

FIRST SET

Lecture 10

15CSE311 Compiler Design

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FIRST Sets

Defn: For any string of grammar symbols α ,
 $FIRST(\alpha) = \{ a \mid a \text{ is a terminal and } \alpha \Rightarrow^* a\beta \}$.
if $\alpha \Rightarrow^* \varepsilon$ then ε is also in $FIRST(\alpha)$.

Example:

$$E \rightarrow T E'$$

$$E' \rightarrow + T E' \mid \varepsilon$$

$$T \rightarrow F T'$$

$$T' \rightarrow * F T' \mid \varepsilon$$

$$F \rightarrow (E) \mid \mathbf{id}$$

$$FIRST(E) = FIRST(T) = FIRST(F) = \{ (, \mathbf{id} \}$$

$$FIRST(E') = \{ +, \varepsilon \}$$

$$FIRST(T') = \{ *, \varepsilon \}$$

Computing FIRST sets: cont'd

For each nonterminal A in the grammar, initialize $\text{FIRST}(A) = \emptyset$.

```
repeat {  
  for each nonterminal  $A$  in the grammar {  
    compute  $\text{FIRST}(A)$ ; /* as described previously */  
  }  
} until there is no change to any FIRST set.
```

Example (FIRST Sets)

$X \rightarrow YZ \mid a$

$Y \rightarrow b \mid \varepsilon$

$Z \rightarrow c \mid \varepsilon$

$X \rightarrow a$, so add **a** to FIRST(X).

$X \rightarrow YZ$, **b** \in FIRST(Y), so add **b** to FIRST(X).

$Y \rightarrow \varepsilon$, i.e. $\varepsilon \in$ FIRST(Y), so add non- ε symbols from FIRST(Z) to FIRST(X).

► add c to FIRST(X).

$\varepsilon \in$ FIRST(Y) and $\varepsilon \in$ FIRST(Z), so add ε to FIRST(X).

Final: FIRST(X) = { **a**, **b**, **c**, ε }.