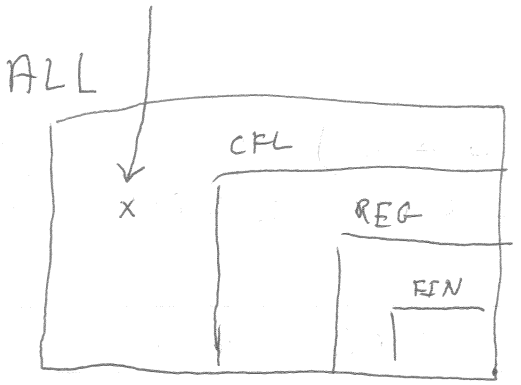
17-1

$a^n b^n c^n$ & CFL



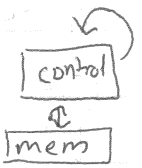
CFLs	CFGs	PDAs
REG	REX	DFAs
Σ_0 & Σ_1	Enumerator	TMs

Turing Machine (made Alan Turing)

DFAs  ← input

PDAs Stack ⟷  ← input

stack: strict interaction pattern (push/pop)

TMs 

memory is initialized to the input

mem: loose pattern (read/write anywhere)

$x\#x$ where $x \in \{0,1\}^*$

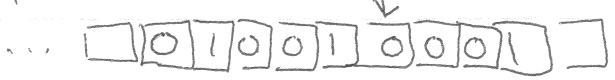
configuration: memory, control, where in the memory you're looking

$u[q_i]v$ memory = uv "when" = just before v

control = q_i

$u = 01001$ $v = 0001$

looking → "the tape" = mem



looking for a 0 on the right

$[]010\#010 \to [\,]10\#010 \to 1[\,]0\#010 \to 10[\,]\#010 \to$

im on right

$10\#[\,]010 \to 10[\,]\#\sqcup 10 \to 1[\,]0\#\sqcup 10 \to []10\#\sqcup 10$

go left all the way

$\to [\,]\_10\#\sqcup 10 \longrightarrow []10\#\sqcup 10 \to [\,]0\#\sqcup 10$

looking for a 1

Turing Machine can:
- move left & right
- change the tape

A TM $t = (Q, \Sigma, \Gamma, q_0, \delta, q_a, q_r)$

Q = finite states

Σ = input alphabet ($\sqcup \notin \Sigma$) $\quad \Sigma = \{0, 1, \#\}$

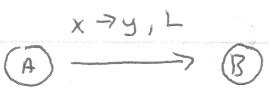
Γ = tape alphabet ($\sqcup \in \Gamma \quad \Sigma \subset \Gamma$) $\quad \Gamma = \{0, 1, \#, \sqcup, \dot{\sqcup}\}$

$q_0 \in Q$ = start state

$q_a \in Q$ = I'm done, Yes $\quad q_r \in Q$ = done, No

δ = transition function

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



$x \quad == \quad x \to x, R$

$x \to y \quad == \quad x \to y, R$

if there is no arrow for a symbol then assume it goes to q_r