

Grammar with left recursion removed:

$EX \rightarrow E$ $E \rightarrow TE'$ $E' \rightarrow +E -E \epsilon$	$T \rightarrow FT'$ $T' \rightarrow *T /T \epsilon$	$F \rightarrow P -P$ $P \rightarrow id in (E)$
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$FIRST(EX) = FIRST(E) = FIRST(T) = FIRST(F) = \{-, ID, IN (\}$

$FIRST(P) = \{id, in, (\}$

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

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

Find First of the right Hand sides:

1. $EX \rightarrow E$ $FIRST(E) = \{-, in, id (\}$
2. $E \rightarrow TE'$ $FIRST(TE') = \{-, in, id (\}$
3. $E' \rightarrow +E$ $FIRST(+E) = \{+\}$
4. $E' \rightarrow -E$ $FIRST(-E) = \{-\}$
5. $E' \rightarrow \epsilon$ $FIRST(\epsilon) = \{\epsilon\}$
6. $T \rightarrow FT'$ $FIRST(FT') = \{-, in, id (\}$
7. $T' \rightarrow *T$ $FIRST(*T) = \{*\}$
8. $T' \rightarrow /T$ $FIRST(/T) = \{/ \}$
9. $T' \rightarrow \epsilon$ $FIRST(\epsilon) = \{\epsilon\}$
10. $F \rightarrow P$ $FIRST(P) = \{-, in, id (\}$
11. $F \rightarrow -P$ $FIRST(-P) = \{-\}$
12. $P \rightarrow id$ $FIRST(ID) = \{id\}$
13. $P \rightarrow b$ $FIRST(ID) = \{in\}$
14. $P \rightarrow (E)$ $FIRST((E)) = \{ \}$

$FOLLOW(EX) = \{\epsilon\}$

$FOLLOW(E) = FOLLOW(E') = \{), \epsilon\}$

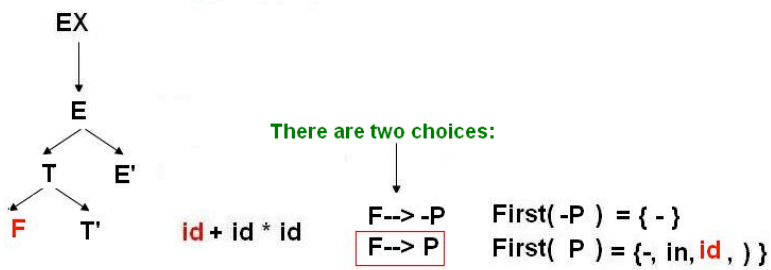
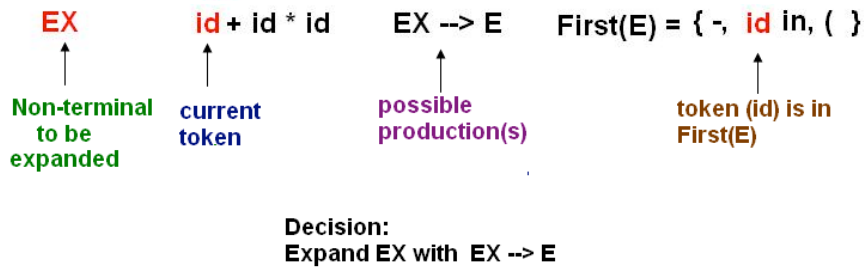
$FOLLOW(T) = FOLLOW(T') = \{+, -,), \epsilon\}$

$FOLLOW(F) = FOLLOW(P) = \{*, /, +, =,), \epsilon\}$

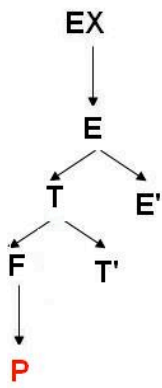
Begin the parse of

id + id * id

Start Symbol is EX



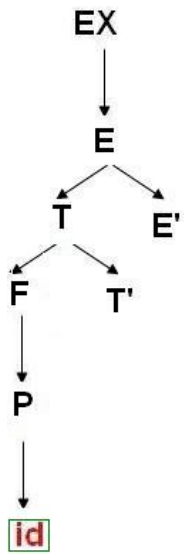
Note : First(P) and First (-P) do not intersect



