

Roll No: _____

Name: _____

[Write your answers in the question paper itself. Be brief and precise.]

1. [LL(1) Parsing] Consider the following grammar.

$$\begin{aligned} S &\rightarrow UV \\ U &\rightarrow aU \mid bU \mid \varepsilon \\ V &\rightarrow aVa \mid bVb \mid cW \\ W &\rightarrow cW \mid \varepsilon \end{aligned}$$

(a) Write the FIRST and FOLLOW functions of the non-terminals.

[8]

Non-Terminal	FIRST	FOLLOW
S	$\{a, b, c\}$	$\{\$ \}$
U	$\{a, b, \varepsilon\}$	$\{a, b, c\}$
V	$\{a, b, c\}$	$\{a, b, \$ \}$
W	$\{c, \varepsilon\}$	$\{a, b, \$ \}$

(b) Using the values of Part (a), derive the LL(1) predictive parsing table for the given grammar. Write the complete productions in the table entries. [16]

Non-Terminal	Input symbol (terminal)			
	a	b	c	$\$$
S	$S \rightarrow UV$	$S \rightarrow UV$	$S \rightarrow UV$	
U	$U \rightarrow aU$ $U \rightarrow \varepsilon$	$U \rightarrow bU$ $U \rightarrow \varepsilon$	$U \rightarrow \varepsilon$	
V	$V \rightarrow aVa$	$V \rightarrow bVb$	$V \rightarrow cW$	
W	$W \rightarrow \varepsilon$	$W \rightarrow \varepsilon$	$W \rightarrow cW$	$W \rightarrow \varepsilon$

(c) From the table of Part (b), justify why the given grammar is **not** LL(1). Identify all the conflicts, and mention what kinds of conflicts are those. [4]

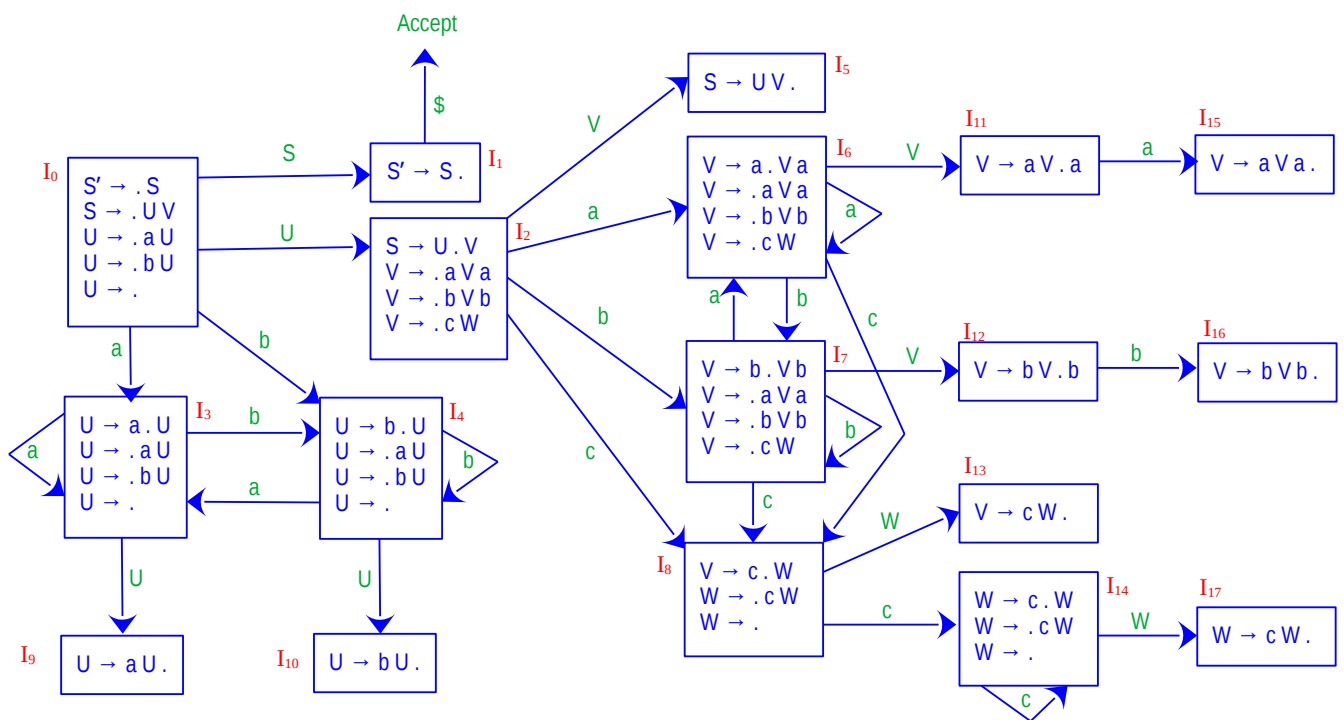
Two cells in the LL(1) parsing table contain multiple entries: the (U, a) -th cell, and the (U, b) -th cell. **Both** are FIRST / FOLLOW conflicts. These conflicts indicate that the grammar in question is **not** LL(1).

2. [SLR(1) Parsing] Let us continue to use the grammar of Exercise 1 (reproduced below).

$$\begin{aligned} S &\rightarrow UV \\ U &\rightarrow aU \mid bU \mid \varepsilon \\ V &\rightarrow aVa \mid bVb \mid cW \\ W &\rightarrow cW \mid \varepsilon \end{aligned}$$

(a) Draw the LR(0) automaton for this grammar in the space below.

[18]



(b) From your automaton of Part (a), derive the SLR(1) (simple LR(1)) parsing table, in the space below. Number the productions as follows. [12]

- (1) $S \rightarrow UV$ (3) $U \rightarrow bU$ (4) $U \rightarrow \varepsilon$
(2) $U \rightarrow aU$ (6) $V \rightarrow bVb$ (7) $V \rightarrow cW$
(5) $V \rightarrow aVa$ (9) $W \rightarrow \varepsilon$
(8) $W \rightarrow cW$

State	ACTION				GOTO			
	<i>a</i>	<i>b</i>	<i>c</i>	\$	<i>S</i>	<i>U</i>	<i>V</i>	<i>W</i>
0	s3 / r4	s4 / r4	r4		1	2		
1				Accept				
2	s6	s7	s8				5	
3	s3 / r4	s4 / r4	r4			9		
4	s3 / r4	s4 / r4	r4			10		
5				r1				
6	s6	s7	s8				11	
7	s6	s7	s8				12	
8	r9	r9	s14	r9				13
9	r2	r2	r2					
10	r3	r3	r3					
11	s15							
12		s16						
13	r7	r7		r7				
14	r9	r9	s14	r9				17
15	r5	r5		r5				
16	r6	r6		r6				
17	r8	r8		r8				

(c) Justify from the parsing table of Part (b) whether the grammar in question is SLR(1). [2]

Since six cells in the SLR(1) parsing table contains multiple entries indicating shift / reduce conflicts, the grammar in question is **not** SLR(1).

For rough work only
