

Compiler Design

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Exercise

- **Example:** Devise predictive parsers and show the parsing tables (You may left-factor and/or eliminate left-recursion from your grammars first.)

$S \rightarrow 0S1 \mid 01$

$S \rightarrow \emptyset A$
 $A \rightarrow S1 \mid 1$

$S \rightarrow \emptyset A$
 $A \rightarrow \emptyset A1 \mid 1$

nonterminal symbol	Enter symbol		
	0	1	\$
S	$S \rightarrow 0A$		
A	$A \rightarrow 0A1$	$A \rightarrow 1$	

Exercise

- **Example:** Devise predictive parsers and show the parsing tables (You may left-factor and/or eliminate left-recursion from your grammars first.)

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

$S \rightarrow A$
 $A \rightarrow (S)SA \mid \epsilon$

nonterminal symbol	Enter symbol		
	()	\$
S	$S \rightarrow A$	$S \rightarrow A$	$S \rightarrow A$
A	$A \rightarrow (S)SA$ $A \rightarrow \epsilon$	$A \rightarrow \epsilon$	$A \rightarrow \epsilon$

Exercise

- **Example:**

$S \rightarrow SS+ \mid SS^* \mid a$

- Left factoring

$$\begin{aligned} S &\rightarrow S S A \mid a \\ A &\rightarrow + \mid * \end{aligned}$$

- Eliminate left recursion

$$\begin{aligned} S &\rightarrow a B \\ B &\rightarrow S A B \mid \epsilon \\ A &\rightarrow + \mid * \end{aligned}$$

$$\begin{aligned} S &\rightarrow a B \\ B &\rightarrow a B A B \mid \epsilon \\ A &\rightarrow + \mid * \end{aligned}$$

Exercise

- **Example:** Give context-free grammars that generate the following languages

$\{ w \in \{0, 1\}^* \mid w \text{ contains at least three 1s} \}$

- $S \rightarrow A1A1A1A$
- $A \rightarrow 0A \mid 1A \mid \varepsilon$

$\{ w \in \{0, 1\}^* \mid w = w^{\mathcal{R}} \text{ and } |w| \text{ is even} \}$

- $S \rightarrow 0S0 \mid 1S1 \mid \varepsilon$

Exercise

- **Example:** Give context-free grammars that generate the following languages

$$\{ a^i b^j c^k \mid i, j, k \geq 0, \text{ and } i = j \text{ or } i = k \}$$

- $S \rightarrow XY \mid W$
- $X \rightarrow aXb \mid \varepsilon$
- $Y \rightarrow cY \mid \varepsilon$
- $W \rightarrow aWc \mid Z$
- $Z \rightarrow bZ \mid \varepsilon$

Exercise

- **Example:** Give context-free grammars that generate the following languages

$$\{ a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i + j = k \}$$

- $S \rightarrow aSc \mid A$
- $A \rightarrow bAc \mid \varepsilon$

Exercise

- **Example:**
- $S \rightarrow S+S \mid SS \mid (S) \mid S^* \mid a$
- **Left factoring**
 - $S \rightarrow SA \mid (S) \mid a$
 - $A \rightarrow +S \mid S \mid *$
- **Eliminate left-recursion**
 - $S \rightarrow (S)S' \mid aS'$
 - $S' \rightarrow AS' \mid \varepsilon$
 - $A \rightarrow +S \mid S \mid *$
- **Eliminate left-recursion**
 - $S \rightarrow (S)S' \mid aS'$
 - $A \rightarrow +S \mid (S)S' \mid aS' \mid *$
 - $S' \rightarrow +SS' \mid (S)S'S' \mid aS'S' \mid *S' \mid \varepsilon$