Three Choices

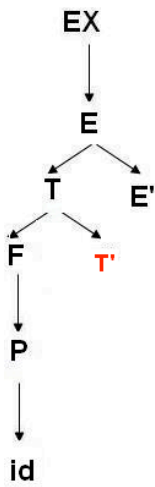
$id + id * id$

$P \rightarrow id$	$First(id) = \{id\}$
$P \rightarrow in$	$First(in) = \{in\}$
$P \rightarrow (E)$	$First((E)) = \{\}$



$id + id * id$

Match id
get next token (+)



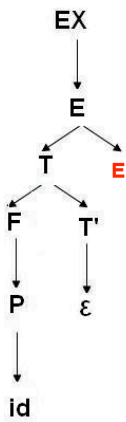
+ id * id

$T' \rightarrow *T$ $\text{First}(*T) = \{*\}$
 $T' \rightarrow /T$ $\text{First}(/T) = \{/ \}$
 $T' \rightarrow \epsilon$ $\text{First}(\epsilon) = \{\epsilon\}$

+ is not in any First set but one first set has ϵ

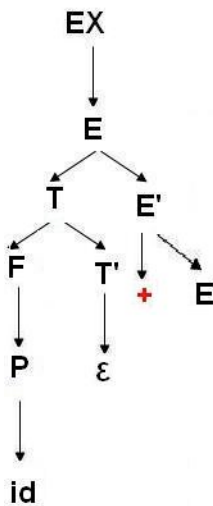
Check follow set of T'
 $\text{Follow}(T') = \{+, -,) \epsilon\}$

Choose $T' \rightarrow \epsilon$



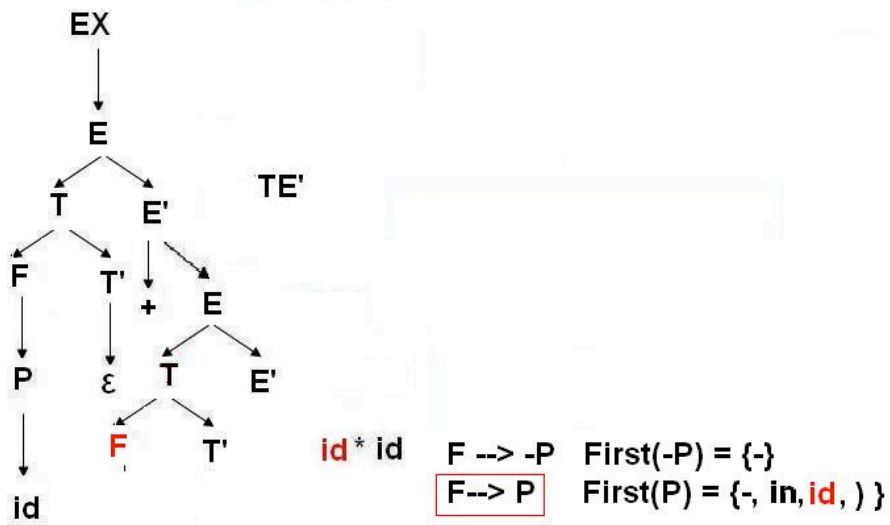
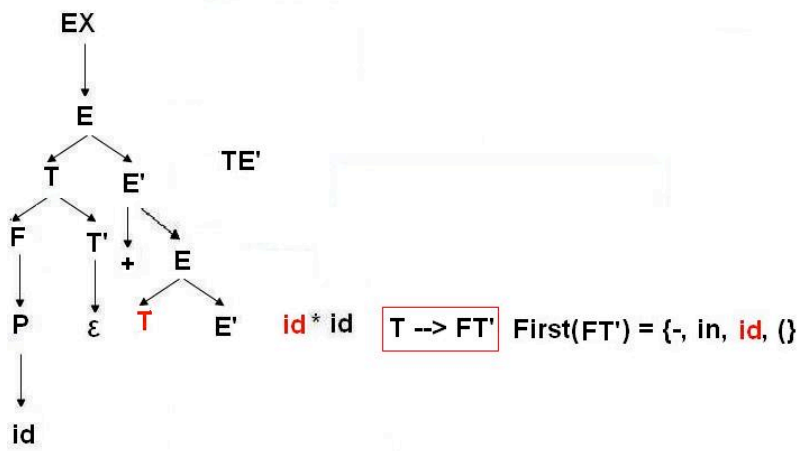
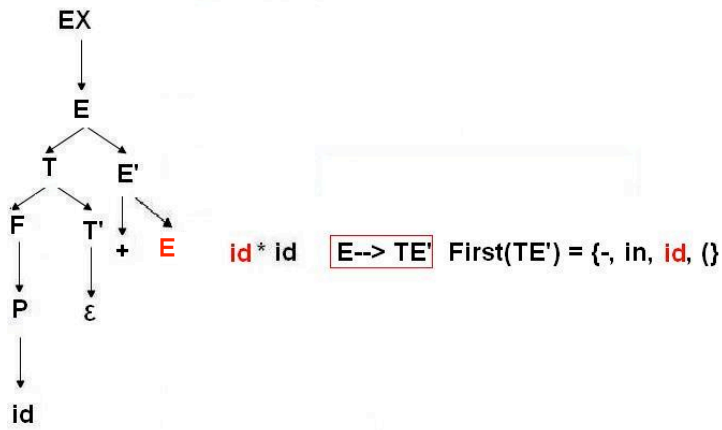
+ id * id

