

Turing Machine Table

Billing

Date :

Page no. :

Present state	Tape Symbol			
	b	0	↑	
→ q ₁	IL q ₂	OR q ₁	—	* b is considered as blank space
q ₂	bR q ₃	OL q ₂	LL q ₂	
q ₃	—	bR q ₄	bR q ₅	
q ₄	OR q ₅	OR q ₄	IR q ₄	
q ₅	OL q ₂	—	—	

Q. Consider the TM description given in the above table. Draw the computation sequence of the i/p string '00'.

Solⁿ Δ 0 0 Δ is represented with 'b' in transition

Initially the 1st pointer head q₁ is pointing to '0'. So that we can read/write it as q₁ 0 0 b or q₁ 0 0 or (0 0)

So, the transitions might be of this type...

I am following this method.

0 0 | 0 0 | 0 0 b | 0 0 |
↑ ↑ ↑ ↑
q₁ q₁ q₁ q₂

→ 0 0 | b 0 0 | b 0 0 |
↑ ↑ ↑
q₂ q₂ q₃

→ | b b 0 | b b 0 | b b 0 | b
↑ ↑ ↑
q₄ q₄ q₄

From the table

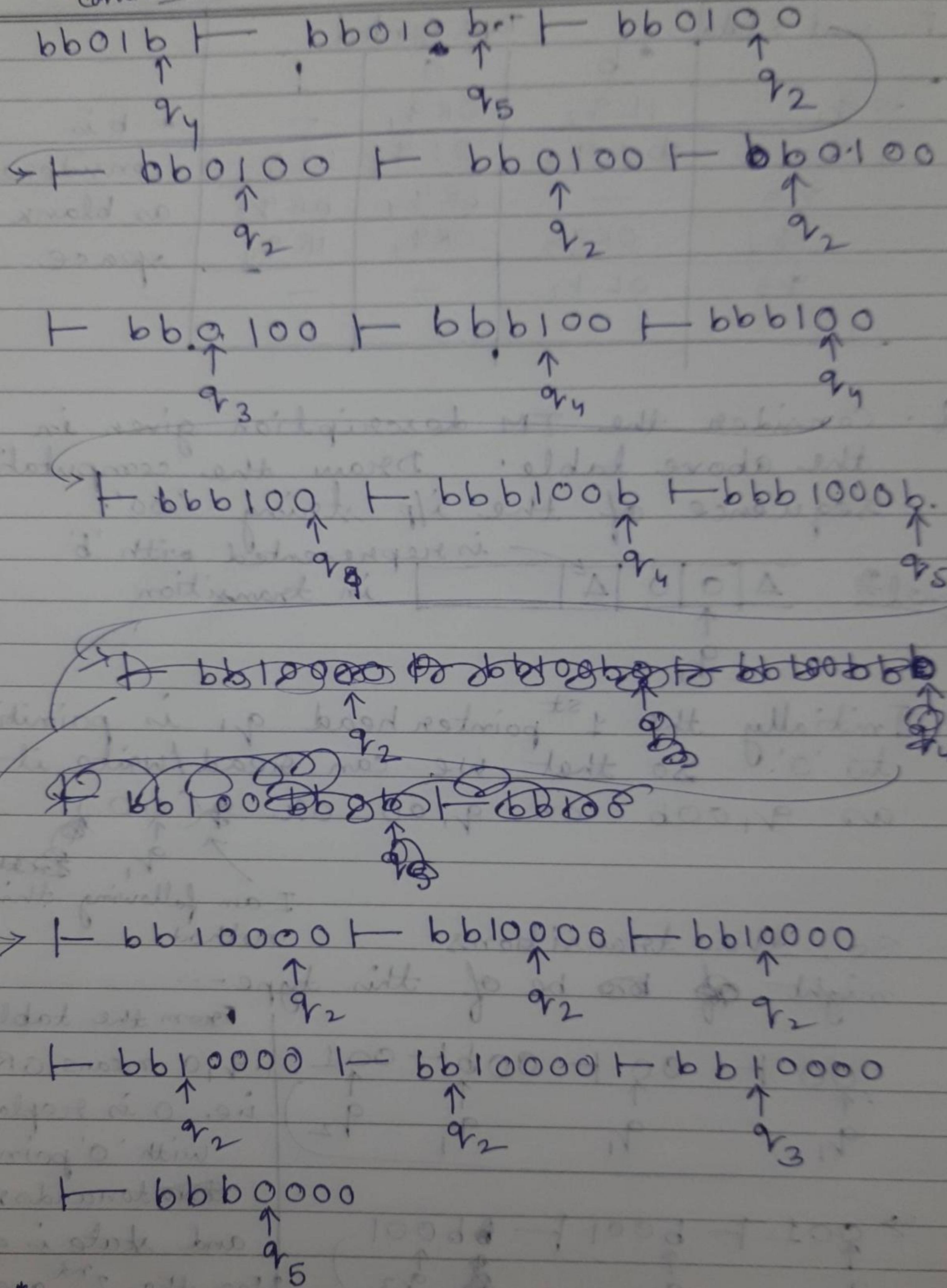
1. q₁ 0 means OR q₁, i.e. 0 is replaced with '0' pointed towards right

and state is q₁

2. For the 2nd q₁ 0

0 0 b
↑ ↑
q₁ q₁

continued



Now (q_5) we don't have any option to replace q_5 and q_5 is the final state. So, accepted string

