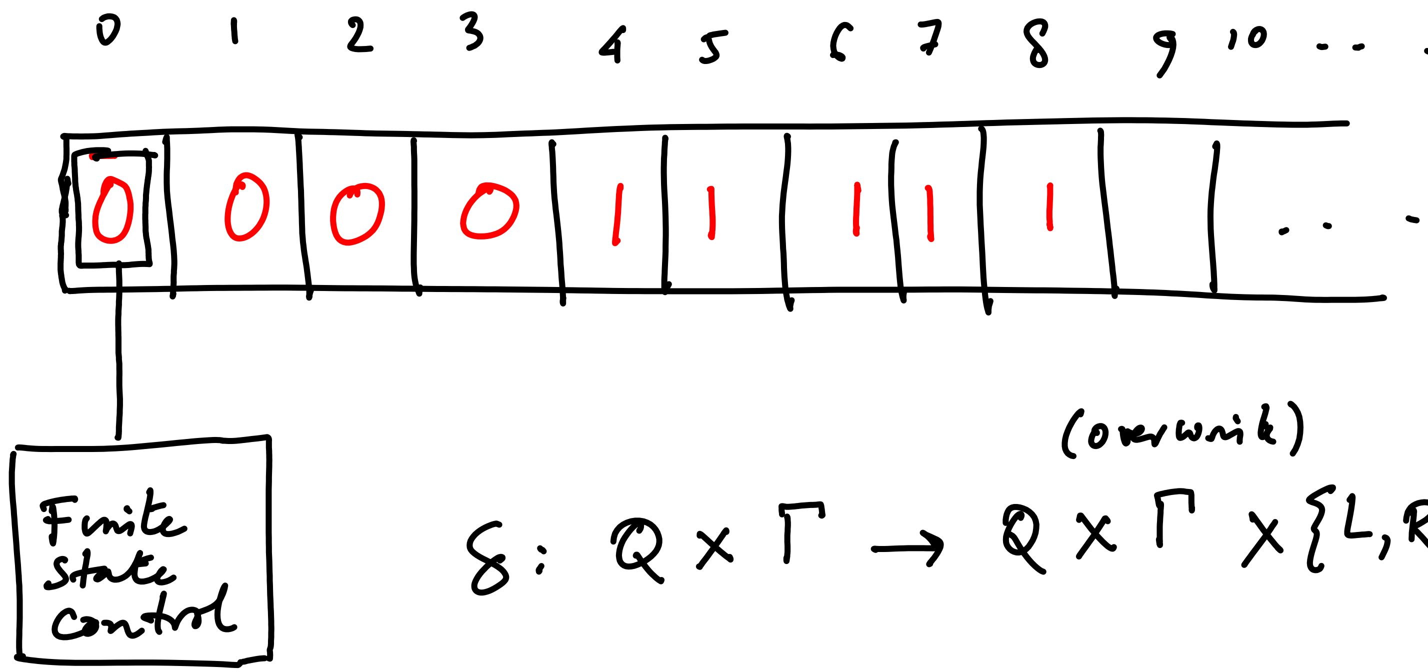
COL 352 Lecture 24 March 14

Class test on Wed (CFG & PDA)



