23-1/ Σ_0 : $\cap$, $\cup$, 0, 0, $*$

Σ_1 : ''

DFA $\subseteq$ TM REG $\subseteq \Sigma_0$

$(Q, \Sigma, q_0, \delta: Q \times \Sigma \to Q, F \subseteq Q)$

$\longrightarrow (Q', \Sigma, \Gamma, q_0', \delta': Q \times \Gamma \to Q \times \Gamma \times \{L, R\}, q_a, q_r)$

$Q' = Q \cup \{q_a, q_r\}$ $\Gamma = \Sigma \cup \{\sqcup\}$

$q_0' = q_0$

$\delta'(q_i, c) = (\delta(q_i, c), \sqcup, R)$

$\delta'(q_i, \sqcup) = (q_a, \sqcup, R)$ if $q_i \in F$

$(q_r, \sqcup, R)$ o.w.

23-2/ A_{DFA} ∋ w iff w = encode⟨M, x⟩
where M is a DFA
and $x \in L(M)$

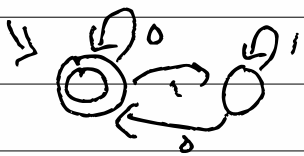
$M = (Q, \Sigma, q_0, \delta, F)$

how many states | which of those | |Q| - bits
2 | $(Q \times \Sigma \to Q)$ | 0 | 10

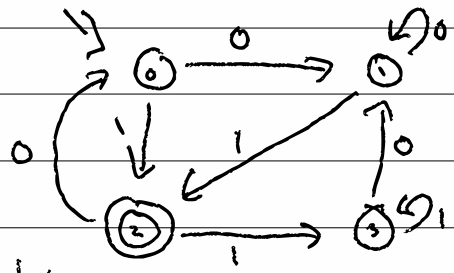
	0	1
0	0	1
1	0	1

0010 0101 10|0 0

00100101100110 ∈ A_{DFA}



23-3



	0	1
0	1	2
1	1	2
2	0	3
3	1	3

00001 = ♀

0 = δ_0

0010 = F

01100110 = 8

00111011

001011101

$\in A_{DFA}$

A_{DFA} is a <u>interpreter</u> for DFA's

$A_{DFA} \in \Sigma_0$

23-4/ tape 0: $\langle M, w \rangle$

tape 1: q_i

tape 2: w

23-5/ A_{NFA}

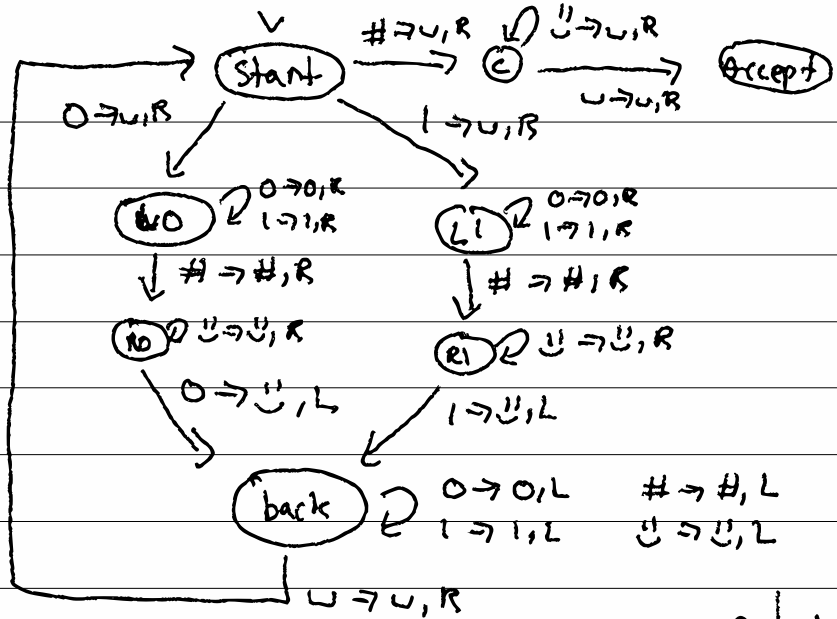
A_{CFG} — what your project

A_{PDA}

A_{TM} ... ?

$\langle M, w \rangle \in A_{TM}$ iff M is a TM and $w \in L(M)$

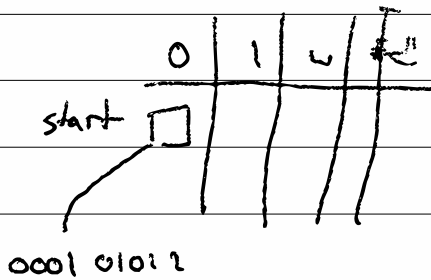
23-6



$Q = 0000000001$ $\quad q_a = 1000$

$\Gamma = 000001$ $\quad q_r = 1001$

$q_0 = 0000$



23-7

example universal turing machine

diagram

23-8

Is $A_{TM} \in \Sigma_0$

or

$\in \Sigma_1$?

$A_{TM} \notin \Sigma_0$