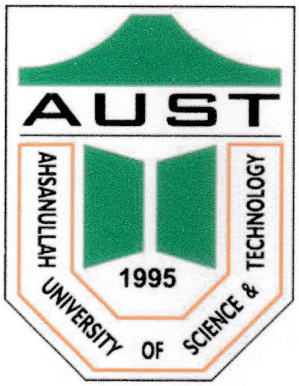

AHSANULLAH UNIVERSITY OF SCIENCE & TECHNOLOGY

CSE 4129

FORMAL LANGUAGES & COMPILERS LAB

Assignment 6 on Predictive Parsing

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Given,

The following grammar:

$S \rightarrow aXd$

$X \rightarrow YZ$

$Y \rightarrow b$

$Y \rightarrow \epsilon$

$Z \rightarrow cX$

$Z \rightarrow \epsilon$

The input string = abcd

1. Find the FIRST and FOLLOW sets of each of the non-terminals.

Soln:

FIRST(S) = {a}

FIRST(X) = {b, c, ε}

FIRST(Y) = {b, ε}

FIRST(Z) = {c, ε}

FOLLOW(S) = {$}

FOLLOW(X) = {d}

FOLLOW(Y) = {c, d}

FOLLOW(Z) = {d}

2. Construct the predictive parsing table for LL(1) method.

Soln:

Non-ter-minal	Input Symbol				
	a	b	c	d	$
S	$S \to aXd$				
X		$X \to YZ$	$X \to YZ$	$X \to YZ$	
Y		$Y \to b$	$Y \to \epsilon$	$Y \to \epsilon$	
Z			$Z \to cX$	$Z \to \epsilon$	

3. Demonstrate the moves of the LL(1) parser on the given input = abcd

Stack	Input	Action
S $	abcd $	S → aXd
aXd $	abcd $	match a
Xd $	bcd $	X → YZ
YZd $	bcd $	Y → b
bZd $	bcd $	match b
Zd $	cd $	Z → cX
cXd $	cd $	match c
Xd $	d $	X → YZ
YZd $	d $	Y → ϵ
Zd $	d $	Z → ϵ
d $	d $	match d
$	$	

4. Construct the LR(0) automaton for the grammar. We can derive an augmented Grammar Z from the given grammar.

Augmented G':

$S' \rightarrow S$

$S \rightarrow aXd$

$X \rightarrow YZ$

$Y \rightarrow b$

$Y \rightarrow \epsilon$

$Z \rightarrow cX$

$Z \rightarrow \epsilon$

Now, we've to find out the LR(0) automaton for the given grammar.

01 Initial state, I_0:

$\text{CLOSURE}(\{S' \rightarrow \cdot S\}) = \{S' \rightarrow \cdot S,\ S \rightarrow \cdot aXd\} = I_0$

02 state I_1:

$\text{GOTO}(I_0, S) = \{S' \rightarrow S\cdot\} = I_1$

$\text{GOTO}(I_1, \$) =$ accepted

03

04 State I_3:

GOTO $(I_2, X) = \{S \to aX \cdot d\} = I_3$

05 State I_4:

GOTO $(I_2, Y) = \{X \to Y \cdot Z,\ Z \to \cdot cX,\ Z \to \cdot\} = I_4$

Now, we've to find out the LR(0) automation for the given grammar.

01 Initial state, I_0:

CLOSURE $(\{S' \to \cdot S\}) = \{S' \to \cdot S,\ S \to \cdot aXd\} = I_0$

02 State I_1:

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

GOTO $(I_1, \$)$ = accepted

03 State I_2:

GOTO $(I_0, a) = \{S \to a \cdot Xd,\ X \to \cdot YZ,\ Y \to \cdot b,\ Y \to \cdot\} = I_2$

