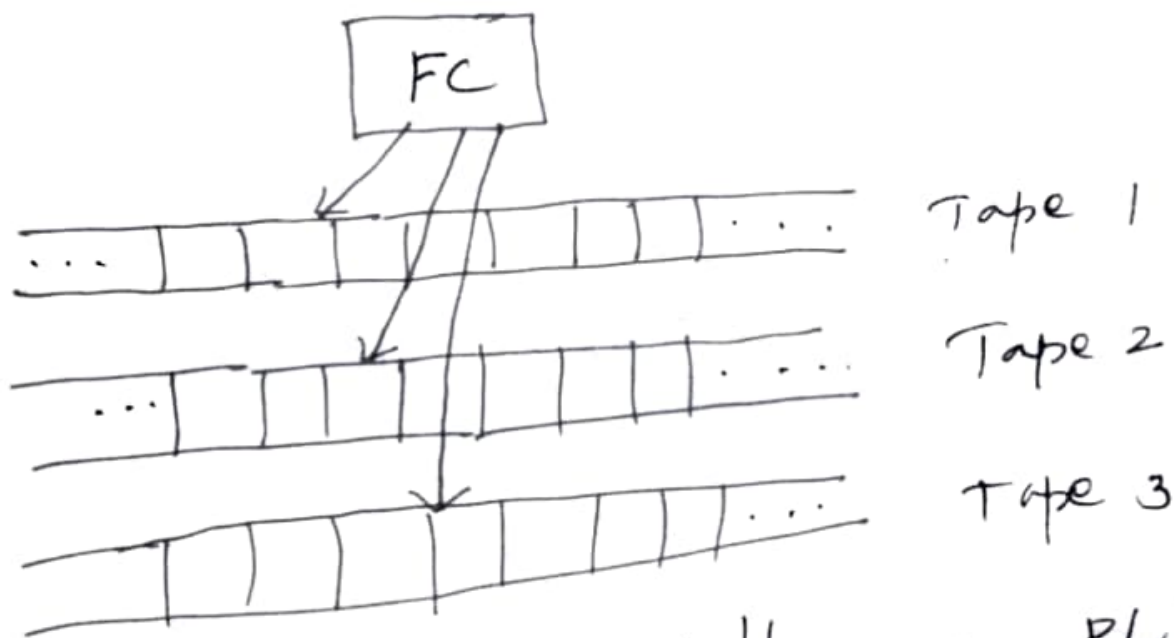# S R M   UNIVERSITY

Multiple Tape TM

A multiple TM has a finite Control with some finite no. of tapes. Each tape is infinite in both directions. It has own initial state & some accepting states

FC

Tape 1

Tape 2

Tape 3

→ Every Tape their Controlled on R/w head

→ For n-tape TM

$$M = \{ Q, \Sigma, x, \delta, q, B, F \}$$

we define $\delta = Q \times x^N \to Q \times x^N \times [L,R]^N$
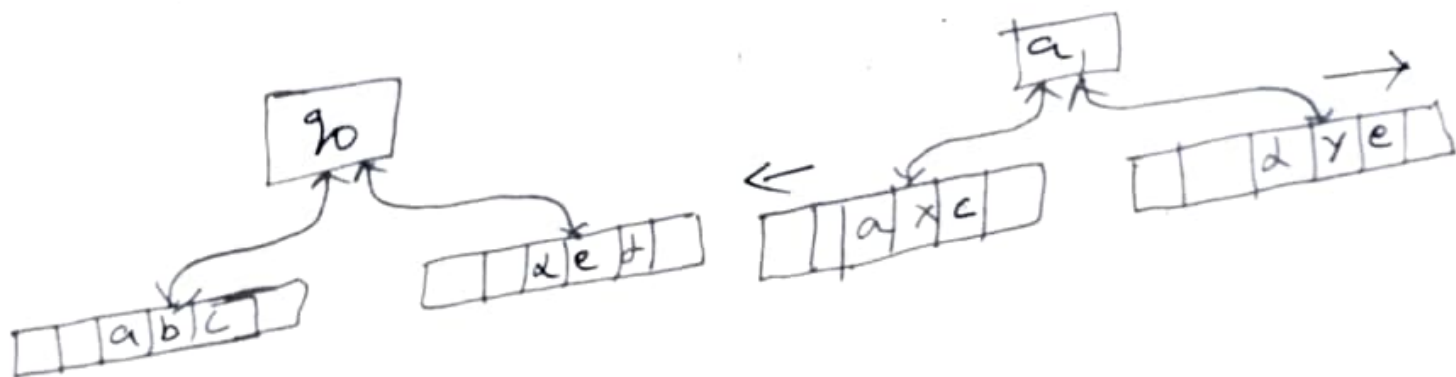
Different Variations of TM

→ Multitape Turing M/c

→ Non-deterministic Turing M/c

→ Multihead Turing m/c.