Multitrack Turing Machine

a	a	b	B
b	c	b	B
c	b	c	B

↑
Finite control

$$\Sigma = \{a, b, c\}$$

$$\Rightarrow \Sigma = \{ \begin{matrix} a \\ b \\ c \end{matrix}, \begin{matrix} a \\ b \end{matrix}, \dots \}$$

a	a	b	B
b	c	b	B
c	b	c	B

↑
Finite control

Single Track TM

Multitrack Turing Machine

$$\delta(q_0, [a, b, c]) = (q_1, [b, b, b], L/R)$$

* Can be convertible ~~to~~ to single track TM.

Q. Design TM to multiply 2 integers

Solⁿ.

$$3 \times 2 = 2 + 2 + 2$$

0

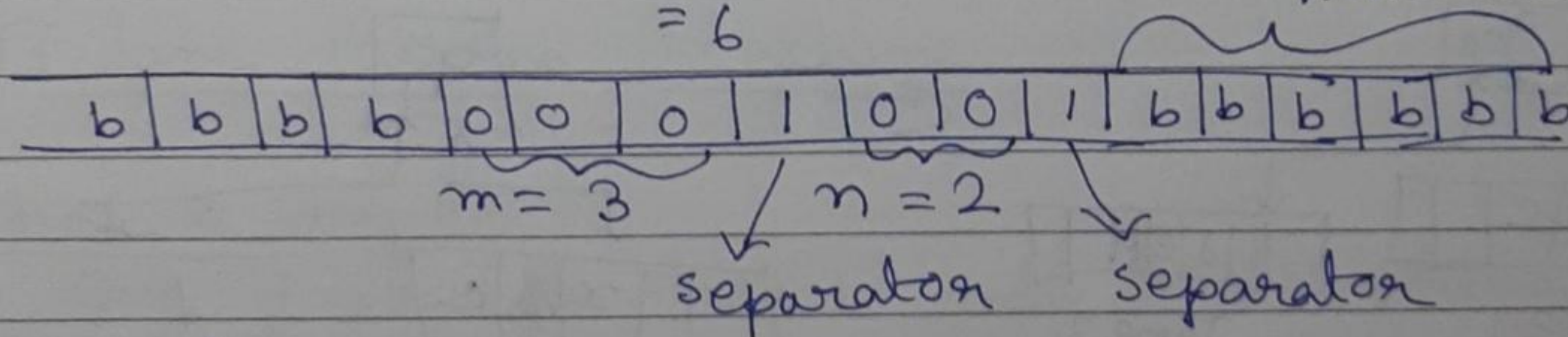
1

2

$$3 \times 2 = 0 + 2 + 2 + 2$$

$$= 6$$

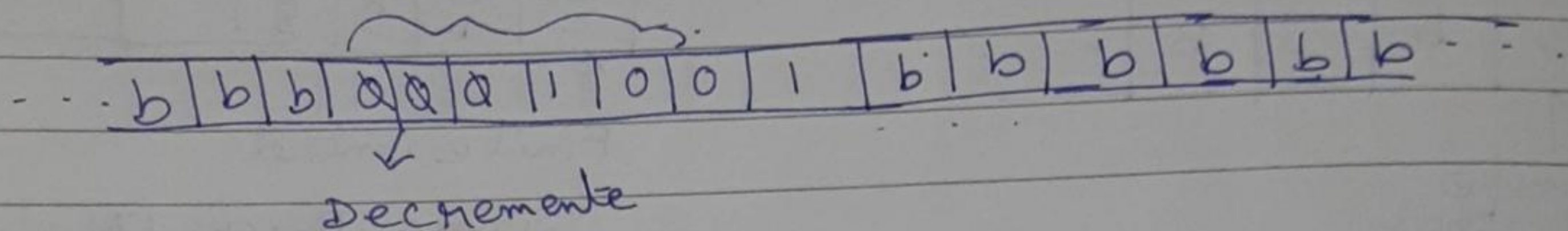
Answer



The steps

1. $0^m, 0^n$ is placed on the tape
(the 0's will be written after the rightmost 1)
2. The leftmost '0' is erased
3. A block of n 0's is copied onto the right end.
(concept is $3 \times 2 = 2 + 2 + 2$)