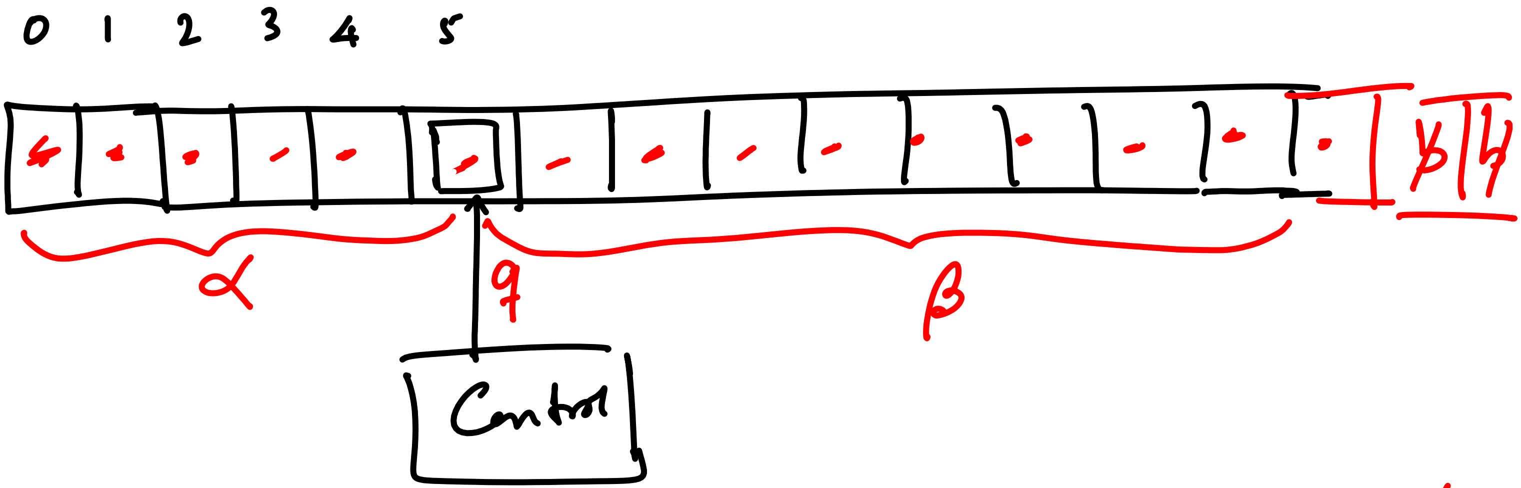
(overwrite)

$$\delta : Q \times \Gamma \rightarrow Q \times \Gamma \times \{L, R\}$$

Γ : tape alphabet
contains Σ : input alphabet as well as some additional symbols including $\not b$

The machine keeps executing until
1. the next move is undefined
2. It reaches a final state $q_f \in F$

Initially the machine is in state q_0 and the tape head is on the leftmost cell



$\alpha q \beta$ contains all the necessary information for the computation till a certain juncture

q is positioned on the leftmost symbol of β

$\alpha, \beta \in \Gamma^*$

$q \in Q$

$\alpha q \beta$ represent the instantaneous description of <u>Turing Machine</u>

Initially the I.D.

(ϵ, q_0, I_n)

I_n : input of length n

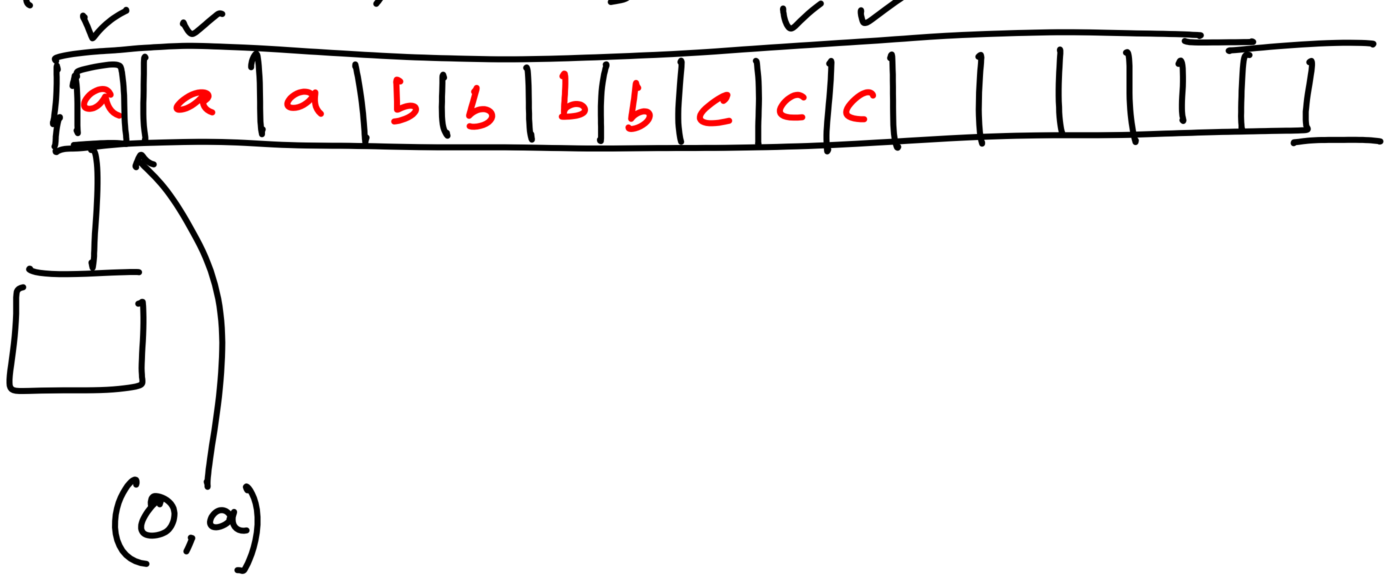
$\alpha_i q_i \beta_i \vdash \alpha_{i+1} q_{i+1} \beta_{i+1} \vdash \cdots$

