南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

COMPILIER @Liu Yepang 2019

for SUSTech CSE

HomeWork 4

Edited by

汪至圆

11610634

2019

SHENZHEN

1 Exercise 1 (Top-Down Parsing):

Consider the following grammar G:

$$S \to aB$$
$$B \to S + B|\epsilon$$

1.1 Construct the predictive parsing table for G. [20 points]

$$FIRST(S) : \{a\}$$
$$FIRST(B) : \{a, \epsilon\}$$
$$FELLOW(S)\{+, \$\}$$
$$FELLOW(B)\{+, \$\}$$

表 1: Parsing Table

Non-Terminal	INPUT SYMBOL		
	a	+	$
S	$S \to aB$		
B	$B \to S + B$	$B \to \epsilon$	$B \to \epsilon$

1.2 Is the grammar LL(1)? [10 points]

For the $B \to S + B|\epsilon$

- $FIRST(S + B) = \{a\}$ and $FIRST(\epsilon) = \{\epsilon\}$, $FIRST(S + B) \bigcup FIRST(\epsilon) = \emptyset$
- $FIRST(\epsilon) = \{\epsilon\}$, and $FIRST(S + B) \bigcup FELLOW(B) = \emptyset$

So $B \to S + B|\epsilon$ is LL(1)

1.3 Can an LL(1) parser accept the input string aaaa+++? If yes, please list the moves made by the parser; otherwise, state the reason. Before parsing, please resolve conflicts in the parsing table if any. [20 points]

Yes, it can

表 2

Matched	Stack	Input	Output Action
	S$	aaaa+++$	
	aB$	aaaa+++$	Output $s \to aB$
a	B$	aaa+++$	Match a
a	S+B$	aaa+++$	Output $B \to S + B$
a	aB+B$	aaa+++$	Output $s \to aB$
aa	B+B$	aa+++$	Match a
aa	S+B+B$	aa+++$	Output $B \to S + B$
aa	aB+B+B$	aa+++$	Output $s \to aB$
aaa	B+B+B$	a+++$	Match a
aaa	S+B+B+B$	a+++$	Output $B \to S + B$
aaa	aB+B+B+B$	a+++$	Output $s \to aB$
aaaa	B+B+B+B$	+++$	Match a
aaaa	+B+B+B$	+++$	Output $B \to \epsilon$
aaaa+	B+B+B$	++$	Match +
aaaa+	+B+B$	++$	Output $B \to \epsilon$
aaaa++	B+B$	+$	Match +
aaaa++	+B$	+$	Output $B \to \epsilon$
aaaa+++	B$	$	Match +
aaaa+++	$	$	Output $B \to \epsilon$

2 Exercise 2 (Bottom-Up Parsing): Consider the grammar G in the required Exercise 1:

2.1 Construct the SLR(1) parsing table for G. [20 points]

The CLOSURE of item set $\{[S' \to - > \cdot S]\}$ is $I_0 = CLOSURE([S' \to \cdot S) = \{[S' \to \cdot S], [S \to \cdot aB]\}$

So, there are:

$I_1 = GOTO(I_0, S) = \{[S' \to S \cdot]\}$

$I_2 = GOTO(I_0, a) = \{[S- > a \cdot B], [B \to \cdot S + B], [B \to \cdot \epsilon], [S \to \cdot aB]\}$

$GOTO(I_2, a) = I_2$

$I_3 = GOTO(I_2, B) = \{[S \to aB \cdot]\}$

$I_4 = GOTO(I_2, S) = \{[B \to S \cdot + B]\}$

$I_5 = GOTO(I_4, +) = \{[B \to S + \cdot B], [B \to \cdot S + B], [B \to \cdot \epsilon], [S \to \cdot aB]\}$