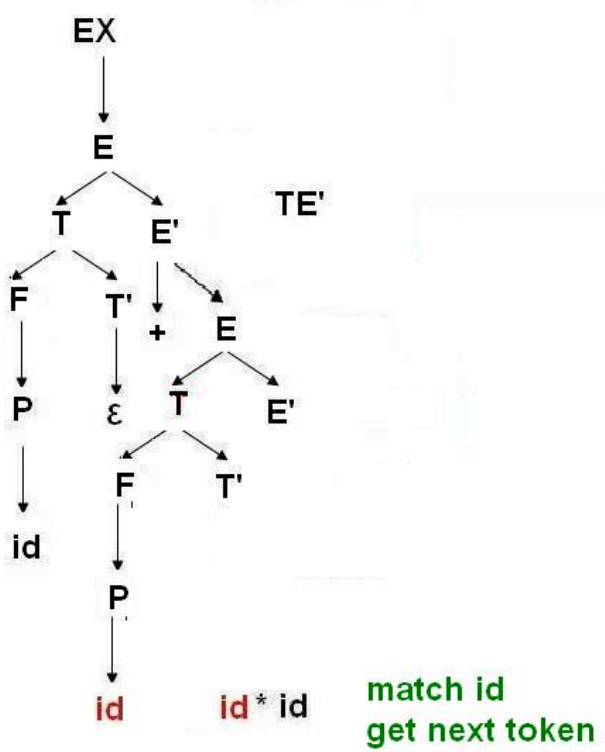
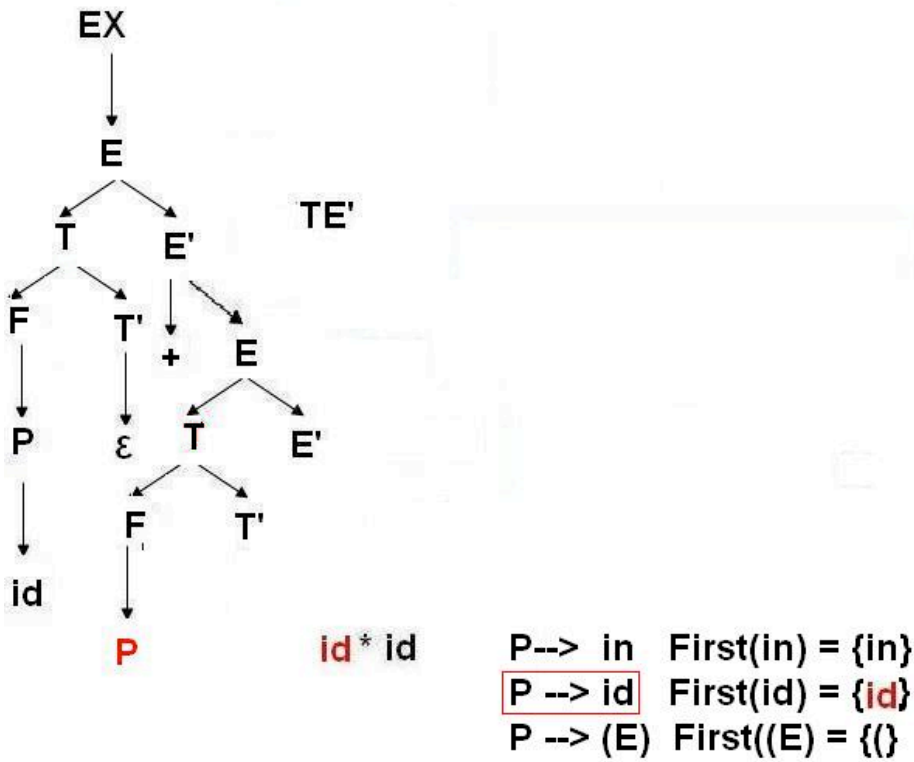
$E' \rightarrow +E$ $\text{First}(+E) = \{+\}$
 $E' \rightarrow -E$ $\text{First}(-E) = \{-\}$
 $E' \rightarrow \epsilon$ $\text{First}(\epsilon) = \{\epsilon\}$

