

# Turing Machines

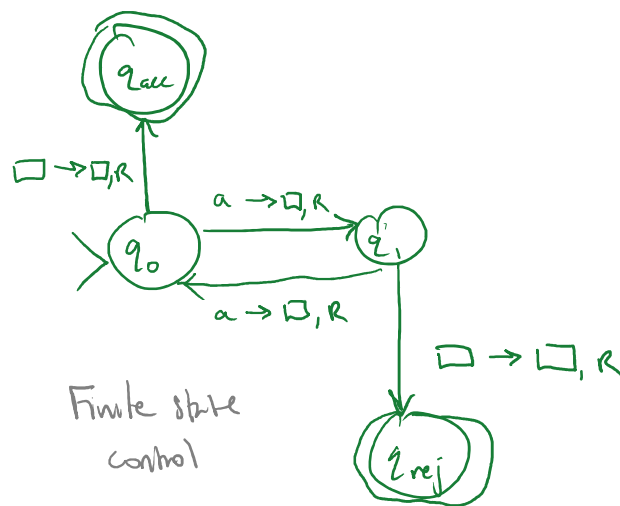
Sunday, November 1, 2020 9:49 PM

## Problem

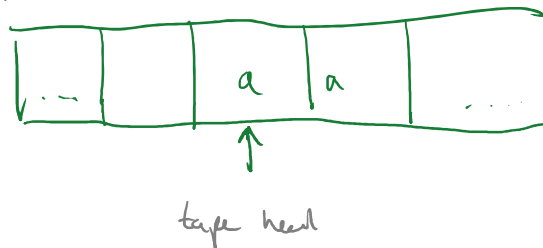
- Finite automata - accept only regular languages
- Need machine w/ finite states to recognize CFL's

## Turing machines

Ex.



infinite tape - each holds state symbol



Each transition: read → write, direction

□ - blank

Defn. Consists of

- finite state control that issues commands
- infinite tape for scratch space

→ tape head - read, write single tape cell

At each step:

→ writes symbol to tape cell

→ changes state

→ moves tape head to left or right

Unlike DFA's - decide when/if accept input  
input - don't stop processing input after  
finishing reading

Language

If  $M$  is a Turing machine w/ alphabet  $\Sigma$ ,  
then its language is the set

$$L(M) = \{ w \in \Sigma^* \mid M \text{ accepts } w \}$$

# Designing Turing Machines

Ex. Let  $\Sigma = \{0, 1\}$   
 Let  $L = \{0^n 1^n \mid n \in \mathbb{N}\}$



CFG:  
 $z \in L$   
 $0w1 \in L$

