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Compiler Design Theory

Lecture 10

Bottom-up parser for the SLR (1) grammar with empty production rules

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SLR (1) parser for grammar with empty production rules

A Goto Table for SLR(1) parser with empty production rules is filled in the same way as for the SLR(0)- parser without empty production rules.

An Action Table for SLR(1) parser with empty production rules is filled in the same way as for the SLR(1) parser without empty production rules but has an extra action:

For every empty production rule A→\$=ε with the number N at the intersection of the line, marked by the grammatical occurrences R_{ij}, where A_k ∈ F_FOLLOW (R_{ij}) and the column marked with *x*, where x_k ∈ FOLLOW (A) is entered the Reduce Action (R(N)).

Bottom-up parser for the SLR (1) grammar with empty production rules. F_FIRST set

Problem statement. Create a bottom-up parser for the grammar $G_{10.1}$: $V_T=\{i, +, ;, (,)\}$, $V_A=\{I, A, C\}$

R:$\{$ **1.** $I \rightarrow i = A;$ **2.** $A \rightarrow i\ C$ **3.** $C \rightarrow + A_3$ **4.** $A \rightarrow (A)\ C$ **5.** $C \rightarrow \$.\}$

Let rewrite production rules with using Grammatical occurrences:

1. $I_0 \rightarrow i_1 = A_1$;

2. $A \rightarrow i_2\ C_2$

3. $C \rightarrow + A_3$

4. $A \rightarrow (A_4)\ C_4$

5. $C \rightarrow \$.$

Let define set F_FIRST for grammar $G_{10.1}$:

F_FIRST$(i_1)=\{i_1\}$
F_FIRST$(=) = \{=\}$
F_FIRST$(A_1)=\{A_1, i_2, (\}$
F_FIRST$(;)=\{;\}$
F_FIRST$(i_2)=\{i_2\}$
F_FIRST$(C_2)=\{C_2, +\}$
F_FIRST$(+)=\{+\}$
F_FIRST$(A_3)=\{A_3, i_2, (\}$
F_FIRST$(( )=\{(\}$
F_FIRST$(A_4)=\{A_4\ i_2, (\}$
F_FIRST$())=\{)\}$
F_FIRST$(C_4)=\{C_4, +\}$
F_FIRST$(I_0)=\{I_0, i_1\}$

Bottom-up parser for the SLR (1) grammar with empty production rules. F_FOLLOW set

1. $I_0 \rightarrow i_1 = A_1$; **2.** $A \rightarrow i_2 C_2$ **3.** $C \rightarrow + A_3$ **4.** $A \rightarrow (A_4) C_4$ **5.** $C \rightarrow \$$.

F_FIRST(i_1)={i_1}
F_FIRST(=) = {=}
F_FIRST(A_1)={$A_1, i_2, ($}
F_FIRST(;)={;}
F_FIRST(i_2)={i_2}
F_FIRST(C_2)={$C_2, +$}
F_FIRST(+)={+}
F_FIRST(A_3)={$A_3, i_2, ($}
F_FIRST(( )={(}
F_FIRST(A_4)={$A_4 i_2, ($}
F_FIRST())={)}
F_FIRST(C_4)={$C_4, +$}
F_FIRST(I_0)={I_0, i_1 }

Let define set F_FOLLOW for grammar $G_{9.1}$:
F_FOLLOW (i_1) = F_FIRST(=) = {=}
F_FOLLOW (=) = {$A_1, i_2, ($}
F_FOLLOW (A_1) = {;}
F_FOLLOW (;) = {$\$$};
F_FOLLOW (i_2) = {$C_2, +$}
F_FOLLOW (C_2) = {$\$$}
F_FOLLOW (+) = {$A_3, i_2, ($}
F_FOLLOW (A_3) = {$\$$}
F_FOLLOW (() = {$A_4, i_2, ($}
F_FOLLOW (A_4) = {)}
F_FOLLOW ()) ={$C_4, +$}
F_FOLLOW (C_4) = {$\$$}
F_FOLLOW (h_0) = F_FIRST(I_0)={ I_0, i_1}
F_FOLLOW (I_0) = {$\$$}.