For eg:

If $n=2$, with Current Configuration

$$\delta(q_0, a, e) = (q_1, x, x, L, R)$$

Non-deterministic TM

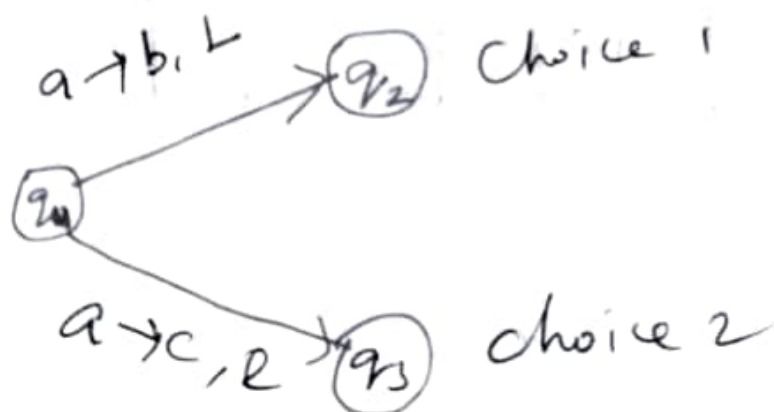→ It is similar DTM except that for any input symbol and Current State it has a no. of choices.

→ A string is accepted by NDTM if there is a sequence of moves that heads to a final state

→ The transition function

$$\delta : Q \times X \to 2^{Q \times X \times (L, R)}$$

A NDTM is allowed to have more than one transition for a given tape symbol.

$$a \to b, L \to \boxed{q_2} \text{ Choice 1}$$

$$\boxed{q_4}$$

$$a \to c, R \to \boxed{q_3} \text{ choice 2}$$

③ **Multi head TM**

→ it has no. of heads instead of one

→ Each head independently read/write symbols and move left/Right.

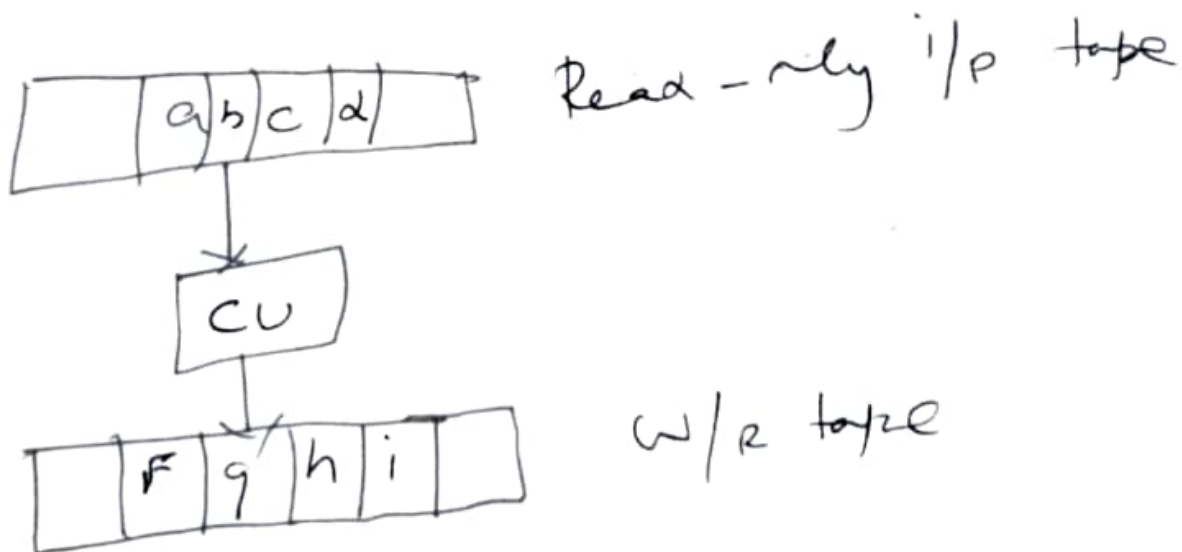Head 1   Head 2   Head 3   Head 4
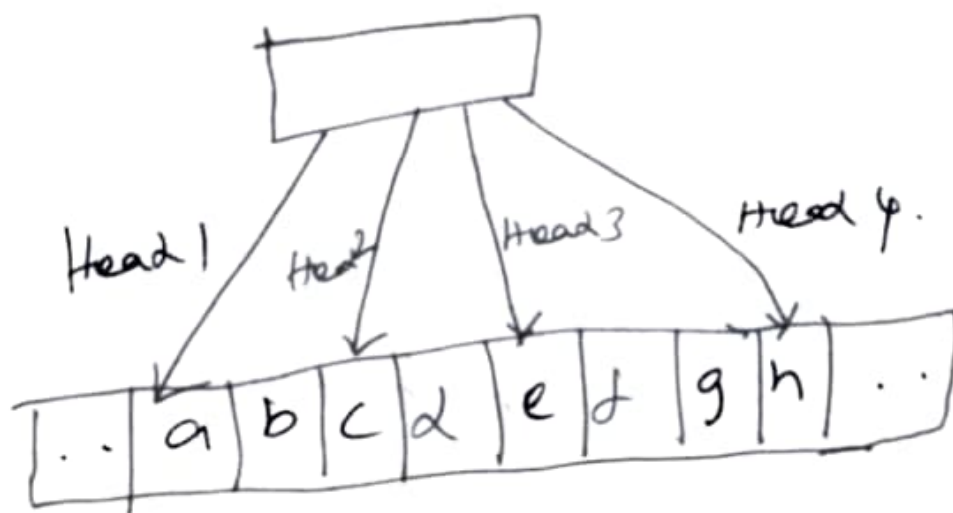
| . . | a | b | c | d | e | f | g | h | . . |

