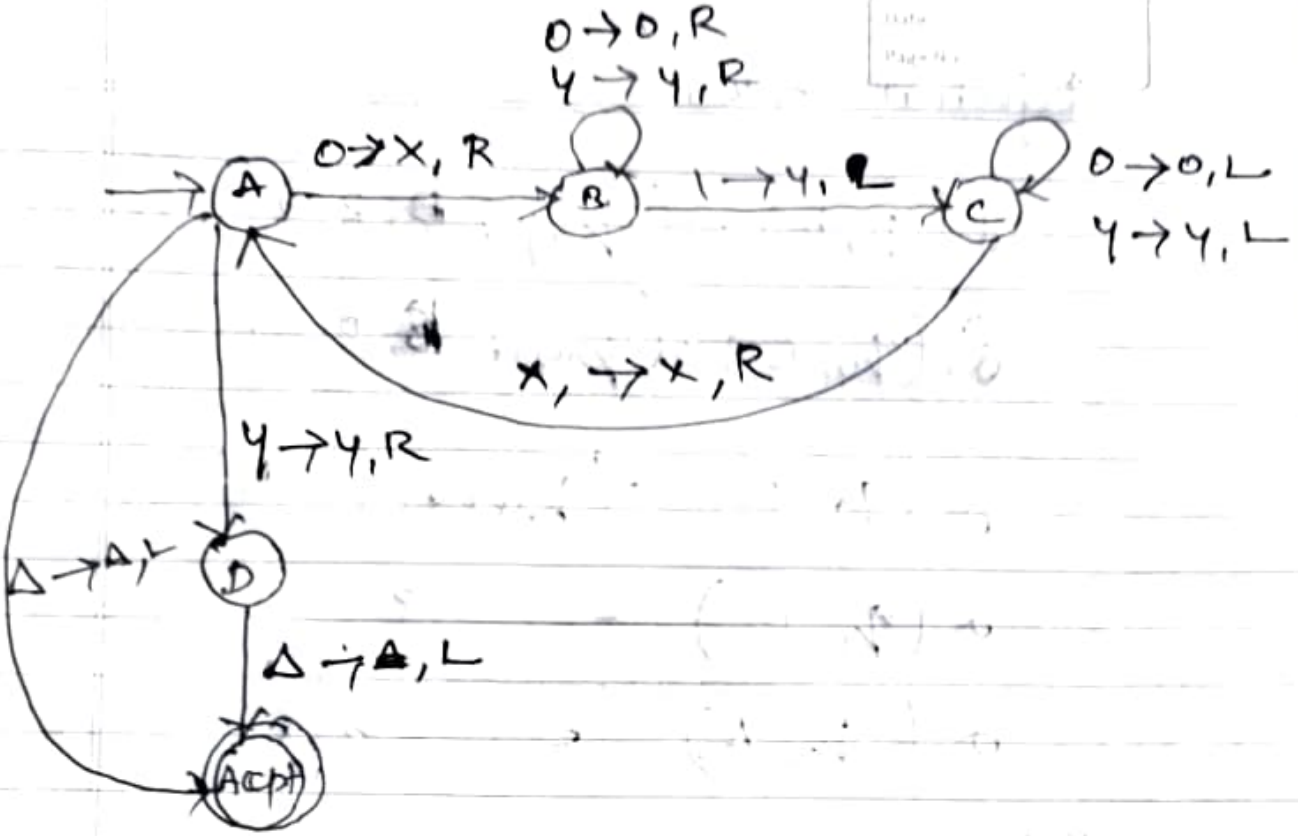


Step 7



Step 8



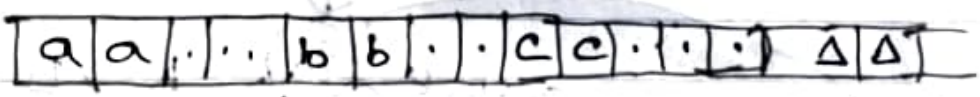


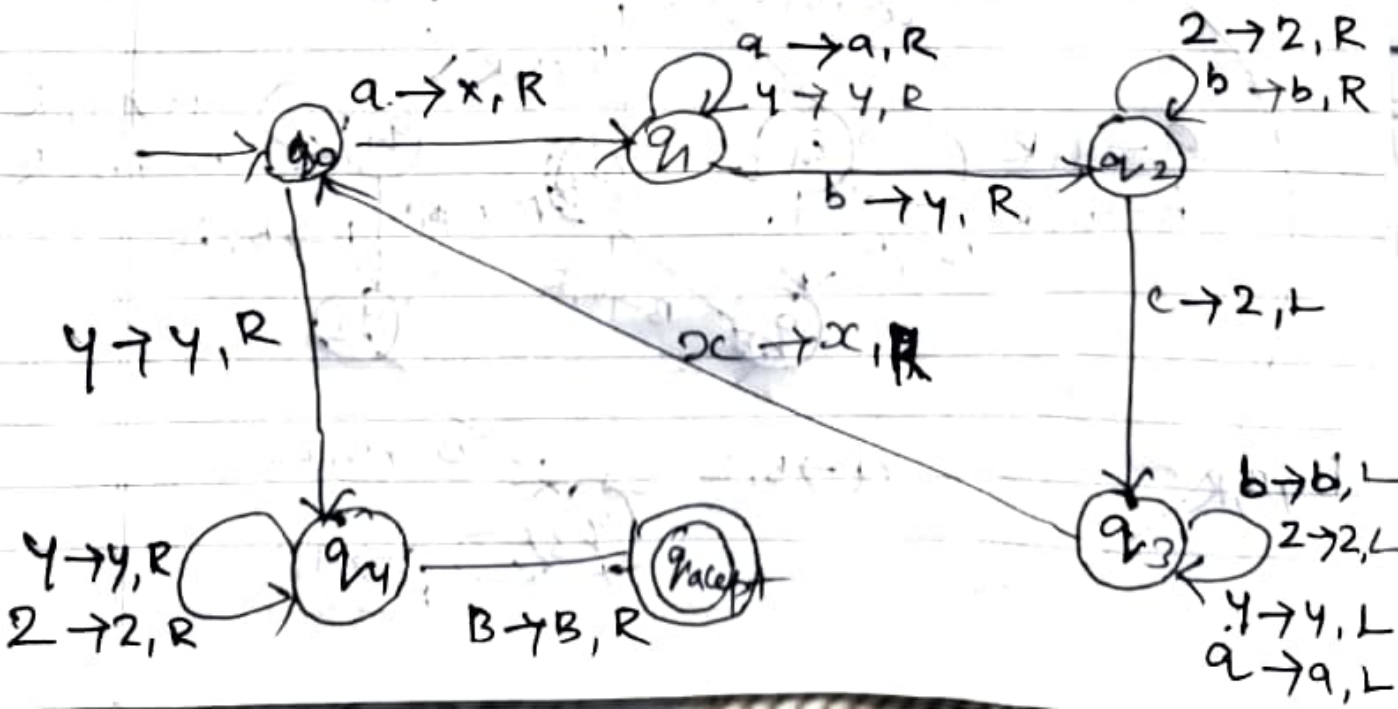
Ex:

Construction of a TM that accept the language $L = \{ a^n b^n c^n \mid n \geq 1 \}$ over an alphabet $\Sigma = \{a, b, c\}$

Sol:

$w = \{ abc, aabbcc \ldots \}$





Rejection States

$\delta(q_4, b) = (q_{reject}, b, R)$

$\delta(q_4, c) = (q_{reject}, c, R)$

$\delta(q_1, 2) = (q_{reject}, 2, R)$

$\delta(q_1, c) = "$

$\delta(q_2, \Delta) = "$

Ex:

