

# Turing Machine: Instantaneous Description (ID)

Definition: ID of a TM is a snapshot of TM to describe the current situation of the TM.

Transitions: Let the initial ID of a TM is

$$x_1 x_2 \dots x_{i-1} q x_i x_{i+1} \dots x_n$$

so,

$$x_1 x_2 \dots x_{i-1} q x_i x_{i+1} \dots x_n$$

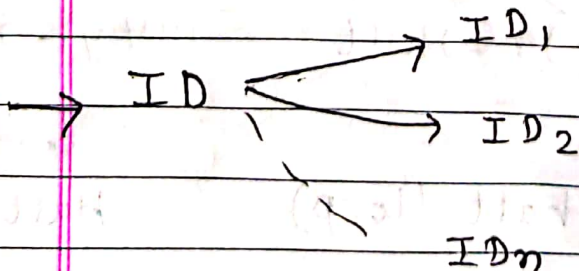
$$\vdash S(q, x_i) = (p, y, L)$$

$$x_1 x_2 \dots x_{i-2} p x_{i-1} y x_{i+1} \dots x_n$$

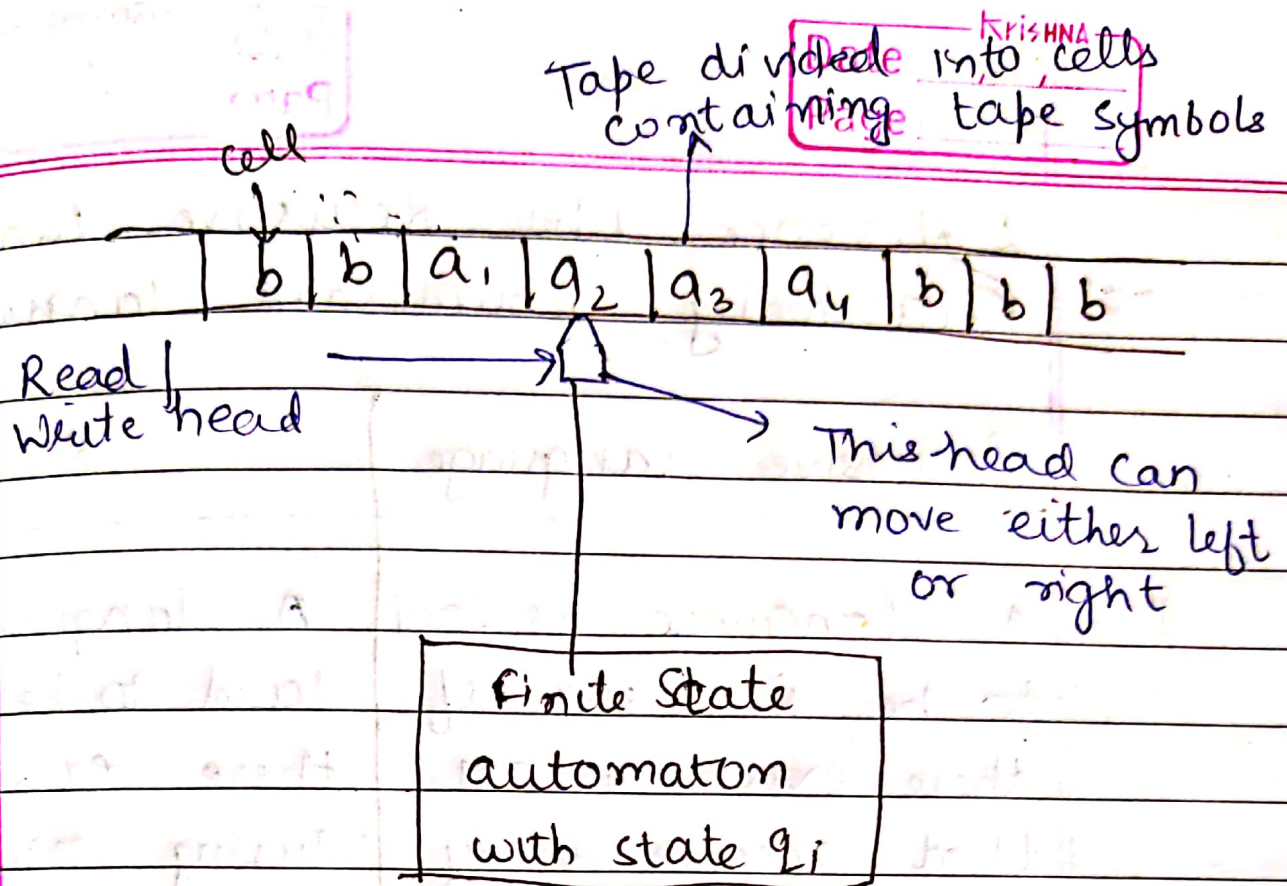
$$2) \quad x_1 x_2 \dots x_{i-1} q x_i x_{i+1} \dots x_n$$

$$\vdash S(q, x_i) = (p, y, R)$$

$$x_1 x_2 \dots x_{i-1} y p x_{i+1} \dots x_n$$



Transition is non-deterministic TM.



## Turing Machine model

So, the respective ID will be

1)  $a_1 \underset{\uparrow q'}{a_2} a_3 a_4$

2)  $a_1 \underset{q'}{\downarrow} a_2 a_3 a_4$

3)  $a_1 q' a_2 a_3 a_4$