...	1	B	B	B	S	B	B	B	...
...	B	S	1	B	B	B	B	B	...
...	B	B	B	B	1	B	B	B	...
...	S	B	S	B	B	B	1	S	...
...	a	b	c	d	e	f	g	h	...

offline TM

└→ It has two tapes.
  └→ one tape is read only & contain the i/p
  └→ The other is read-write & intially blank.

Read-only i/p tape

| | a | b | c | d | |

CU

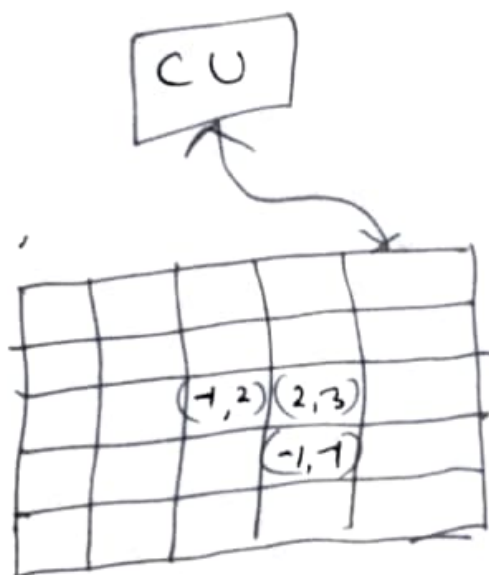| | F | g | h | i | |

w/r tape

Multi dimensional TM

└→ It has multidimensional tape
  * a two-dimensinal TM would read
  and write on an infinite tape
  divided into squares like a checkboard

* Transition function

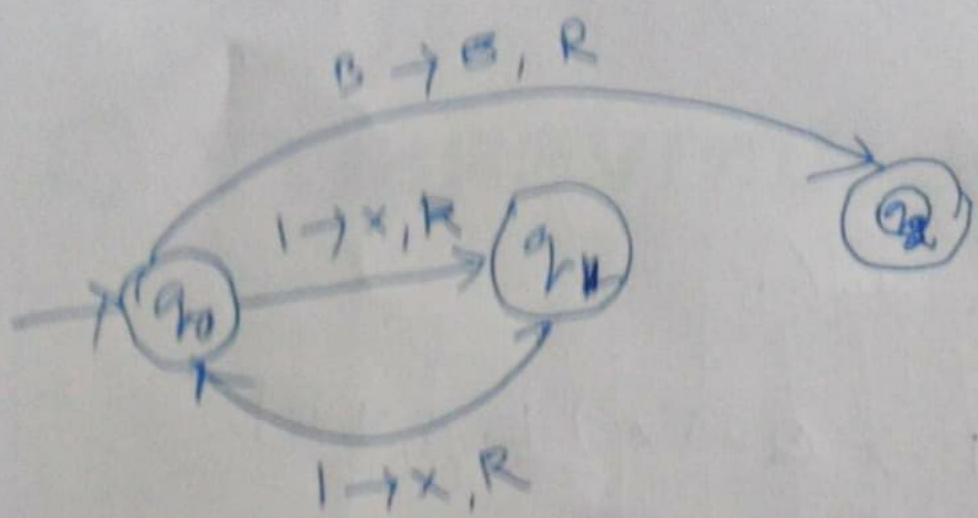$$\delta : Q \times T \rightarrow Q \times T \times [L, R, U, D]$$

infinite tape

Construct a TM that accept string over {1}, containing even Number of 1's

Sol:

logic: Read a i/p symbol one by one where on reading one 1, replace it by X and goto next state. At final stage it encounter 1, replace it by X and goto the Previous State.

Repeat the Steps, till q_1 encounter the blank.

$$B \rightarrow B, R$$

$$1 \rightarrow x, R$$

$q_0 \qquad q_1 \qquad q_2$

$$1 \rightarrow x, R$$

	x	B
$\rightarrow q_0$	(q_1, x, R)	(q_2, B, R)
q_1	(q_1, x, R)	—
* q_2	—	—