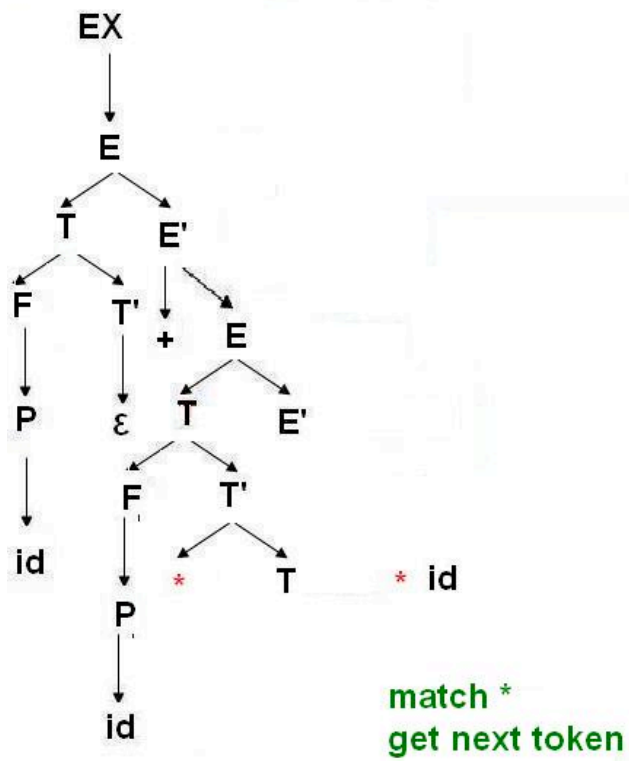
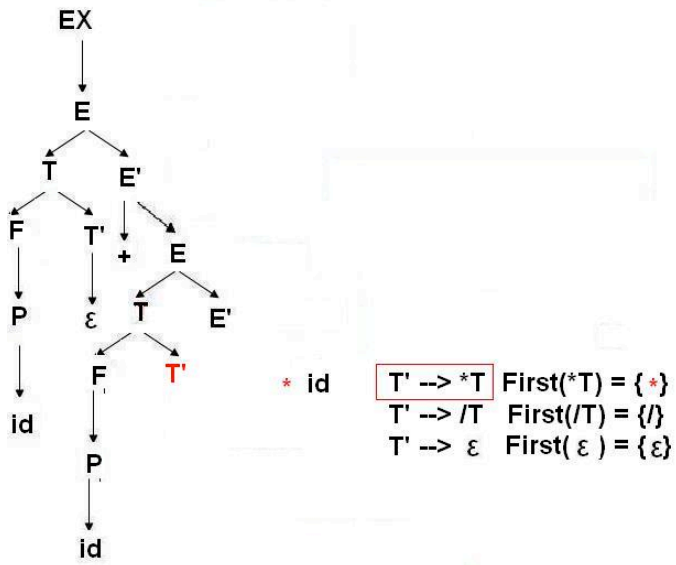


