

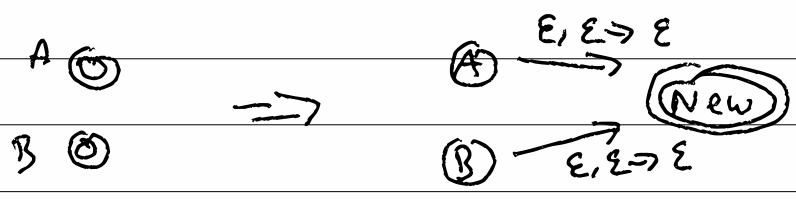
15-1/ $CFG \rightarrow PDA$, $PDA \rightarrow CFG$
 $CFG \leftrightarrow PDA$ CFL

$CFG \Rightarrow CNF \Rightarrow PDA$
 \swarrow
 simplifed CFG

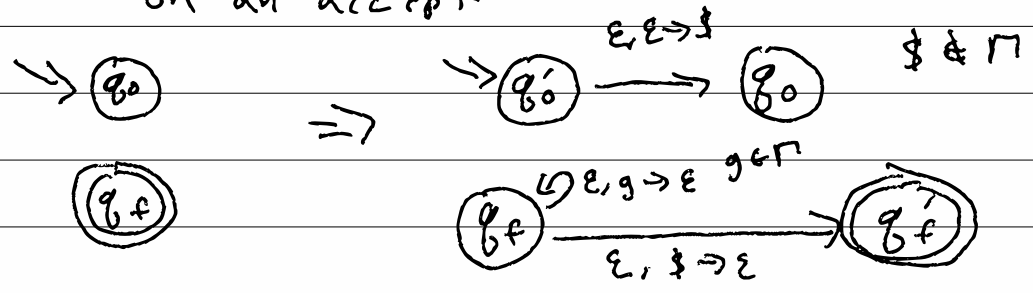
15-2/ Simplified PDA ...

$$F = \{ \epsilon f \}$$

- One accept state



- Guarantee that the stack is empty on an accept



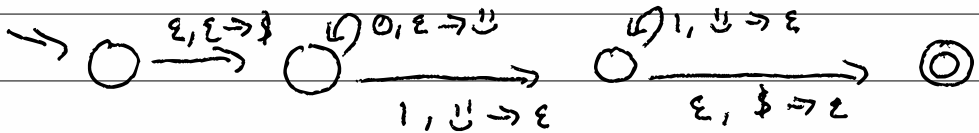
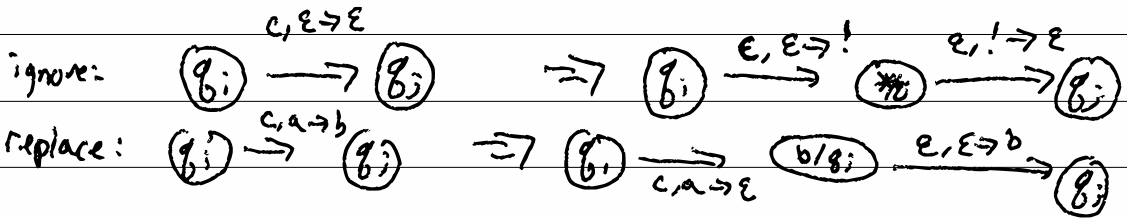
15-3 - We always or pop, never both or none

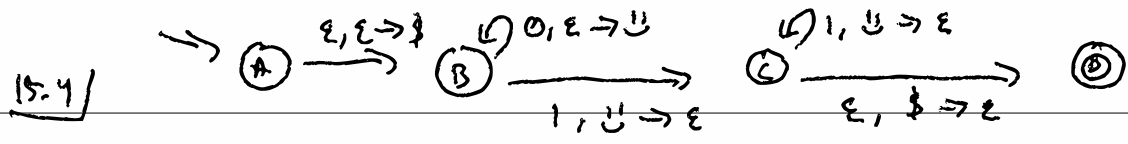
push : $w, \epsilon \rightarrow \Gamma$

pop : $w, \Gamma \rightarrow \epsilon$

X ignore : $w, \epsilon \rightarrow \epsilon$

X replace : $w, \Gamma \rightarrow \Gamma$





in: $(Q, \Sigma, q_0 \in Q, \delta: Q \times M(\Sigma) \times M(\Gamma) \rightarrow P(Q \times M(\Gamma)), \{f\})$
 out: $(V, \Sigma, R, S) \quad V = (Q \times Q) \quad S = (q_0, F)$

$\forall q_i \in Q.$

$\forall q_i, q_j, q_k.$

$(q_i, q_i) \rightarrow \epsilon$

$(q_i, q_k) \rightarrow (q_i, q_j) (q_j, q_k)$

$(q_r, +) \in \delta(q_i, a, \epsilon)$

$(q_s, \epsilon) \in \delta(q_s, b, +)$

$(q_i, q_j) \rightarrow a (q_r, q_s) b$

$$S = AD$$

15-5/ | AA AA

AA $\rightarrow \epsilon$ | AB BA | BA CA DA

AC CA | AD DA

AB \rightarrow AA AB | BB $\rightarrow \epsilon$ CB DB

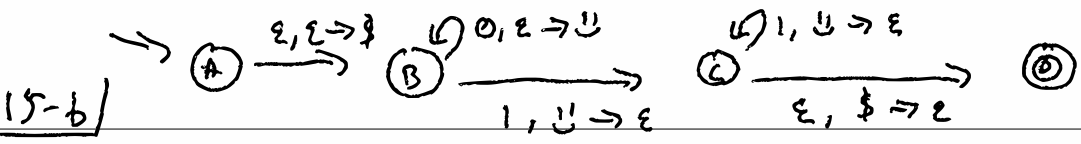
AB BB |

AC CB |

AD DB

AC BC CC $\rightarrow \epsilon$ DC

AD BD CD DD $\rightarrow \epsilon$



$$\delta(A, \epsilon, \epsilon) = \{(B, \$)\} \Rightarrow (A, D) \rightarrow \epsilon \quad (B, C) \epsilon$$

$$\delta(C, \epsilon, \$) = \{(D, \epsilon)\}$$

$$\delta(B, 0, \epsilon) = \{(B, \cup)\} \Rightarrow (B, C) \rightarrow 0 \quad (B, B) 1$$

$$1 \quad 0 \quad (B, C) 1$$

$$\delta(B, 1, \cup) = \{(C, \epsilon)\} \quad \delta(C, 1, \cup) = \{(C, \epsilon)\}$$

$(A, D) \rightarrow \epsilon$	$(B, C) \epsilon$	$S \rightarrow X$
$(B, C) \rightarrow 0$	$(B, B) 1$	$X \rightarrow 0Y1 \quad \quad 0X1$
	$1 \quad 0 \quad (B, C) 1$	$Y \rightarrow \epsilon$
$(B, B) \rightarrow \epsilon$		

15-71 CFGs \leftrightarrow PDAs
CFL

"context-free
languages"