FOLLOW (A) = {), ;}. FOLLOW (C) = = FOLLOW(A)={), ;}. FOLLOW (I) = {$\$$}.

Goto table

The rows of the Goto table match to each **Grammatical occurrence and bottom marker h_0**, the columns match to each **Grammatical symbol**.

The table cells are filled with item of the F_FOLLOW (Yj) set in such a way: an item $Xk \in$ F_FOLLOW (Yj) is filled into the cell located at the intersection of the row Yj and the column X.

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2,) };F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

Grammatical occurrences	Grammatical symbols								
	I	i	=	A	C	+	(	)	;
i_1			=						
=									
A_1									
;									
i_2									
C_2									
+									
A_3									
(									
A_4									
)									
C_4									
h_0									
I_0									

GOTO TABLE

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2,) };F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

Grammatical occurrences	Grammatical symbols								
	I	i	=	A	C	+	(	)	;
i_1			=						
=		i_2		A_1			(		
A_1									
;									
i_2									
C_2									
+									
A_3									
(									
A_4									
)									
C_4									
h_0									
I_0									

GOTO TABLE

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$};F_FOLLOW (+) = {$A_3$, i_2,) };F_FOLLOW (A_3) = {$};F_FOLLOW (() = {$A_4$, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$};.

Grammatical occurrences	Grammatical symbols								
	I	i	$=$	A	C	$+$	$($	$)$	$;$
i_1			=						
$=$		i_2		A_1				$($	
A_1									$;$
$;$									
i_2									
C_2									
$+$									
A_3									
$($									
A_4									
$)$									
C_4									
h_0									
I_0									

GOTO TABLE

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2, (};F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

Grammatical occurrences	Grammatical symbols								
	I	i	=	A	C	+	(	)	;
i_1			=						
=		i_2		A_1			(		
A_1									;
;									
i_2					C_2	+			
C_2									
+		i_2		A_3			(		
A_3									
(		i_2		A_4			(		
A_4								)	
)					C_4	+			
C_4									
h_0	I_0	i_1							
I_0									

Action table for SLR(1)- parser

The action table is filled element-wise for each row marked by grammatical occurrences, as follows:

- At the intersection of the line, marked with h_0 and the column marked with $\$=\varepsilon$, is entered the Allow Action (A), in the other columns are filled the Reject Action (R_j) (we will use empty sell).

- At the intersection of the line, marked by the not rightmost grammatical occurrences R_{ij}, and the column marked with x, where $x_k \in$ F_FOLLOW (R_{ij}) is entered the Shift Action (S).

- If there is a production rule $A \rightarrow \mu p_{ij}$ with the number N. Then at the intersection of the line, marked by the rightmost grammatical occurrences p_{ij}, and the column marked with x, where $x_k \in$ FOLLOW (A) is entered the Reduce Action (R(N)).

- If there is an empty production rule $A \rightarrow \$$ with the number N. Then at the intersection of the line, marked by the grammatical occurrences R_{ij}, where $A_k \in$ F_FOLLOW (R_{ij}) and the column marked with x, where $x_k \in$ FOLLOW (A) is entered the Reduce Action (R(N)).

Action Table. Part 1

$1. I_0 \rightarrow i_1 = A_1$; $2. A \rightarrow i_2 C_2$ $3. C \rightarrow + A_3$ $4. A \rightarrow (A_4) C_4$ $5. C \rightarrow \$$.

