

TOPIC TOC

DATE 30/4/24

BTECH SEM 4th IT

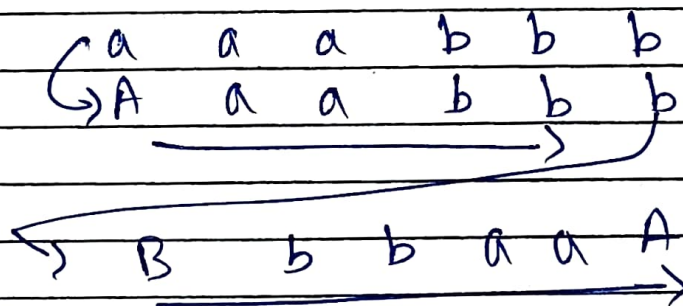
Assignment-2
(TOC)

(1)

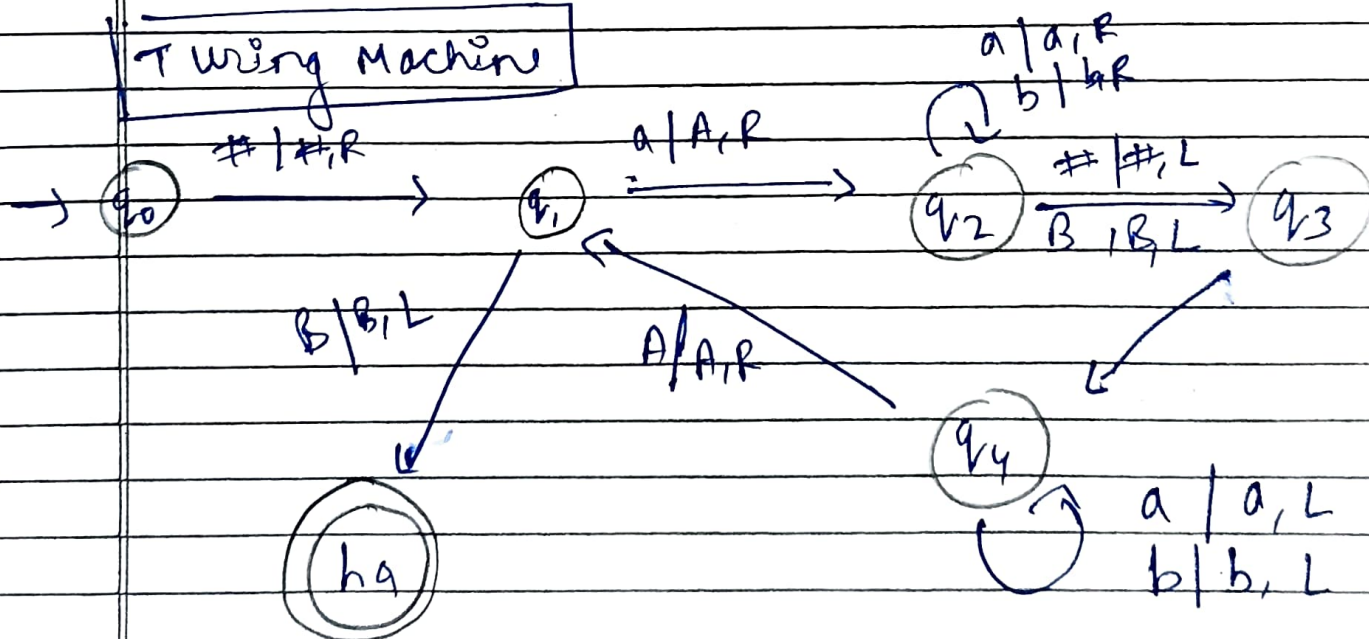
Q1. Turing machine for $L = \{a^n, b^n \mid n \geq 1\}$ Here we have $n \geq 1$ as smallest accepted string $\rightarrow 'ab'$

and Empty string should not be accepted

Steps Read 'a' & replace it with 'A'
 move to the end of string
 Read b & replace it with 'B'
 move to the start of string &
 Repeat.