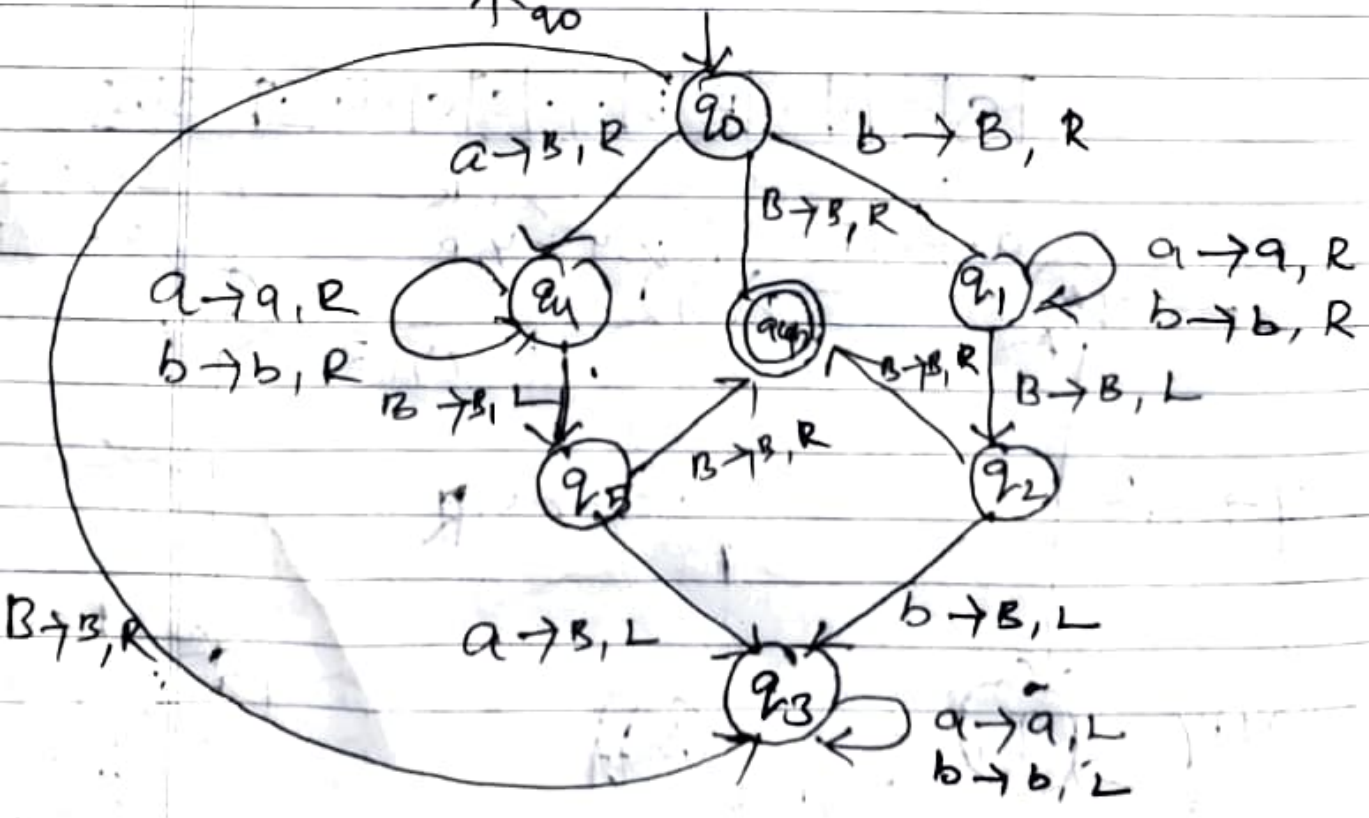
Construct a TM that accept Palindrome of the string over an alphabet $\Sigma = \{a, b\}$

Sol

I/p string : ababa

b	a	b	b	a	b	B	B	B	B

↑ q_0



Rejection State

$$\delta(q_{5}, b) = (q_{reject}, B, L)$$

$$\delta(q_{2}, a) = (q_{reject}, B, L)$$