Suppose

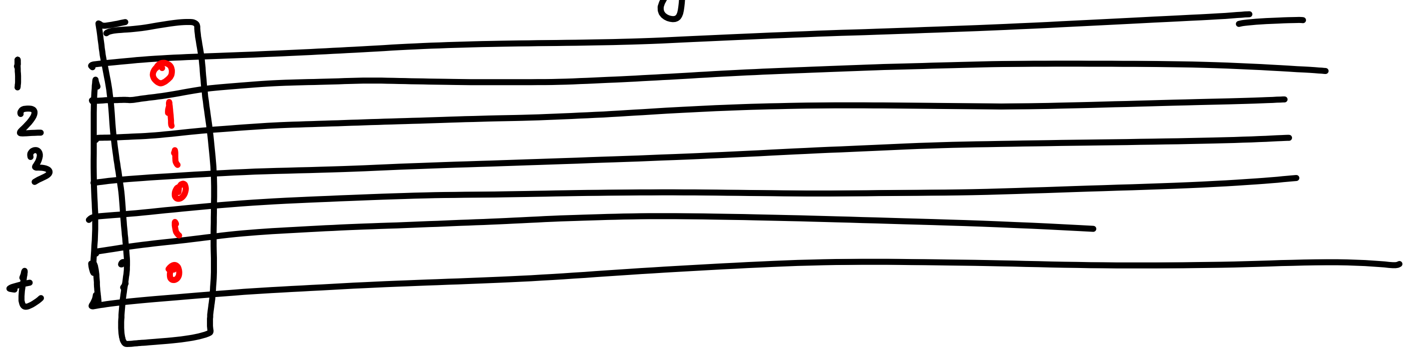
$0 0 q_2 1 0 1 \vdash 0 q_3 0 0 0 1$

$\delta(q_2, 1)$ contains $(q_3, 0, L)$

$L = \{a^n b^n c^n, n \geq 1\}$



Multitrack Turing Machine



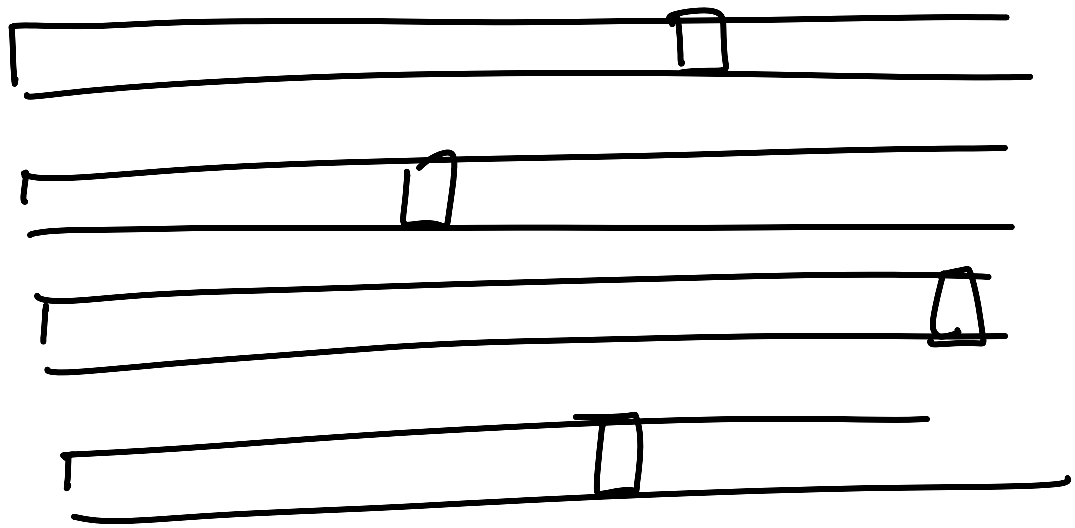
$$\delta : Q \times \underbrace{\Gamma^1 \times \Gamma^2 \times \dots \Gamma^t}_{\Gamma^t} \to Q \times \Gamma^1 \times \Gamma^2 \dots \times \Gamma^t \times \{L, R\}$$