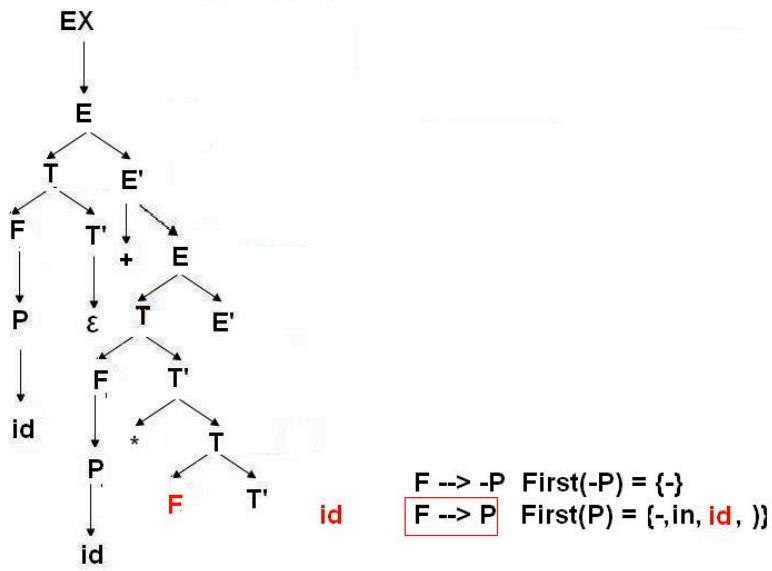
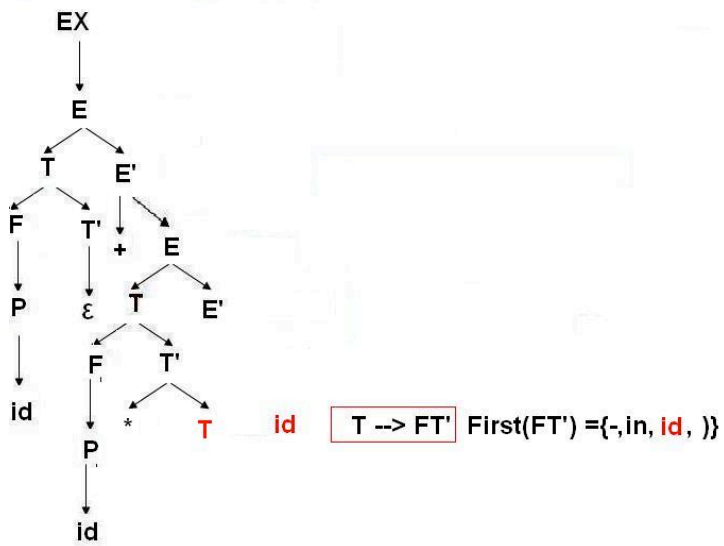
+ id * id

