第 7 周编译原理课堂笔记

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1 自顶向下的语法分析

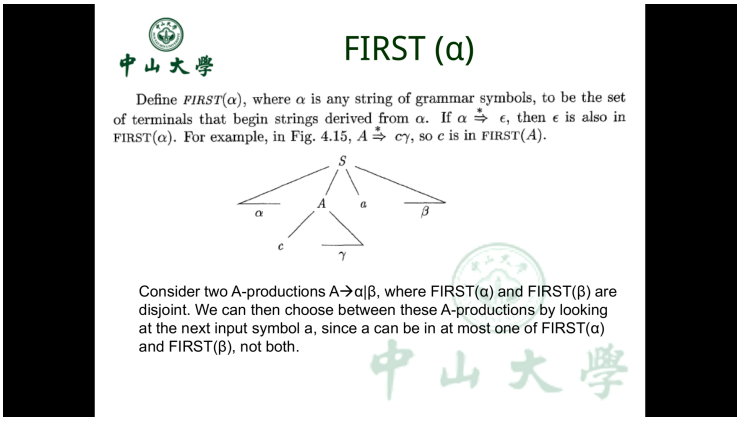
1.1 first 函数

first (α) 被定义为可从 α 推导的到的串的首符号的集合

1.2 follow 函数

对于非终结符号 A，follow (A) 被定义为可能在某些句型中紧跟在 A 右边的终结符号的集合

1. follow (F)={*,+,$,$\varepsilon$}
2. follow (T')={+,$,$\varepsilon$}
3. follow (T)={+,$,$\varepsilon$}



Computing FIRST(X)

To compute FIRST(X) for all grammar symbols X, apply the following rules until no more terminals or ϵ can be added to any FIRST set.

1. If X is a terminal, then FIRST(X) = $\{X\}$.
2. If X is a nonterminal and $X \to Y_1 Y_2 \cdots Y_k$ is a production for some $k \geq 1$, then place a in FIRST(X) if for some i, a is in FIRST(Y_i), and ϵ is in all of FIRST(Y_1), ... , FIRST(Y_{i-1}); that is, $Y_1 \cdots Y_{i-1} \stackrel{*}{\Rightarrow} \epsilon$. If ϵ is in FIRST(Y_j) for all $j = 1, 2, \ldots, k$, then add ϵ to FIRST(X). For example, everything in FIRST(Y_1) is surely in FIRST(X). If Y_1 does not derive ϵ, then we add nothing more to FIRST(X), but if $Y_1 \stackrel{*}{\Rightarrow} \epsilon$, then we add FIRST($Y_2$), and so on.
3. If $X \to \epsilon$ is a production, then add ϵ to FIRST(X).

Example

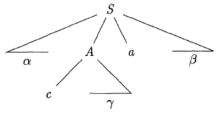
$$
\begin{array}{lcl}
E & \to & T\ E' \\
E' & \to & +\ T\ E' \mid \epsilon \\
T & \to & F\ T' \\
T' & \to & *\ F\ T' \mid \epsilon \\
F & \to & (\ E\ ) \mid \mathbf{id}
\end{array}
$$

Compute the FIRST(X) for each nonterminal X.

FOLLOW(A)

S→aA|ε, if the next input symbol is not 'a', then will will choose S→ ε; otherwise both productions can be chosen.

Define *FOLLOW*(A), for nonterminal A, to be the set of terminals a that can appear immediately to the right of A in some sentential form; that is, the set of terminals a such that there exists a derivation of the form $S \stackrel{*}{\Rightarrow} \alpha A a \beta$, for some α and β



if A can be the rightmost symbol in some sentential form, then $ is in FOLLOW(A).

Computing FOLLOW(A)

To compute FOLLOW(A) for all nonterminals A, apply the following rules until nothing can be added to any FOLLOW set.

1. Place \$ in FOLLOW(S), where S is the start symbol, and \$ is the input right endmarker.
2. If there is a production $A \to \alpha B \beta$, then everything in FIRST(β) except ϵ is in FOLLOW(B).
3. If there is a production $A \to \alpha B$, or a production $A \to \alpha B \beta$, where FIRST(β) contains ϵ, then everything in FOLLOW(A) is in FOLLOW(B).

Practice

$$
\begin{array}{lcl}
E & \to & T\ E' \\
E' & \to & +\ T\ E' \mid \epsilon \\
T & \to & F\ T' \\
T' & \to & *\ F\ T' \mid \epsilon \\
F & \to & (\ E\ ) \mid \mathbf{id}
\end{array}
$$

Compute the FOLLOW(X) for each nonterminal X.

4. follow (E')={$,$\varepsilon$}

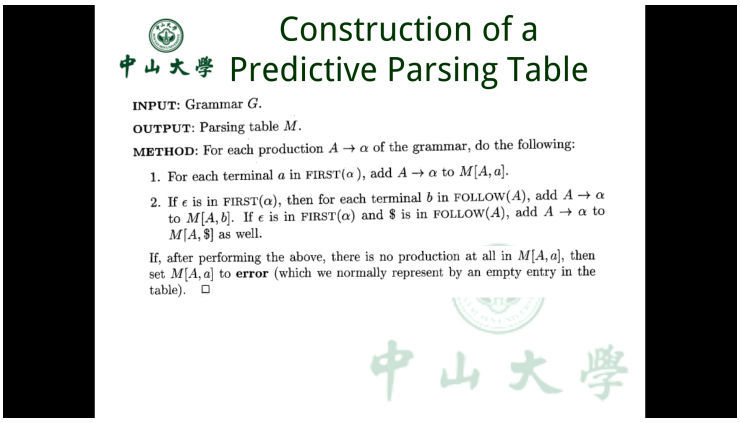
5. follow (E)={$,$\varepsilon$}

1.3 LL (1) 文法

解决做产生式选择的问题

1. 预测分析器的转换图
   要构造一个文法的转换图，首先要消除左递归，然后对文法提前左公因子。
   [redacted]

2. 构造预测分析表
   严重不理解第二步



3. 递归预测分析

4. 非递归的预测分析（利用到预测分析表和栈）

2 自底向上的语法分析

最左规约

2.1 移进-规约

重点在于：什么时候移进，怎么选择规约

Predictive Parsing Table

NON-TERMINAL	INPUT SYMBOL					
	id	+	*	(	)	$
E	$E \to TE'$			$E \to TE'$		
E'		$E' \to +TE'$			$E' \to \epsilon$	$E' \to \epsilon$
T	$T \to FT'$			$T \to FT'$		
T'		$T' \to \epsilon$	$T' \to *FT'$		$T' \to \epsilon$	$T' \to \epsilon$
F	$F \to \mathbf{id}$			$F \to (E)$		