Turing Machine



Q2 Turing machine for $f(n) = 1 + 2 + \dots + n$

Suppose we want to compute $f(4)$

$$f(4) = 1 + 2 + 3 + 4 = 10$$

$$\text{So } 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1$$

So we have to copy str on tape and

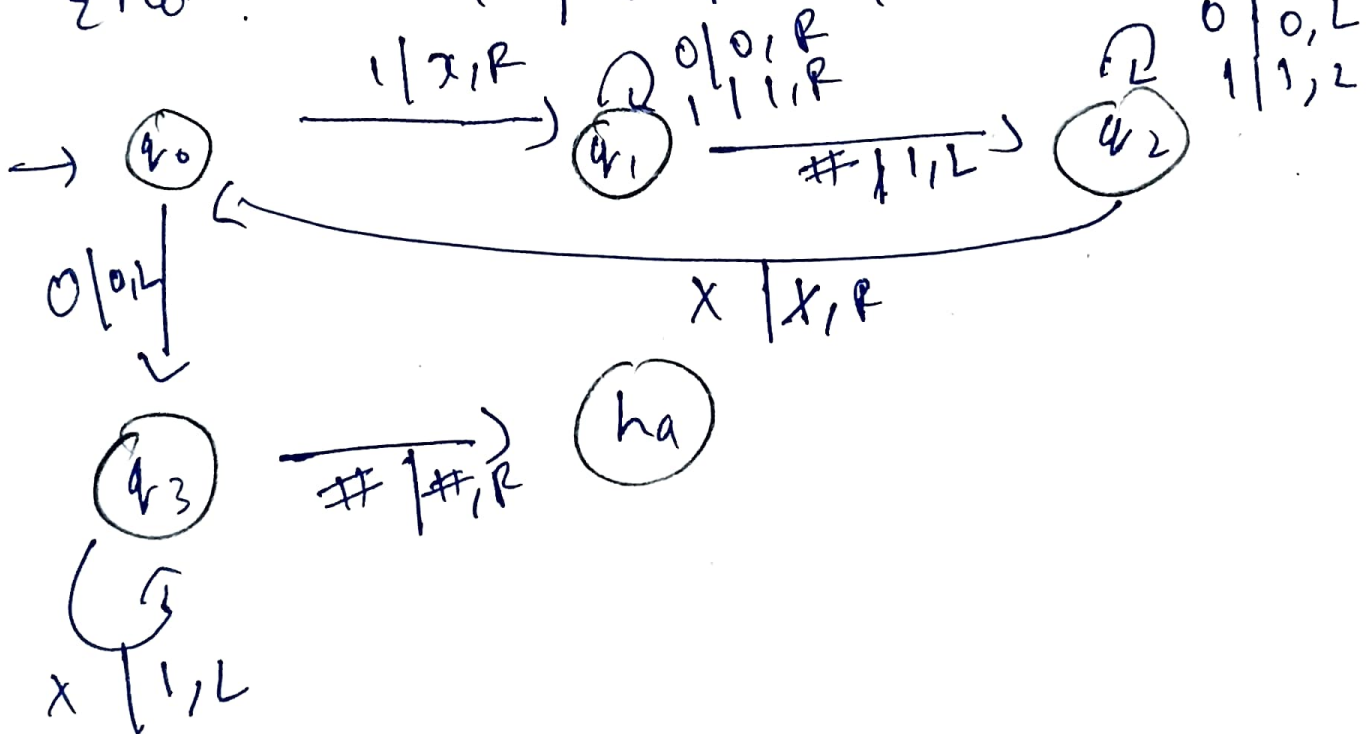
Turing machine to copy string

Start : 1 | 1 | 1 | 1 | 0 | # | # | #

R/w head

Place copy str after 0

End : 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1



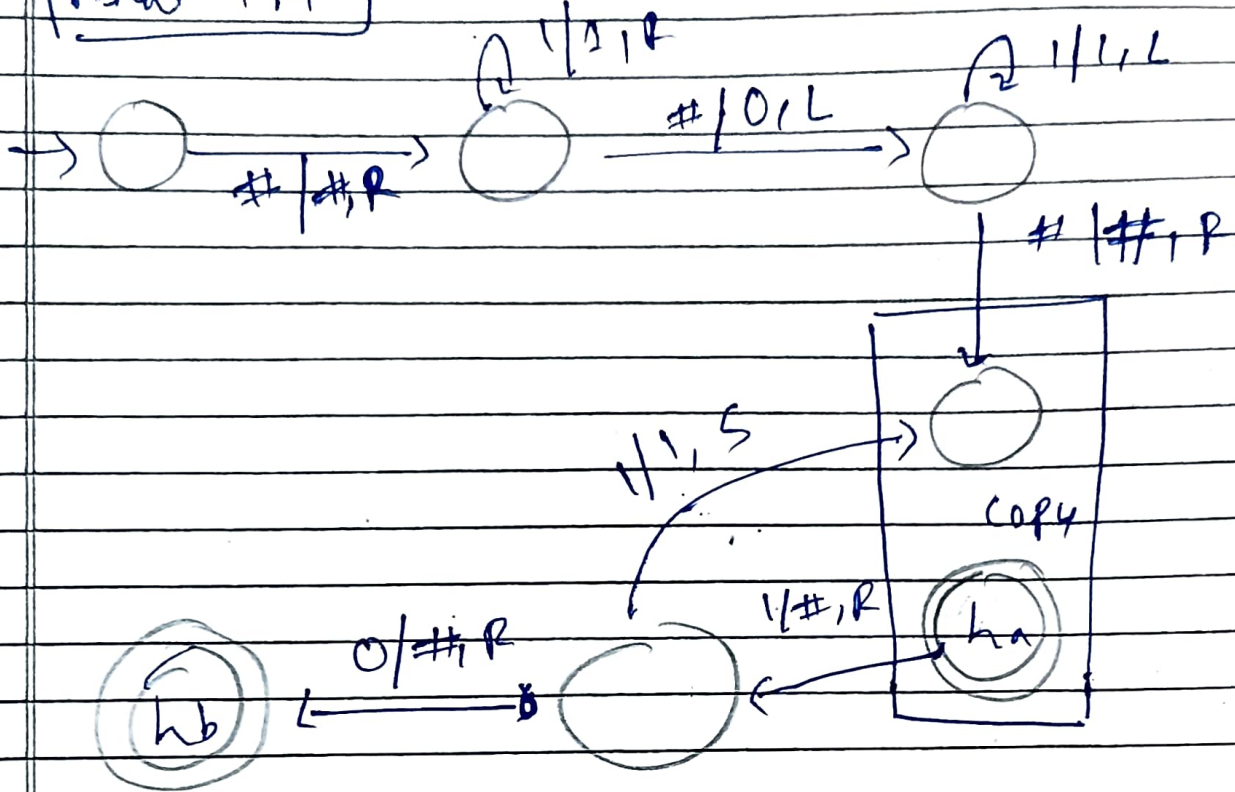
Abhay Dixit

(004 164 01 522)

30/4/22

(3)

Final TM



Q3

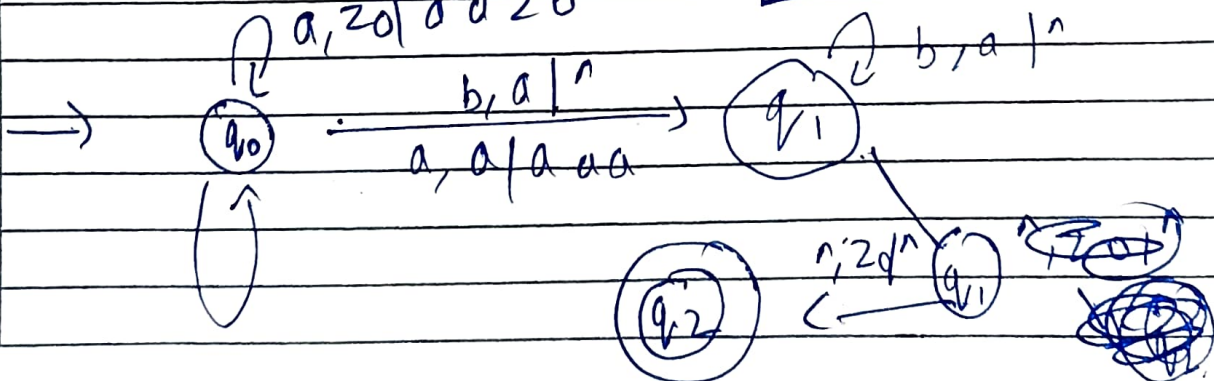
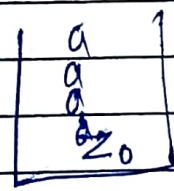
PDA for $L = \{ a^n b^n \mid n \geq 1 \}$

read 'a' & push 'aa' to the top of stack

read 'b' and pop from stack

a a b b b b

a, z0 | a a z0



→ PDA to CFG

Transition function δ of PDA

ABHAY Dixit
(00416401522) (4)

$$\tau_1 \quad \delta(q_0, a, z_0) = (q_0, a a z_0)$$

$$\tau_2 \quad \delta(q_0, a, a) = (q_0, a a a)$$

$$\tau_3 \quad \delta(q_0, b, a) = (q_1, \wedge)$$

$$\tau_4 \quad \delta(q_1, b, a) = (q_1, \wedge)$$