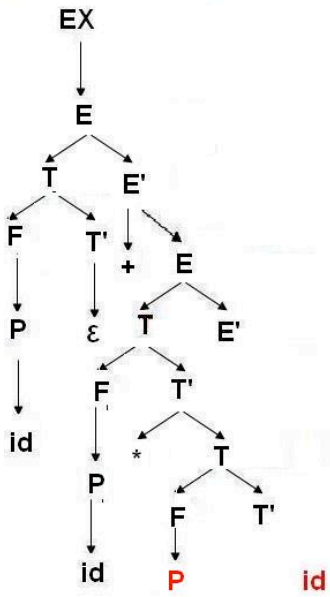
Matched +
get next token



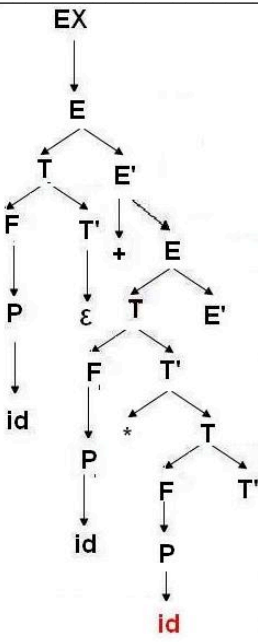




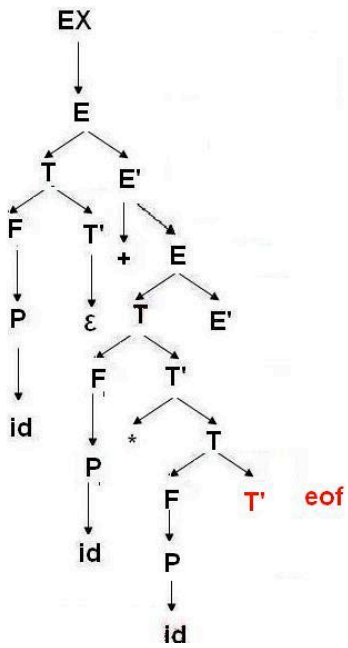




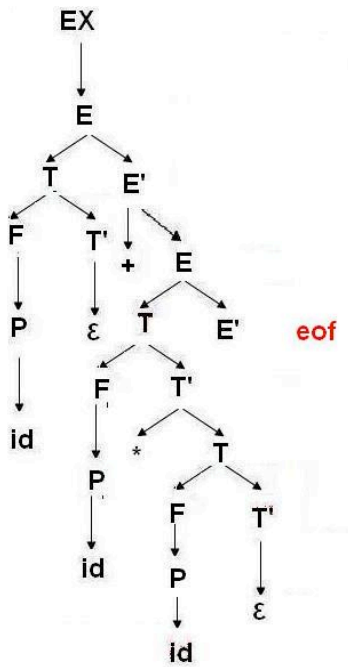
$P \rightarrow in \quad \text{First}(in) = \{ in \}$
 $P \rightarrow id \quad \text{First}(id) = \{ id \}$
 $p \rightarrow (E) \quad \text{First}((E)) = \{ (\}$



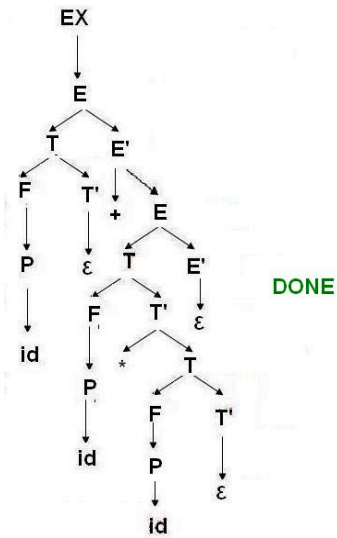
match id
 next token eof



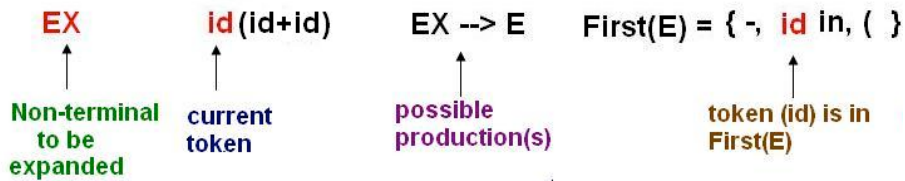
$T' \rightarrow *T$ $\text{First}(*T) = \{ * \}$
 $T' \rightarrow /T$ $\text{First}(/T) = \{ / \}$
 $T' \rightarrow \varepsilon$ $\text{First}(\varepsilon) = \{ \varepsilon \}$