F_FOLLOW $(i_1) = \{=\}$;F_FOLLOW $(=) = \{A_1, i_2, (\}$;F_FOLLOW $(A_1) = \{;\}$;F_FOLLOW $(;) = \{\$\}$;F_FOLLOW $(i_2) = \{C_2,$
$+\}$;F_FOLLOW $(C_2) = \{\$\}$;F_FOLLOW $(+) = \{A_3, i_2,)\}$;F_FOLLOW $(A_3) = \{\$\}$;F_FOLLOW $(() = \{A_4, i_2, (\}$;F_FOLLOW $(A_4) =$
$\{)\}$;F_FOLLOW $()) = \{C_4, +\}$;F_FOLLOW $(C_4) = \{\$\}$;F_FOLLOW $(h_0) = \{I_0, i_1\}$;F_FOLLOW $(I_0) = \{\$\}$.

At the intersection of the line, marked by the not rightmost grammatical occurrences R_{ij}, and the column marked with x, where $x_k \in$ F_FOLLOW (R_{ij}) is entered the Shift Action (S).

Grammatical occurrences	Terminal symbol						
	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1		S					
$=$							
A_1							
$;$							
i_2							
C_2							
$+$							
A_3							
$($							
A_4							
$)$							
C_4							
h_0							
I_0							

Action Table. Part 2

$1. I_0 \rightarrow i_1 = A_1 ;$ $2. A \rightarrow i_2 \, C_2$ $3. C \rightarrow + A_3$ $4. A \rightarrow (A_4) \, C_4$ $5. C \rightarrow \$.$

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {$A_1, i_2,$ (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {$A_3, i_2,$) };F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {$A_4, i_2,$ (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

At the intersection of the line, marked by the not rightmost grammatical occurrences R_{ij}, and the column marked with x, where $x_k \in$ F_FOLLOW (R_{ij}) is entered the Shift Action (S).

Grammatical occurrences	Terminal symbol						
	i	=	+	(	)	;	$\$$
i_1		S					
=	S			S			
A_1							
;							
i_2							
C_2							
+							
A_3							
(							
A_4							
)							
C_4							
h_0							
I_0							

Action Table. Part 3

1. $I_0 \to i_1 = A_1$;   2. $A \to i_2\, C_2$ 3. $C \to + A_3$ 4. $A \to (A_4)\, C_4$ 5. $C \to \$$.

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2, (};F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)}};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

FOLLOW (A) = {), ;}. FOLLOW (C) = = FOLLOW(A)={), ;}. FOLLOW (I) = {$\$$}.

At the intersection of the line, marked by the not rightmost grammatical occurrences R_{ij}, and the column marked with x, where $x_k \in$ F_FOLLOW (R_{ij}) is entered the Shift Action (S).

Grammatical occurrences	Terminal symbol						
	i	=	+	(	)	;	$\$$
i_1		S					
=	S			S			
A_1						S	
;							
i_2			S				
C_2							
+	S			S			
A_3							
(	S			S			
A_4					S		
)			S				
C_4							
h_0	S						
I_0							

Action Table. Part 4

1. $I_0 \rightarrow i_1 = A_1$; 2. $A \rightarrow i_2 \ C_2$ 3. $C \rightarrow + A_3$ 4. $A \rightarrow (A_4) \ C_4$ 5. $C \rightarrow \$$.

F_FOLLOW $(i_1) = \{=\}$;F_FOLLOW $(=) = \{A_1, i_2, (\}$;F_FOLLOW $(A_1) = \{;\}$;F_FOLLOW $(;) = \{\$\}$;F_FOLLOW $(i_2) = \{C_2,$
$+\}$;F_FOLLOW $(C_2) = \{\$\}$;F_FOLLOW $(+) = \{A_3, i_2,)\}$;F_FOLLOW $(A_3) = \{\$\}$;F_FOLLOW $(() = \{A_4, i_2, (\}$;F_FOLLOW $(A_4) =$
$\{)\}$;F_FOLLOW $()) = \{C_4, +\}$;F_FOLLOW $(C_4) = \{\$\}$;F_FOLLOW $(h_0) = \{I_0, i_1\}$;F_FOLLOW $(I_0) = \{\$\}$;.
FOLLOW $(A) = \{), ;\}$. FOLLOW $(C) = =$ FOLLOW(A)=$\{), ;\}$. FOLLOW $(I) = \{\$\}$.

