

FIRST SETS

$$E \rightarrow TE'$$

$$E' \rightarrow +TE' \mid \epsilon$$

$$T \rightarrow FT'$$

$$T' \rightarrow *FT' \mid \epsilon$$

$$F \rightarrow (E) \mid id$$

$$\text{FIRST}(E) \leftarrow \text{FIRST}(T)$$

$T \xrightarrow{*} \epsilon ?$ NO

$$\text{FIRST}(E') \leftarrow \begin{matrix} \{+\} \\ \{\epsilon\} \end{matrix}$$

$$\text{FIRST}(T) \leftarrow \text{FIRST}(F)$$

$F \xrightarrow{*} \epsilon ?$ NO

$$\text{FIRST}(T') \leftarrow \begin{matrix} \{*\} \\ \{\epsilon\} \end{matrix}$$

$$\text{FIRST}(F) \leftarrow \begin{matrix} \{(\} \\ \{id\} \end{matrix}$$

$$\text{FIRST}(id) = \{id\}$$

	FIRST
E	{(, id}
E'	{+, \epsilon}
T	{(, id}
T'	{*, \epsilon}
F	{(, id}
id	{id}

FOLLOW SETS

$E \rightarrow TE'$
 $E' \rightarrow +TE' \mid \epsilon$
 $T \rightarrow FT'$
 $T' \rightarrow *FT' \mid \epsilon$
 $F \rightarrow (E) \mid \rho d$

	FOLLOW
E	{), #}
E'	{), #}
T	{+,), #}
T'	{+,), #}
F	{+, *,), #}

$FOLLOW(E) = \{ \# \}$

$\underbrace{E}_{A} \rightarrow \underbrace{T}_{X} \underbrace{E'}_{B} \mid \epsilon \quad \left. \vphantom{\begin{matrix} E \\ T \\ E' \end{matrix}} \right\} FOLLOW(E') = FOLLOW(E)$

$\underbrace{E'}_{A} \rightarrow \underbrace{+}_{X} \underbrace{T}_{B} \underbrace{E'}_{B} \mid \epsilon \quad \wedge \quad E' \xrightarrow{*} \epsilon \quad \left. \vphantom{\begin{matrix} E' \\ T \\ E' \end{matrix}} \right\} FOLLOW(T) = FOLLOW(E')$
 $\underbrace{E'}_{A} \rightarrow \underbrace{+}_{X} \underbrace{E'}_{B} \quad \left. \vphantom{\begin{matrix} E' \\ T \\ E' \end{matrix}} \right\} FOLLOW(T) = FIRST(E')$

$\left. \vphantom{\begin{matrix} FOLLOW(T) = \\ FOLLOW(E') \cup \\ FIRST(E') \end{matrix}} \right\} FOLLOW(T) = FOLLOW(E') \cup FIRST(E')$

$\underbrace{T}_{A} \rightarrow \underbrace{F}_{X} \underbrace{T'}_{B} \quad \left. \vphantom{\begin{matrix} T \\ T' \end{matrix}} \right\} FOLLOW(T') = FOLLOW(T)$

$\underbrace{T'}_{A} \rightarrow \underbrace{*}_{X} \underbrace{F}_{B} \underbrace{T'}_{B} \mid \epsilon \quad \wedge \quad T' \xrightarrow{*} \epsilon \quad \left. \vphantom{\begin{matrix} T' \\ F \\ T' \end{matrix}} \right\} FOLLOW(F) = FOLLOW(T')$
 $\underbrace{T'}_{A} \rightarrow \underbrace{*}_{X} \underbrace{T'}_{B} \quad \left. \vphantom{\begin{matrix} T' \\ F \\ T' \end{matrix}} \right\} FOLLOW(F) = FIRST(T')$

$\left. \vphantom{\begin{matrix} FOLLOW(F) = \\ FOLLOW(T') \cup \\ FIRST(T') \end{matrix}} \right\} FOLLOW(F) = FOLLOW(T') \cup FIRST(T')$

$\underbrace{F}_{A} \rightarrow \underbrace{(}_{X} \underbrace{E}_{B} \underbrace{)}_{B} \quad \left. \vphantom{\begin{matrix} F \\ E \end{matrix}} \right\} FOLLOW(E) = FIRST()$

Predictive Parsing Table

Nonterminal	Input Symbol					
	id	+	*	()	⊥
E	$E \rightarrow TE'$			$E \rightarrow TE'$		
E'		$E' \rightarrow +TE'$			$E' \rightarrow \epsilon$	$E' \rightarrow \epsilon$
T	$T \rightarrow FT'$			$T \rightarrow FT'$		
T'		$T' \rightarrow \epsilon$	$T' \rightarrow *FT'$		$T' \rightarrow \epsilon$	$T' \rightarrow \epsilon$
F	$F \rightarrow id$			$F \rightarrow (E)$		

