

$$L \subseteq \{a, b\}^*$$

$$L = \{\epsilon\} \cup \{a\} \cdot L \cdot \{b\}$$

$$L = \{a^n b^n \mid n \geq 0\}$$

M



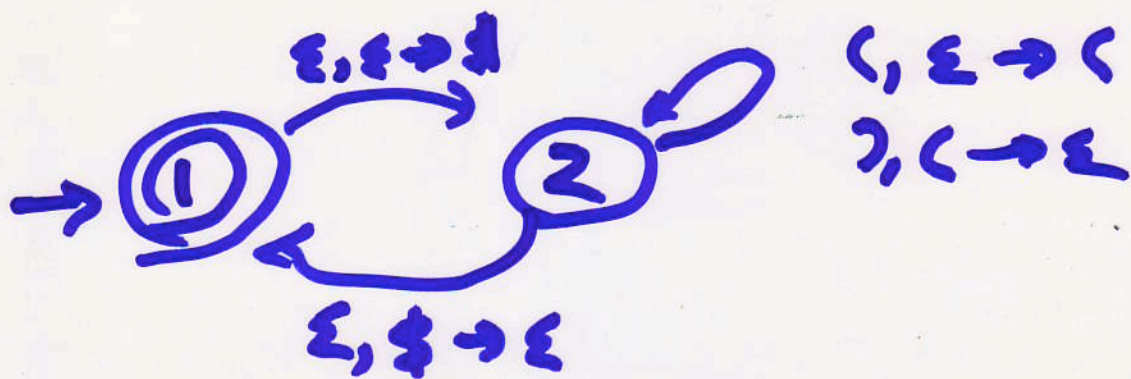
(,  $\epsilon \rightarrow \epsilon$   
) ,  $\epsilon \rightarrow \epsilon$

$$L_{22} = \{ x \mid [2, \epsilon, x] \vdash^* [2, \epsilon, \epsilon] \}$$

$$L_{22} = \{ \epsilon \} \cup L_{22} \cdot L_{22} \cup (\cdot L_{22} \cdot)$$

$$S \rightarrow \epsilon \mid SS \mid (S)$$

$$L(M) \stackrel{?}{=} \emptyset$$



$$L_{22} = \epsilon \cup L_{22} \cdot L_{22} \cup (L_{22})$$

$$L_{11} = \{\epsilon\} \cup L_{11} \cdot L_{11} \cup \epsilon L_{22} \epsilon$$

$$A_{22} \rightarrow \epsilon \mid A_{22} A_{22} \mid (A_{22})$$

$$A_{11} \rightarrow \epsilon \mid A_{11} A_{11} \mid A_{22}$$

$$L_{12} = \phi = L_{21}$$

# PDA $\rightarrow$ CFG

I. WLOG, PDA:

a) has only 1 final state

b) accepts only when stack empty

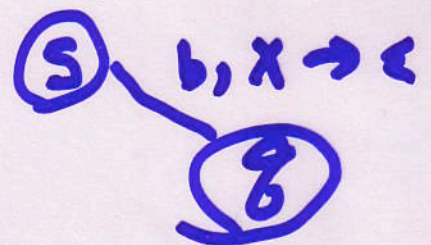
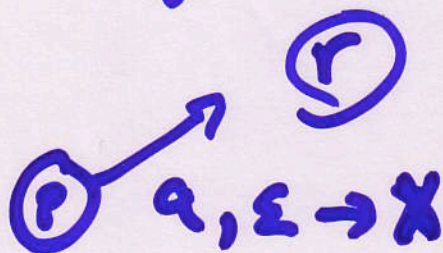
c) all transitions either push or pop, never both/neither.

II,  $\forall p, q \in Q$

non-termin.  $A_p q$

$A_p p \rightarrow \epsilon \quad \forall p \in Q$

$A_p q \rightarrow A_p r \quad A_p r q \quad \forall p, q, r \in Q$



$A_p q \rightarrow a A_r s b$

start =  $A_{start}$ , final