If there is a production rule $A \rightarrow \mu p_{ij}$ with the number N. Then at the intersection of the line, marked by the rightmost grammatical occurrences p_{ij}, and the column marked with x, where $x_k \in$ FOLLOW (A) is entered the Reduce Action (R(N)).

Grammatical occurrences	Terminal symbol						
	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1		S					
$=$	S			S			
A_1						S	
$;$							R(1)
i_2			S				
C_2							
$+$	S			S			
A_3							
$($	S			S			
A_4					S		
$)$		S					
C_4							
h_0	S						
I_0							

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Action Table. Part 5

$1. I_0 \to i_1 = A_1$; $2. A \to i_2\ C_2$ $3. C \to + A_3$ $4. A \to (A_4)\ C_4$ $5. C \to \$.$

F_FOLLOW $(i_1) = \{=\}$;F_FOLLOW $(=) = \{A_1, i_2, (\}$;F_FOLLOW $(A_1) = \{;\}$;F_FOLLOW $(;) = \{\$\}$;F_FOLLOW $(i_2) = \{C_2, +\}$;F_FOLLOW $(C_2) = \{\$\}$;F_FOLLOW $(+) = \{A_3, i_2,)\}$;F_FOLLOW $(A_3) = \{\$\}$;F_FOLLOW $(() = \{A_4, i_2, (\}$;F_FOLLOW $(A_4) = \{)\}$;F_FOLLOW $()) = \{C_4, +\}$;F_FOLLOW $(C_4) = \{\$\}$;F_FOLLOW $(h_0) = \{I_0, i_1\}$;F_FOLLOW $(I_0) = \{\$\}$;.

FOLLOW $(A) = \{), ;\}$. FOLLOW $(C) = $ FOLLOW$(A) = \{), ;\}$. FOLLOW $(I_0) = \{\$\}$.

If there is a production rule $A \to \mu p_{ij}$ with the number N. Then at the intersection of the line, marked by the rightmost grammatical occurrences p_{ij}, and the column marked with x, where $X_k \in$ FOLLOW (A) is entered the Reduce Action (R(N)).

Grammatical occurrences	Terminal symbol							
	i	$=$	$+$	$($	$)$	$;$	$\$$	
i_1		S						
$=$	S			S				
A_1						S		
$;$							R(1)	
i_2			S					
C_2					R(2)	R(2)		
$+$	S			S				
A_3								
$($	S			S				
A_4					S			
$)$		S						
C_4								
h_0	S							
I_0								

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1.$I_0 \rightarrow i_1 = A_1$;   2.$A \rightarrow i_2 C_2$ 3.$C \rightarrow + A_3$ 4. $A \rightarrow (A_4) C_4$ 5.$C \rightarrow \$$.

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2,) };F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

FOLLOW (A) = {), ;}. FOLLOW (C) = FOLLOW(A)={), ;}. FOLLOW (I_0) = {$\$$}.

If there is a production rule A→μp$_{ij}$ with the number N. Then at the intersection of the line, marked by the rightmost grammatical occurrences p$_{ij}$, and the column marked with x, where X$_k$ ∈ FOLLOW (A) is entered the Reduce Action (R(N)).

Grammatical occurrences	Terminal symbol						
	i	=	+	(	)	;	⊥=$
i_1		S					
=	S			S			
A_1						S	
;							R(1)
i_2			S				
C_2					R(2)	R(2)	
+	S			S			
A_3					R(3)	R(3)	
(	S			S			
A_4					S		
)		S					
C_4							
h_0	S						
I_0							

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1.$I_0 \to i_1 = A_1$;   2.$A \to i_2\ C_2$ 3.$C \to +\ A_3$ 4.$A \to (A_4)\ C_4$ 5.$C \to \$$.

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {$\$$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {$\$$};F_FOLLOW (+) = {A_3, i_2,)};F_FOLLOW (A_3) = {$\$$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) = {C_4, +};F_FOLLOW (C_4) = {$\$$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {$\$$};.