3. Step 2 & 3 are repeated n times and $10^m 10^{mn}$ is obtained on the tape.



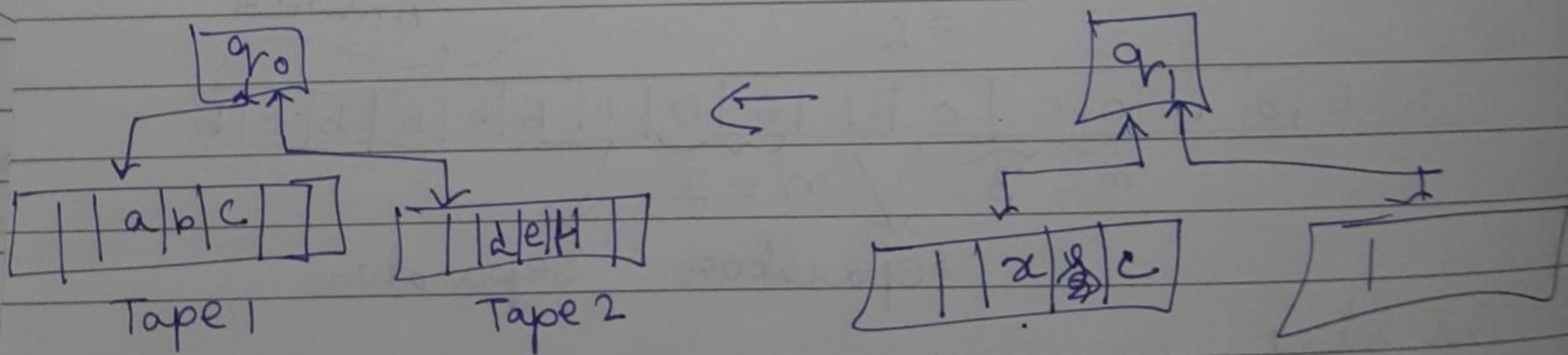
Subroutine

This will have a initial state and a return state. After reaching the return state, there is a ~~temporary~~ temporary halt.

Non-Deterministic Turing Machine

eg. if $n = 2$ with current configuration

$$\delta(q_0, a, e) = (q_1, x, y, L, R) \quad n = 2$$



Non - Deterministic Turing Machine

→ It is similar to DTM except that for any i/p example and current state it has a no. of choices.

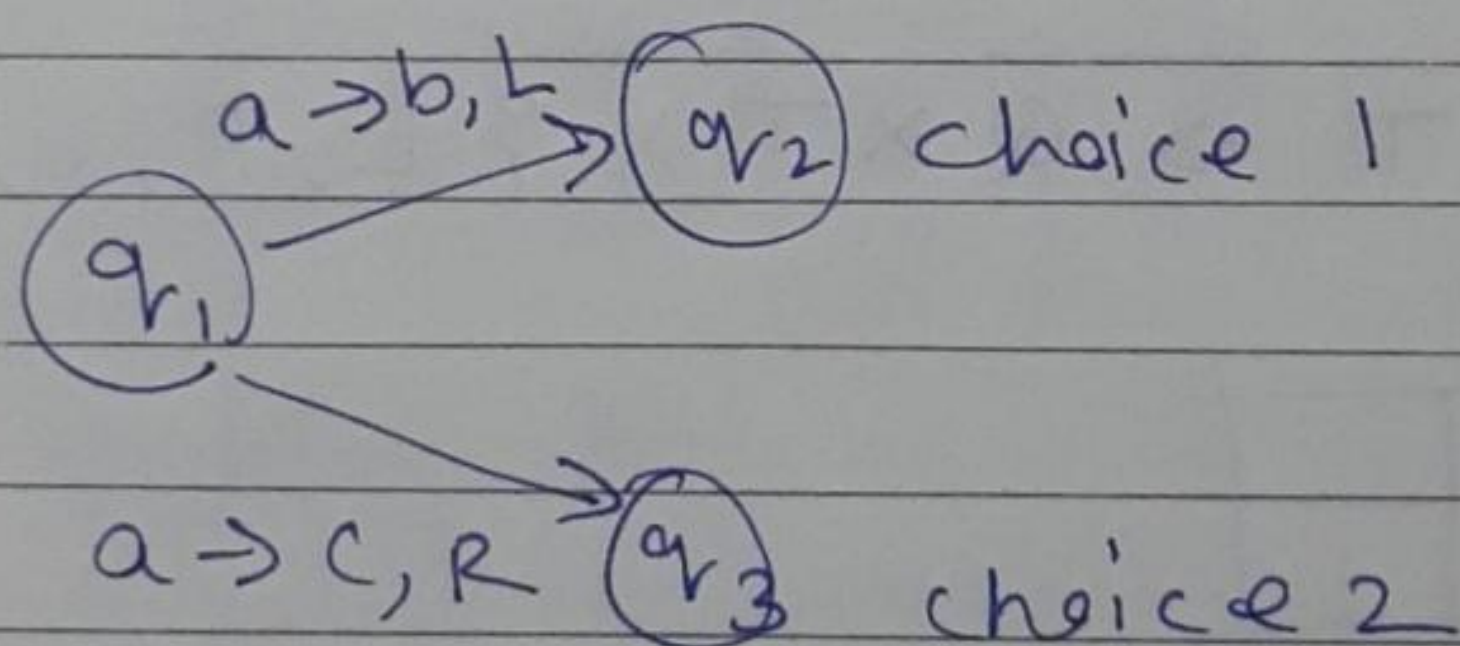
→ A string is accepted by a NDTM if there is ~~sequence~~^{sequence} of moves that leads to a final state.