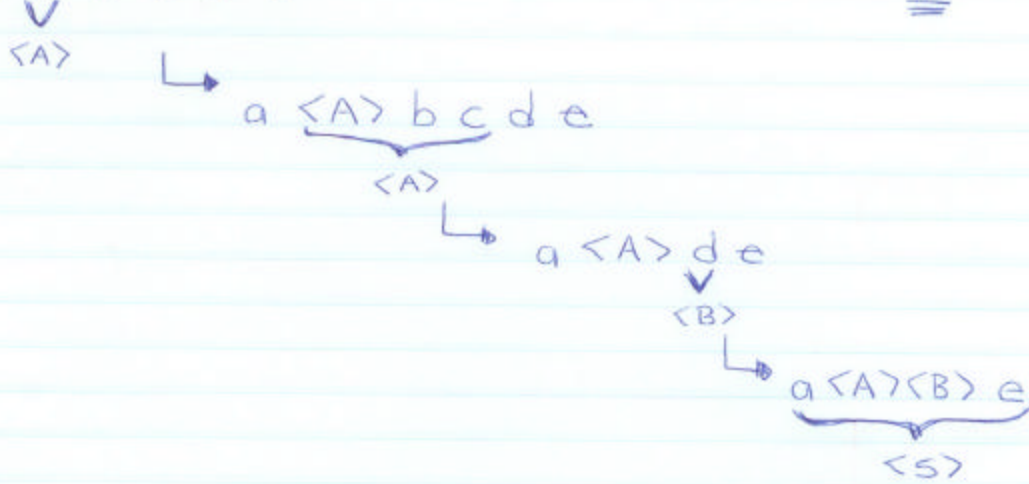
Sequence of Moves

Stack	Input	Output
⊥ E	id + id * id ⊥	
⊥ E' T	id + id * id ⊥	$E \rightarrow TE'$
⊥ E' T' F	id + id * id ⊥	$T \rightarrow FT'$
⊥ E' T' id	id + id * id ⊥	$F \rightarrow id$
⊥ E' T'	+ id * id ⊥	
⊥ E'	+ id * id ⊥	$T' \rightarrow \epsilon$
⊥ E' T +	+ id * id ⊥	$E' \rightarrow +TE'$
⊥ E' T	id * id ⊥	
⊥ E' T' F	id * id ⊥	$T \rightarrow FT'$
⊥ E' T' id	id * id ⊥	$F \rightarrow id$
⊥ E' T'	* id ⊥	
⊥ E' T' F *	* id ⊥	$T' \rightarrow *FT'$
⊥ E' T' F	id ⊥	
⊥ E' T' id	id ⊥	$F \rightarrow id$
⊥ E' T'	⊥	

handles

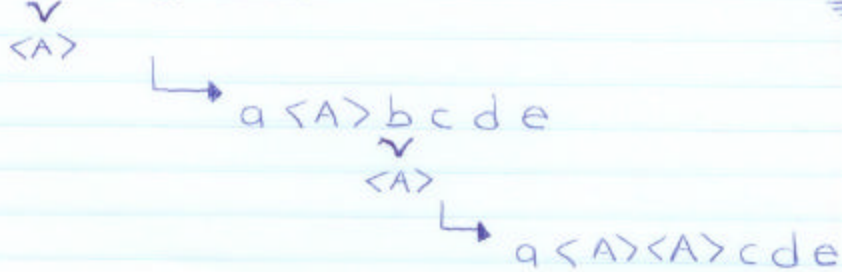
a b b c d e

OK



a b b c d e

NO



Reduction Table

Right-sentential form	Handle	Reducing Production
$id_1 + id_2 * id_3$	id_1	$E \rightarrow id$
$E + id_2 * id_3$	id_2	$E \rightarrow id$
$E + E * id_3$	id_3	$E \rightarrow id$
$E + E + E$	$E + E$	$E \rightarrow E * E$
$E + E$	$E + E$	$E \rightarrow E + E$
E		

Shift-reduce Parsing Table

Stack	Input	Action
$\$$	$id_1 + id_2 * id_3 \#$	shift
$\$ id_1$	$+ id_2 * id_3 \#$	reduce by $E \rightarrow id$
$\$ E$	$+ id_2 * id_3 \#$	shift
$\$ E +$	$id_2 * id_3 \#$	shift
$\$ E + id_2$	$* id_3 \#$	reduce by $E \rightarrow id$
$\$ E + E$	$* id_3 \#$	shift
$\$ E + E *$	$id_3 \#$	shift
$\$ E + E * id_3$	$\#$	reduce by $E \rightarrow id$
$\$ E + E * E$	$\#$	reduce by $E \rightarrow E * E$
$\$ E + E$	$\#$	reduce by $E \rightarrow E + E$
$\$ E$	$\#$	accept