FOLLOW (A) = {), ;}. FOLLOW (C) = FOLLOW(A)={), ;}. FOLLOW (I_0) = {$\$$}.

If there is a production rule A→μp$_{ij}$ with the number N. Then at the intersection of the line, marked by the rightmost grammatical occurrences p$_{ij}$, and the column marked with x, where X_k ∈ FOLLOW (A) is entered the Reduce Action (R(N)).

Grammatical occurrences	Terminal symbol						
	i	=	+	(	)	;	$\$$
i_1		S					
=	S			S			
A_1						S	
;							R(1)
i_2			S				
C_2					R(2)	R(2)	
+	S			S			
A_3					R(3)	R(3)	
(	S			S			
A_4					S		
)			S				
C_4					R(4)	R(4)	
h_0	S						
I_0							

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Action Table. Part 5

1. $I_0 \rightarrow i_1 = A_1$; 2. $A \rightarrow i_2 C_2$ 3. $C \rightarrow + A_3$ 4. $A \rightarrow (A_4) C_4$ 5. $C \rightarrow \$.$

F_FOLLOW $(i_1) = \{=\}$;F_FOLLOW $(=) = \{A_1, i_2, (\}$;F_FOLLOW $(A_1) = \{;\}$;F_FOLLOW $(;) = \{\$\}$;F_FOLLOW $(i_2) = \{C_2, +\}$;F_FOLLOW $(C_2) = \{\$\}$;F_FOLLOW $(+) = \{A_3, i_2, (\}$;F_FOLLOW $(A_3) = \{\$\}$;F_FOLLOW $(() = \{A_4, i_2, (\}$;F_FOLLOW $(A_4) = \{)\}$;F_FOLLOW $()) = \{C_4, +\}$;F_FOLLOW $(C_4) = \{\$\}$;F_FOLLOW $(h_0) = \{I_0, i_1\}$;F_FOLLOW $(I_0) = \{\$\}$;.
FOLLOW $(A) = \{), ;\}$. FOLLOW $(C) = = $ FOLLOW$(A) = \{), ;\}$. FOLLOW $(I_0) = \{\$\}$.

If there is an empty production rule A→$ with the number N. Then at the intersection of the line, marked by the grammatical occurrences R_{ij}, where $A_k \in$ F_FOLLOW (R_{ij}) and the column marked with x, where $X_k \in$ FOLLOW (A) is entered the Reduce Action (R(N)).

Grammatical occurrences	Terminal symbol						
	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1		S					
$=$	S			S			
A_1						S	
$;$							R(1)
i_2			S		R(5)	R(5)	
C_2					R(2)	R(2)	
$+$	S			S			
A_3					R(3)	R(3)	
$($	S			S			
A_4					S		
$)$			S		R(5)	R(5)	
C_4					R(4)	R(4)	
h_0	S						
I_0							

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Action Table. Part 5

$1. I_0 \to i_1 = A_1$; $\quad 2. A \to i_2\ C_2$ $\quad 3. C \to + A_3$ $\quad 4.\ A \to (A_4)\ C_4$ $\qquad 5. C \to \$ $.

F_FOLLOW (i_1) = {=};F_FOLLOW (=) = {A_1, i_2, (};F_FOLLOW (A_1) = {;};F_FOLLOW (;) = {\$};F_FOLLOW (i_2) = {C_2, +};F_FOLLOW (C_2) = {\$};F_FOLLOW (+) = {A_3, i_2,) };F_FOLLOW (A_3) = {\$};F_FOLLOW (() = {A_4, i_2, (};F_FOLLOW (A_4) = {)};F_FOLLOW ()) ={C_4, +};F_FOLLOW (C_4) = {\$};F_FOLLOW (h_0) = {I_0, i_1};F_FOLLOW (I_0) = {\$};.

FOLLOW (A) = {), ;}. FOLLOW (C) = = FOLLOW(A)={), ;}. FOLLOW (I_0) = {\$}.

