Lecture #9

Syntax Analysis - III

Parsing Table Generation

- Given the production $A \rightarrow \alpha$, and a token t
- $M[A, t] = \alpha$ occurs in two cases:

1. If $\alpha \rightarrow^* t\beta$
   - α can derive a 't' in the first position in 0 or more moves
   - We say that t ϵ First(α)
     - 't' is one of the terminals that α can produce in the first position
2. If $A \rightarrow \alpha$ and $\alpha \rightarrow^* \varepsilon$ and $S \rightarrow^* \beta A t \delta$
   - Stack has A, input is t, and A cannot derive t
   - In this case only option is to get rid of A (by deriving ε)
   - Can work only if 't' follows A in at least one derivation
   - We say t ϵ Follow(A)

First Sets

- Definition
  - First(X) = { t | t is a terminal and $X \rightarrow^* t\alpha$} or {ε | $X \rightarrow^* \varepsilon$}

- To build FIRST(X):
  1. If $X \in$ terminal, then FIRST(X) is {X}
  2. If $((X \rightarrow \varepsilon)$ or $((X \rightarrow Y_1 \ldots Y_k)$ and $(\varepsilon \in [\forall i: 1 < i \leq k \text{ First } (Y_i)]))$
     then add ε to FIRST(X)
  3. If $((X \rightarrow Y_1 Y_2 \ldots Y_k\, \alpha)$ and $(\varepsilon \in [\forall i: 1 < i \leq k \text{ First } (Y_i)]))$
     then add FIRST(α) to FIRST(X)

- Find the first sets in the grammar:

$E \rightarrow T\ X$ $\quad$ $X \rightarrow +\ E \mid \varepsilon$

$T \rightarrow (\ E\ ) \mid \text{int}\ Y$ $\quad$ $Y \rightarrow *\ T \mid \varepsilon$

Next Lecture

Top-Down Predictive Parsing Continued...