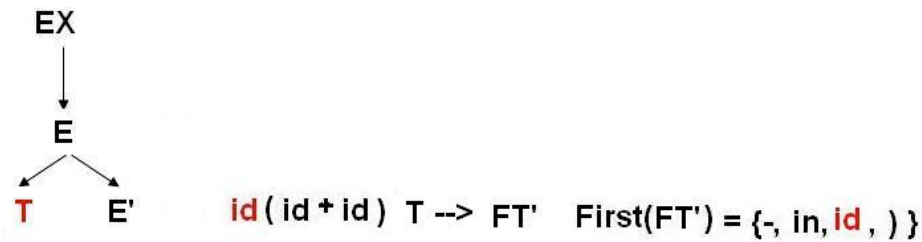
$E' \rightarrow +E$ $\text{First}(+E) = \{ + \}$
 $E' \rightarrow -E$ $\text{First}(-E) = \{ - \}$
 $E' \rightarrow \varepsilon$ $\text{First}(\varepsilon) = \{ \varepsilon \}$

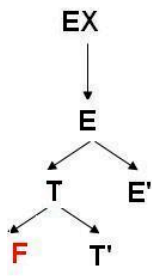


Parse id(id+id)



Decision:
Expand EX with $EX \rightarrow E$



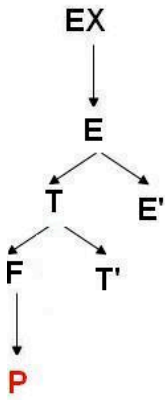


There are two choices:

$id(id + id)$

$F \rightarrow -P$ $First(-P) = \{-\}$
 $F \rightarrow P$ $First(P) = \{-, in, id, \}$

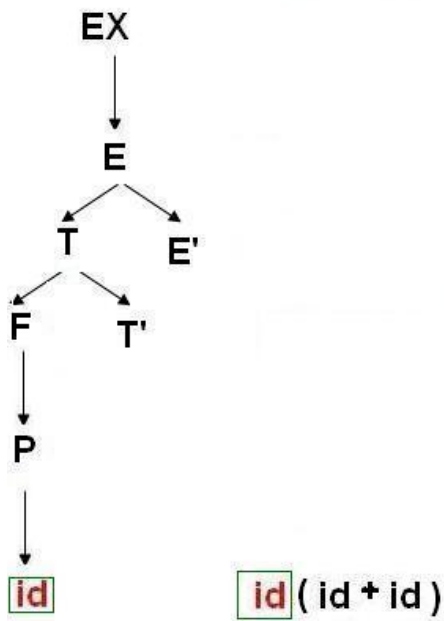
Note : First(P) and First (-P) do not intersect



Three Choices

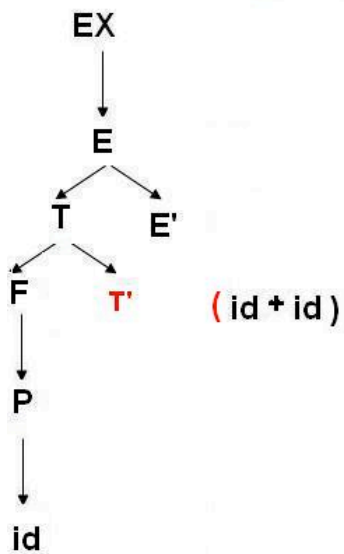
$id(id + id)$

$P \rightarrow id$ $First(id) = \{id\}$
 $P \rightarrow in$ $First(in) = \{in\}$
 $P \rightarrow (E)$ $First((E)) = \{\}$



Match id

get next token (



$T' \rightarrow *T$ First($*T$) = { $*$ }

$T' \rightarrow /T$ First($/T$) = { $/$ }

$T' \rightarrow \epsilon$ First(ϵ) = { ϵ }

(is not in any First set but one first set has ϵ

Check follow set of T'
 Follow(T') = { $+$, $-$, $)$ ϵ }

(is not in the Follow set

ERROR!