At the intersection of the line, marked with h_0 and the column marked with \$, is entered the Allow Action (A), in the other columns is filled the Reject Action (R_j) (we will use empty sell).

Grammatical occurrences	Terminal symbol						
	i	=	+	(	)	;	$
i_1		S					
=	S			S			
A_1						S	
;							R(1)
i_2			S		R(5)	R(5)	
C_2					R(2)	R(2)	
+	S			S			
A_3					R(3)	R(3)	
(	S			S			
A_4					S		
)			S		R(5)	R(5)	
C_4					R(4)	R(4)	
h_0	S						
I_0							A

Example of SLR(1) parser work for grammar $G_{10.1}$

Grammar $G_{10.1}$

1. $I \rightarrow i_1 = A_1 \; ;$
2. $A \rightarrow i_2 \, C_2$
3. $C \rightarrow + \, A_3$ 4.
$A \rightarrow (A_4) \, C_4$
5. $C \rightarrow \$$

Let Input buffer is:

$i=(i+i+i);$

Goto Table — Grammatical symbol | **Action Table** — Terminal symbol

Grammatical occurrences	I	i	=	A	C	+	(	)	;	i	=	+	(	)	;	$
i_1			=								S					
=		i_2		A_1			(			S			S			
A_1									;						S	
;																R(1)
i_2					C_2	+						S		R(5)	R(5)	
C_2														R(2)	K(2)	
+		i_2		A_3			(			S			S			
A_3														R(3)	R(3)	
(		i_2		A_4			(			S			S			
A_4								)						S		
)					C_4	+						S		R(5)	R(5)	
C_4														R(4)	R(4)	
h_0	I_0	i_1								S						
I_0																A

Stack	Input buffer	Action
h_0	$i=(i+i+i);\,\Upsilon$	S
$h_0 \, i_1$	$=(i+i+i);\,\Upsilon$	

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Example of SLR(1) parser work for grammar $G_{10.1}$

| Grammatical occurrences | Goto Table | | | | | | | | | Action Table | | | | | | |
| | Grammatical symbol | | | | | | | | | Terminal symbol | | | | | | |
	I	i	$=$	A	C	$+$	$($	$)$	$;$	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1			$=$							S						
$=$		i_2		A_1			$($			S			S			
A_1									$;$						S	
$;$																$R(1)$
i_2					C_2	$+$					S			$R(5)$	$R(5)$	
C_2														$R(2)$	$K(2)$	
$+$		i_2		A_3			$($			S			S			
A_3														$R(3)$	$R(3)$	
$($		i_2		A_4			$($			S			S			
A_4								$)$						S		
$)$					C_4	$+$				S				$R(5)$	$R(5)$	
C_4														$R(4)$	$R(4)$	
h_0	I_0	i_1								S						
I_0																A

Grammar $G_{10.1}$

1. $I \rightarrow i_1 = A_1 \;;$
2. $A \rightarrow i_2\, C_2$
3. $C \rightarrow + A_3$ 4. $A \rightarrow (A_4)\, C_4$
5. $C \rightarrow \$$

Let Input buffer is:

$i=(i+i+i);$

Stack	Input buffer	Action
h_0	$i=(i+i+i);\,\gamma$	S
$h_0\, i_1$	$=(i+i+i);\,\gamma$	S
$h_0 i_1 =$	$(i+i+i);\,\gamma$	

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Example of SLR(1) parser work for grammar G$_{10.1}$

Grammar G$_{10.1}$

1. $I \rightarrow i_1 = A_1$;
2. $A \rightarrow i_2\ C_2$
3. $C \rightarrow + A_3$
4. $A \rightarrow (A_4)\ C_4$
5. $C \rightarrow \$$

Let Input buffer is:

$i=(i+i+i);$

Grammatical occurrences	Goto Table — Grammatical symbol									Action Table — Terminal symbol						
	I	i	$=$	A	C	$+$	$($	$)$	$;$	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1			$=$								S					
$=$		i_2		A_1			$($			S			S			
A_1									$;$						S	
$;$																$R(1)$
i_2					C_2	$+$						S		$R(5)$	$R(5)$	
C_2														$R(2)$	$K(2)$	
$+$		i_2		A_3			$($			S		S				
A_3														$R(3)$	$R(3)$	
$($		i_2		A_4			$($			S			S			
A_4								$)$						S		
$)$					C_4	$+$						S		$R(5)$	$R(5)$	
C_4														$R(4)$	$R(4)$	
h_0	I_0	i_1								S						
I_0																A

Stack	Input buffer	Action
h_0	$i=(i+i+i);Ɣ$	S
$h_0\,i_1$	$=(i+i+i);Ɣ$	S
$h_0 i_1=$	$(i+i+i);Ɣ$	S
$h_0\,i_1=($	$i+i+i);Ɣ$	S
$h_0\,i_1=(i_2$	$+i+i);Ɣ$	S
$h_0\,i_1=(i_2+$	$i+i);Ɣ$	S
$h_0\,i_1=(i_2+i_2$	$+i);Ɣ$	S
$h_0\,i_1=(i_2+i_2+$	$i);Ɣ$	S
$h_0 i_1=(i_2+i_2+i_2$	$);Ɣ$	$R(5)$
$h_0 i_1=(i_2+i_2+i_2C_2$	$);Ɣ$	$R(2)$
$h_0\,i_1=(i_2+i_2+A_3$	$);Ɣ$	$R(3)$

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Example of SLR(1) parser work for grammar $G_{10.1}$

Grammar $G_{10.1}$

1. $I \rightarrow i_1 = A_1 \;;$
2. $A \rightarrow i_2\, C_2$
3. $C \rightarrow +\, A_3$ 4.
$A \rightarrow (A_4)\, C_4$
5. $C \rightarrow \varepsilon$

Let Input buffer is:

$i=(i+i+i);$

Grammatical occurrences	Goto Table — Grammatical symbol									Action Table — Terminal symbol						
	I	i	$=$	A	C	$+$	$($	$)$	$;$	i	$=$	$+$	$($	$)$	$;$	$\$ $
i_1			$=$								S						
$=$		i_2		A_1			$($			S				S			
A_1									$;$							S	
$;$																	$R(1)$
i_2				C_2		$+$						S		$R(5)$	$R(5)$		
C_2														$R(2)$	$K(2)$	
$+$		i_2		A_3			$($			S			S				
A_3														$R(3)$	$R(3)$	
$($		i_2		A_4			$($			S			S				
A_4							$)$							S			
$)$					C_4	$+$						S		$R(5)$	$R(5)$		
C_4														$R(4)$	$R(4)$	
h_0	I_0	i_1								S						
I_0																A

Stack	Input buffer	Action
h_0	$i=(i+i+i);\,\dashv$	S
$h_0\, i_1$	$=(i+i+i);\,\dashv$	S
$h_0 i_1 =$	$(i+i+i);\,\dashv$	S
$h_0\, i_1 =($	$i+i+i);\,\dashv$	S
$h_0\, i_1 =(i_2$	$+i+i);\,\dashv$	S
$h_0\, i_1 =(i_2+$	$i+i);\,\dashv$	S
$h_0\, i_1 =(i_2+i_2$	$+i);\,\dashv$	S
$h_0\, i_1 =(i_2+i_2+$	$i);\,\dashv$	S
$h_0 i_1 =(i_2+i_2+i_2$	$);\,\dashv$	$R(5)$
$h_0 i_1 =(i_2+i_2+i_2 C_2$	$);\,\dashv$	$R(2)$
$h_0\, i_1 =(i_2+i_2+A_3$	$);\,\dashv$	$R(3)$

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Example of SLR(1) parser work for grammar $G_{10.1}$