04 State I_3:

GOTO $(I_2, X) = \{S \to aX \cdot d\} = I_3$

05 State I_4:

06 State I_5:

GOTO $(I_2, b) = \{Y \to b\cdot\} = I_5$

07 State I_6:

GOTO $(I_3, d) = \{a \times d\cdot\} = I_6$

08 State I_7:

GOTO $(I_4, Z) = \{X \to YZ\cdot\} = I_7$

09 State I_8:

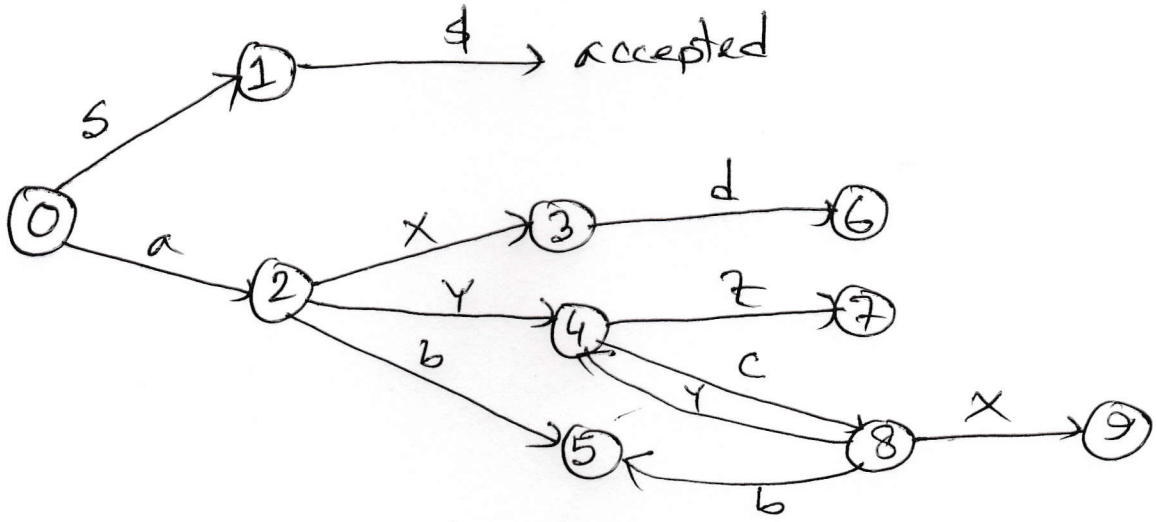
GOTO $(I_4, c) = \{Z \to c\cdot X, X \to \cdot YZ, Y \to \cdot b, Y \to \cdot\}$
$= I_8$

10 State I_9:

GOTO $(I_8, X) = \{Z \to cX\cdot\} = I_9$

11 GOTO $(I_8, Y) = \{X \to Y\cdot Z, Z \to \cdot cX, Z \to \cdot\} = I_4$

12 GOTO $(I_8, b) = \{Y \to b\cdot\} = I_5$



05 Construct the parsing table for LR(1) parsing with the grammar.

State	Action					GOTO			
	a	b	c	d	$	S	X	Y	Z
0	s2					1			
1					accepted				
2		s5	r4	r4			3	4	
3				s6					
4			s8	r6					7
5			r3	r3					
6					r1				
7				r2					
8		s5	r4	r4			9	4	
9				r5					

6 Demonstrate the moves of the LR(1) parse on the given input

	Stack Symbol	Stack State	Input	Action
0	$	0	abcd$	s2
1	$ab	02	bcd$	s5
2	$ab	025	cd$	r3(Y→b)
3	$aY	024	cd$	s8
4	$aYc	0248	d$	r4 (Y→ϵ)
5	$aYcY	02484	d$	r6(Z→ϵ)
6	$aYcYZ	024847	d$	r2(X→YZ)
7	$aYcX	02489	d$	r5(Z→cX)
8	$aYZ	0247	d$	r2(X→YZ)
9	$aX	023	d$	s6
10	$aXd	0236	$	r1(S→aXd)
11	$	01		accepted