→ The transition ~~is~~ fn.

Multiple choices.

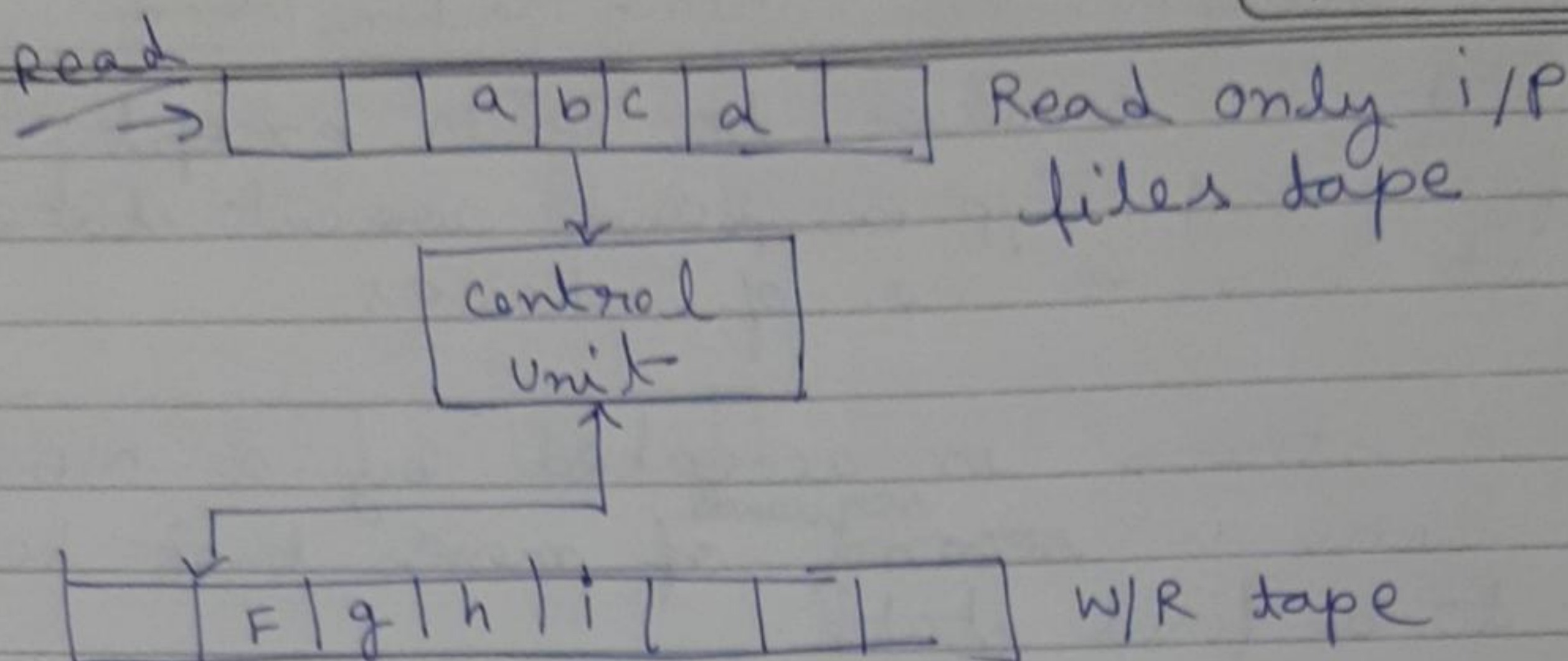
$$\delta : Q \times X \rightarrow 2^{Q \times X \times \{L, R\}}$$

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

OFF line turing machine

Has 2 tapes.

- ① One tape is read only and contains i/p.
- ② The other is read-write and is initially blank



Multidimensional turing machine

→ It has a multidimensional tape
eg. A two dimensional T.M. would read and write on an infinite tape divided into ~~squares~~ squares, like a checkboard

$$\rightarrow \delta: Q \times T \rightarrow Q \times T \times \{L, R, U, D\}$$