	Goto Table									Action Table						
Grammatical occurrences	Grammatical symbol									Terminal symbol						
	I	i	$=$	A	C	$+$	$($	$)$	$;$	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1			$=$								S					
$=$		i_2		A_1			$($			S			S			
A_1									$;$						S	
$;$																$R(1)$
i_2					C_2	$+$							S	$R(5)$	$R(5)$	
C_2														$R(2)$	$K(2)$	
$+$		i_2		A_3			$($			S		S				
A_3														$R(3)$	$R(3)$	
$($		i_2		A_4			$($			S			S			
A_4								$)$						S		
$)$					C_4	$+$						S		$R(5)$	$R(5)$	
C_4														$R(4)$	$R(4)$	
h_0	I_0	i_1								S						
I_0																A

Grammar $G_{10.1}$

1. $I \rightarrow i_1 = A_1 \; ;$
2. $A \rightarrow i_2 \; C_2$
3. $C \rightarrow + A_3$
4. $A \rightarrow (A_4) \; C_4$
5. $C \rightarrow \$$

Let Input buffer is:

$i=(i+i+i);$

Stack	Input buffer	Action	Stack	Input buffer	Action
h_0	$i=(i+i+i);\$$	S	$h_0i_1=(i_2+i_2+i_2C_2$	$);\ \$$	$R(2)$
$h_0 \, i_1$	$=(i+i+i);\$$	S	$h_0 \, i_1=(i_2+i_2+A_3$	$);\ \$$	$R(3)$
$h_0i_1=$	$(i+i+i);\ \$$	S	$h_0 \, i_1=(i_2+i_2C_2$	$);\ \$$	$R(2)$
$h_0 \, i_1=($	$i+i+i);\ \$$	S	$h_0 \, i_1=(i_2+A_3$	$);\ \$$	$R(3)$
$h_0 \, i_1=(i_2$	$+i+i);\ \$$	S	$h_0 \, i_1=(i_2C_2$	$);\ \$$	$R(2)$
$h_0 \, i_1=(i_2+$	$i+i);\ \$$	S	$h_0 \, i_1=(A_4$	$);\ \$$	S
$h_0 \, i_1=(i_2+i_2$	$+i);\ \$$	S	$h_0 \, i_1=(A_4)$	$;\ \$$	$R(5)$
$h_0 \, i_1=(i_2+i_2+$	$i);\ \$$	S	$h_0 \, i_1=(A_4)C_4$	$;\ \$$	$R(4)$
$h_0i_1=(i_2+i_2+i_2$	$);\ \$$	$R(5)$	$h_0 \, i_1=A_1$	$;\ \$$	$R(4)$

Example of SLR(1) parser work for grammar $G_{10.1}$

Grammar $G_{10.1}$

1. $I_0 \rightarrow i_1 = A_1 \ ;$
2. $A \rightarrow i_2 \ C_2$
3. $C \rightarrow + \ A_3$
4. $A \rightarrow (A_4) \ C_4$
5. $C \rightarrow \$$

Let Input buffer is:

$i=(i+i+i);$

Grammatical occurrences	Goto Table — Grammatical symbol									Action Table — Terminal symbol						
	I	i	$=$	A	C	$+$	$($	$)$	$;$	i	$=$	$+$	$($	$)$	$;$	$\$$
i_1			$=$								S					
$=$		i_2		A_1			$($			S			S			
A_1									$;$						S	
$;$																$R(1)$
i_2					C_2	$+$					S		$R(5)$	$R(5)$		
C_2													$R(2)$	$R(2)$		
$+$		i_2		A_3			$($			S	S					
A_3													$R(3)$	$R(3)$		
$($		i_2		A_4			$($			S			S			
A_4								$)$						S		
$)$					C_4	$+$						S	$R(5)$	$R(5)$		
C_4													$R(4)$	$R(4)$		
h_0	I_0	i_1								S						
I_0																A

Stack	Input buffer	Action
$h_0 \ i_1{=}A_1$	$; \ \$$	S
$h_0 \ i_1{=}A_1;$	$\$$	R(1)
$h_0 \ I_0$	$\$$	A

Thank you very much