

LL(1) Parsing

Example of LL(1) Parser: Example 1

$$S \rightarrow aABb$$
$$A \rightarrow c \mid \epsilon$$
$$B \rightarrow d \mid \epsilon$$

Step: 1: No left recursion in the grammar, hence no modification required.

Step 2: Calculation of First Set

$$\text{First}(S) = \{a\}$$
$$\text{First}(A) = \{c, \epsilon\}$$
$$\text{First}(B) = \{d, \epsilon\}$$

Example of LL(1) Parser

$S \rightarrow aABb$

$A \rightarrow c \mid \epsilon$

$B \rightarrow d \mid \epsilon$

Step 3: Calculation of Follow Set

Follow(S) = {\$}

$\text{Follow}(A) = \text{First}(Bb) = \text{First}(B) = \{d, \epsilon\}$

Since it contains ϵ , continue FIRST rule.

$\text{First}(Bb) = \text{First}(B) - \epsilon \cup \text{First}(b) = \{d, b\}$

Follow(A) = {d,b}

Follow(B) = {b}

Example of LL(1) Parser

$S \rightarrow aABb \rightarrow \text{First}(aABb) = a$

$A \rightarrow c \mid \epsilon \rightarrow \text{First}(c) = c$ and $\text{First}(\epsilon) = \epsilon$ (Use follow)

$B \rightarrow d \mid \epsilon \rightarrow \text{First}(d) = d$ and $\text{First}(\epsilon) = \epsilon$ (Use follow)

Step 4: Parsing Table

Grammar is LL(1)

Example String: acdb\$

H/w string: adb\$

	a	b	c	d	\$
S	$S \rightarrow aABb$				
A		$A \rightarrow \epsilon$	$A \rightarrow c$	$A \rightarrow \epsilon$	
B		$B \rightarrow \epsilon$		$B \rightarrow d$	

Example of LL(1) Parser

Example String: acdb\$

	a	b	c	d	\$
S	$S \rightarrow aABb$				
A		$A \rightarrow \epsilon$	$A \rightarrow c$	$A \rightarrow \epsilon$	
B		$B \rightarrow \epsilon$		$B \rightarrow d$	

Stack	Input	Action
\$	acdb\$	Push S into Stack
\$S	acdb\$	$S \rightarrow aABb$
\$bBAa	acdb\$	Pop a
\$bBA	cdb\$	$A \rightarrow c$
\$bBc	cdb\$	Pop c
\$bB	db\$	$B \rightarrow d$
\$bd	db\$	Pop d
\$b	b\$	Pop b
\$	\$	Accept

Example of LL(1) Parser: Example 2

$S \rightarrow AaAb \mid BbBa$

$A \rightarrow \epsilon$

$B \rightarrow \epsilon$

Step: 1: No left recursion in the grammar, hence no modification required.

Step 2: Calculation of First Set

$\text{First}(S) = \text{First}(AaAb) \cup \text{First}(BbBa)$

$\text{First}(AaAb) = \text{First}(A) = \epsilon$

Since it contains ϵ , continue FIRST rule

$\text{First}(AaAb) = \text{First}(A) - \epsilon \cup \text{First}(aAb) = \{a\}$

Similarly: $\text{First}(BbBa) = \{b\}$

$\text{First}(S) = \{a, b\}$

Example of LL(1) Parser: Example 2

$S \rightarrow AaAb \mid BbBa$

$A \rightarrow \epsilon$

$B \rightarrow \epsilon$

Step 3: Calculation of Follow Set

$\text{Follow}(S) = \{\$ \}$

$\text{Follow}(A) = \text{First}(aAb) = a$

$\text{Follow}(A) = \text{First}(b) = \{b\}$

$\text{Follow}(A) = \{a, b\}$

Similarly $\text{Follow}(B) = \{a, b\}$

Example of LL(1) Parser: Example 2

$S \rightarrow AaAb \mid BbBa$

$A \rightarrow \epsilon$

$B \rightarrow \epsilon$

Step 4: Construction of Parsing Table: Grammar is LL(1)

	a	b	\$
S	$S \rightarrow AaAb$	$S \rightarrow BbBa$	
A	$A \rightarrow \epsilon$	$A \rightarrow \epsilon$	
B	$B \rightarrow \epsilon$	$B \rightarrow \epsilon$	

Example of LL(1) Parser: Example 3

$S \rightarrow AB \mid eDa$

$A \rightarrow ab \mid c$

$B \rightarrow dC$

$C \rightarrow eC \mid \epsilon$

$D \rightarrow fD \mid \epsilon$

Step: 1: No left recursion in the grammar, hence no modification required.

Step 2: Calculation of First Set

$\text{First}(S) = \{a, c, e\}$

$\text{First}(A) = \{a, c\}$

$\text{First}(B) = \{d\}$

$\text{First}(C) = \{e, \epsilon\}$

$\text{First}(D) = \{f, \epsilon\}$

Example of LL(1) Parser: Example 3

$S \rightarrow AB \mid eDa$

$A \rightarrow ab \mid c$

$B \rightarrow dC$

$C \rightarrow eC \mid \epsilon$

$D \rightarrow fD \mid \epsilon$

$S \rightarrow eDA$

$\text{Follow}(D) = \text{First}(a) = \{a\}$

$B \rightarrow dC$

$\text{Follow}(C) = \text{Follow}(B) = \{\$\}$

$C \rightarrow eC$

$\text{Follow}(C) = \text{Follow}(C) = \{\$\}$

$D \rightarrow fD$

$\text{Follow}(D) = \text{Follow}(D) = \{a\}$

Step 3: Calculation of Follow Set

$\text{Follow}(S) = \{\$\}$

$S \rightarrow AB$

$\text{Follow}(A) = \text{First}(B) = \{d\}$

$\text{Follow}(B) = \text{Follow}(S) = \{\$\}$

Example of LL(1) Parser: Example 3

$S \rightarrow AB \mid eDa$

$A \rightarrow ab \mid c$

$B \rightarrow dC$

$C \rightarrow eC \mid \epsilon$

$D \rightarrow fD \mid \epsilon$

Construction of Parsing Table:

	a	b	c	d	e	f	\$
S	$S \rightarrow AB$		$S \rightarrow AB$		$S \rightarrow eDa$		
A	$A \rightarrow ab$		$A \rightarrow c$				
B		$B \rightarrow dC$					
C					$C \rightarrow eC$		$C \rightarrow \epsilon$
D	$D \rightarrow \epsilon$					$D \rightarrow fD$	