Claim: Multitrack can be simulated by a normal 1 track machine.

(by blowing up the tape alphabet)

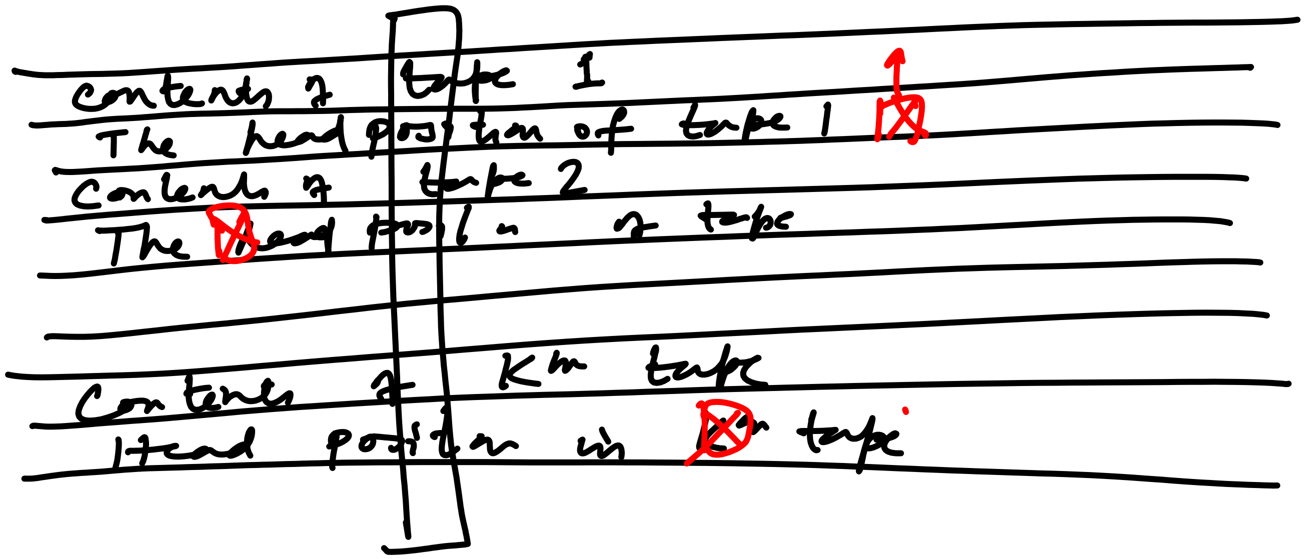
Multihead Turing Machine

k tapes



$$\delta : Q \times \underbrace{\Gamma \times \Gamma \times \Gamma}_{k} \to Q \times \underbrace{\Gamma \times \Gamma \times \Gamma \times \cdots \Gamma}_{k} \times \{L, R\}^k$$

Simulate a k multitape TM by a Multitrack $2k$ track TM



The head scans from leftmost cell till it has counted K markers (must be done using some special states)

2^{nd} scan: it replaces the symbols according the δ function of the multitape machine

How do we remember the # head markers as we scan from left to right. The state space of the multi track machine can be as follows

$[\ \cdot\ ,\ 0/1,\ ,\ ,\ ,\ ,\ ]$ ← we have counted the head on the i^{th} track

scanning for head position/replacing the tape symbols

Suppose the multitape TM takes T steps

How many steps (in O notation) will the simulation take?

about $O(T^2)$