$GOTO(I_5, a) = I_2$

$GOTO(I_5, S) = I_4$

$I_6 = GOTO(I_5, B) = \{[B \to S + B \cdot]\}$

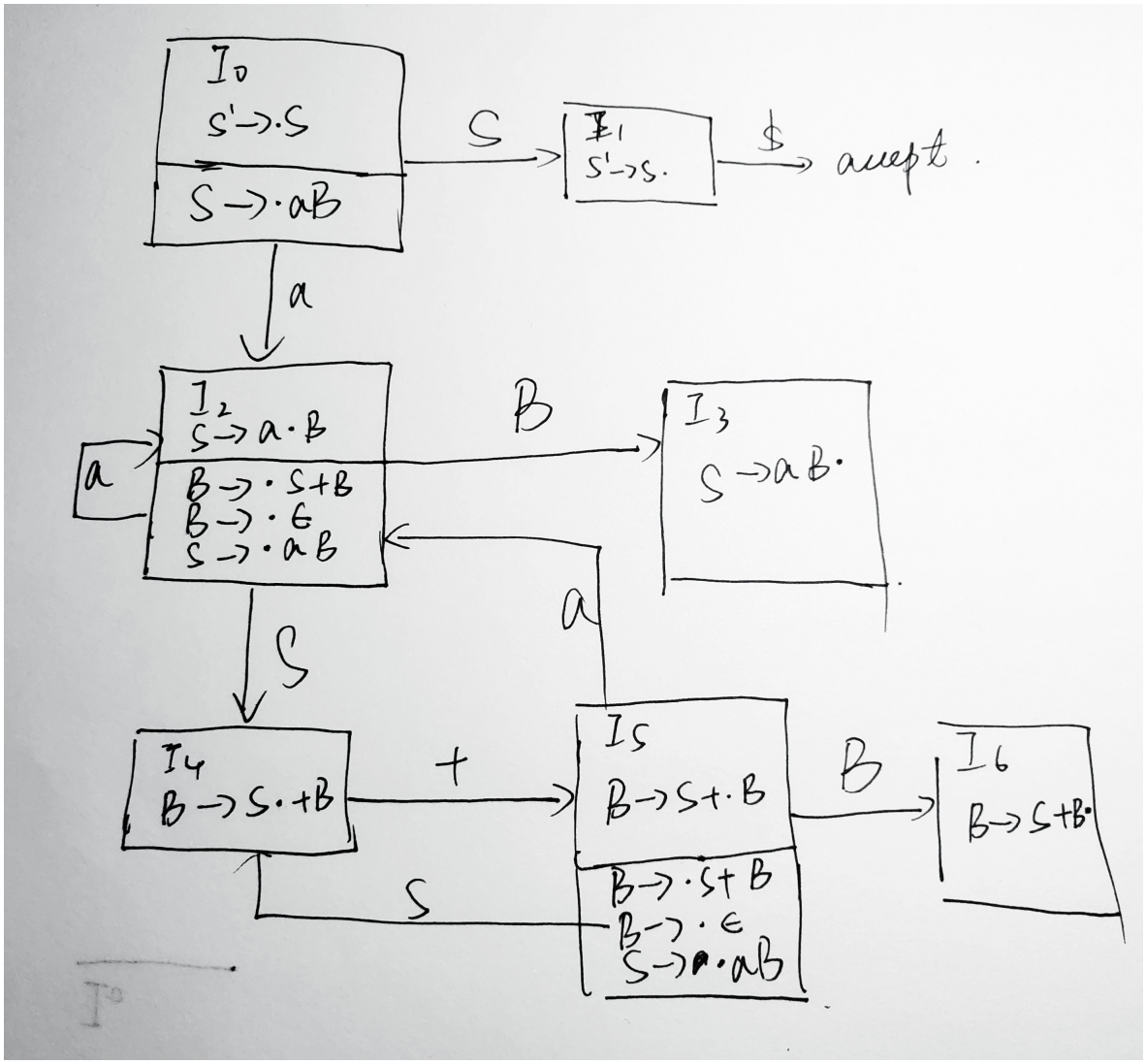

图 1

$(1)S \to aB(2)B \to S + B(3)B \to \epsilon$

表 3: Parsing Table

STATE	ACTION			GOTO	
	a	+	$	S	B
0	s_2			1	
1			*accept*		
2	s_2	r_3	r_3	4	3
3		r_1	r_1		
4		s_5			
5	s_2	r_3	r_3	4	6
6		r_2	r_2		

2.2 Is the grammar SLR(1)? [10 points]

Yes, it is, there is no conflict during the parsing table construction

2.3 Can an SLR(1) parser accept the input string aaaa+++? If yes, please list the moves made by the parser; otherwise, state the reason. Before parsing, please resolve conflicts if any. [20 points]

Yes, it can.

表 4

	STACK	SYMBOLS	INPUT	ACTION
0	0		aaaa+++$	Shift
1	02	a	aaa+++$	Shift
2	022	aa	aa+++$	Shift
3	0222	aaa	a+++$	Shift
4	02222	aaaa	+++$	Reduce $B \to \epsilon$
5	022223	aaaaB	+++$	Reduce $S \to aB$
6	02224	aaaS	+++$	Shift
7	022245	aaaS+	++$	Reduce $B \to \epsilon$
8	0222456	aaaS+B	++$	Reduce $B \to S + B$
9	02223	aaaB	++$	Reduce $S \to aB$
10	0224	aaS	++$	Shift
11	02245	aaS+	+$	Reduce $B \to \epsilon$
12	022456	aaS+B	+$	Reduce $B \to S + B$
13	0223	aaB	+$	Reduce $S \to aB$
14	024	aS	+$	Shift
15	0245	aS+	$	Reduce $B \to \epsilon$
16	02456	aS+B	$	Reduce $B \to S + B$
17	023	aB	$	Reduce $S \to aB$
18	01	S	$	Accept