$$\tau_5 \quad \delta(q_1, \wedge, z_0) = (q_2, \wedge)$$

→ for τ_1 (increasing length) use R-3

$$[q_0 \quad z_0 \quad \wedge] \rightarrow a [q_0 \quad a \quad q] [q \quad a \quad \wedge] [\uparrow z_0 \quad \wedge]$$

This is equivalent to (27) production

for τ_2 (increasing length) use Rule-3.

$$[q_0 \quad a \quad \wedge] \rightarrow a [q_0 \quad a \quad q] [q \quad a \quad \wedge] [\uparrow a \quad \wedge]$$

$$\rightarrow q, w, \uparrow \in \{q_0, q_1, q_2\}$$

is equivalent to (27) production

→ for τ_3 (decreasing length) use Rule 2

$$[q_0 \quad a \quad q_1] \rightarrow b$$

(1) production

ABHAY DIXIT (00416401522)

30/4/24

(5)

for T_4 (Decreasing length) use Rule 2

$$\boxed{[q_1 a q_1] \rightarrow b}$$

\Downarrow

① Production

for T_5 (Decreasing length) use Rule 2

$$\boxed{[q_1 z_0 q_2] \rightarrow \Lambda}$$

\downarrow

① Production

S-transition, use Rule-1

$$\boxed{\begin{array}{l} S \rightarrow [q_0 z_0 q_0] \\ S \rightarrow [q_0 z_0 q_1] \\ S \rightarrow [q_0 z_0 q_2] \end{array}}$$

\Downarrow

③ Production

→ There will be a total of 60 Production
is equivalent CF 4