12-1

PDA => CFG

Assume:
$F = \{q_f\}$

input: $(Q, \Sigma, \Gamma, q_0, \delta, F)$

output: (V, Σ, R, S)

$V = Q \times Q$ $\quad \Sigma = \Sigma$ $\quad S = (q_0, q_f)$

$(q_0, q_f) \Rightarrow^* w$ iff $[q_0] w \rightarrow^* [q_f]$

$(q_i, q_j) \Rightarrow^* w$ iff $u [q_i] w v \rightarrow^* u [q_j] v$

Assume on PDA: only pushes xor pops

$a, \varepsilon \to c$	push	
$a, b \to \varepsilon$	pop	
$a, \varepsilon \to \varepsilon$	ignore	
$a, b \to c$	replace	

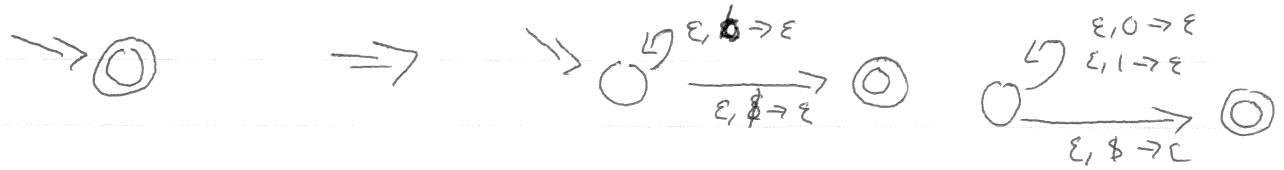
X

Y

$X \xrightarrow{a, \varepsilon \to c} Z/y \xrightarrow{\varepsilon, c \to \varepsilon} y$

$X \xrightarrow{a, b \to \varepsilon} Z/c/y \xrightarrow{\varepsilon, \varepsilon \to c} y$

Assume that the stack is fully emptied on accept $\quad F = \{0, 1, \$\}$



$\forall p \in Q$ $\quad (p, p) \to \varepsilon \in R$ $\quad u [p] \varepsilon v \Rightarrow^* u [p] \varepsilon v$

$\forall p, q, r \in Q$ $\quad (p, r) \to (p, q)(q, r) \in R$ $\quad u [p] x y v \rightarrow^* u [q] y v \rightarrow^* u [r] v$

$(r, t) \in \delta(p, a, \varepsilon)$

$(q, \varepsilon) \in \delta(s, b, t)$

$(p, q) \to a \ (r, s) \ b \in R$

$u [p] a x b v$
$\to u t [r] x b v$
$\to^* u t [s] b v$
$\to u [q] v$