



دانشگاه صنعتی اصفهان
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Q1) Determine the correctness of each statement below. for correct ones, briefly explain why, and for wrong ones, provide a counterexample

A) $LR(0) \subset LALR(1) \subset LR(2) \subset LR(1)$

B) any CFG can be parsed in $O(n^3)$

C) all unambiguous grammars can be parsed using $LR(1)$

Q2) compare $LR(1)$, $LALR(1)$ and $SLR(1)$ based on number of states and power

Q3) consider the following grammar

1: $S \rightarrow A B C$

1 – 2: $A \rightarrow a q A \mid \epsilon$

3 – 4: $B \rightarrow b B q A \mid \epsilon$

5 – 6: $C \rightarrow c C \mid \epsilon$

A) draw the **$SLR(1)$ state automata** and build the **parsing table** of this grammar

B) **parse** the following input and show the step-by-step status of **stack, input line** and **actions taken**

$a q b b q c c \$$

Q4) consider the following grammar

$S' \rightarrow S$

$S \rightarrow 0A0 \mid 1A1 \mid 0B1 \mid 1B0$

$A \rightarrow 2$

$B \rightarrow 2$

A) draw the **$LR(1)$ state automata**

B) build the **$LR(1)$ parsing table** of this grammar

C) is this grammar **$LALR(1)$** ?

If not, briefly describe **why**, otherwise combine states from part A to build the **$LALR(1)$ automata**.

Q5) Over the alphabet {0}, provide a grammar that...

A)

has **exactly one** shift/reduce conflict and **exactly one** reduce/reduce conflict in ***SLR*(1)**. Also, provide the sets and GOTO transitions of **state automata (starting from set 0)** that reaches those conflicts (you don't need to draw the whole automata)

B)

has **exactly 2** shift/reduce conflicts and **no** reduce/reduce conflict in ***LR*(1)**. Also, provide the sets and GOTO transitions of **state automata (starting from set 0)** that reaches those conflicts (you don't need to draw the whole automata)

Q6) Below is the *SLR(1)* parsing table of a grammar, along with the size of each production. find the whole grammar, explain with detail.

SLR table											
State	ACTION						GOTO				
	0	1	a	b	c	\$	S'	S	A	B	C
0			s4		s3			1	2		
1					acc						
2	s5										
3					r ₂						
4	r ₄		s4						6		
5				s8						7	
6	r ₃										
7		s9		s10							
8		r ₆		r ₆							
9					s12						11
10		r ₅		r ₅							
11					r ₁						
12					r ₇						

#	LHS	Size of RHS
0	S'	1
1	S	5
2	S	1
3	A	2
4	A	1
5	B	2
6	B	1
7	C	1

Q7) Consider the following grammar

$$\begin{aligned} S' &\rightarrow S \\ S &\rightarrow L = R ; \mid R \\ L &\rightarrow id \mid * R \\ R &\rightarrow L \end{aligned}$$

- A) draw its $LR(1)$ **state automata**
- B) using the answer for part A, tell which states should be **merged** together to get to **$LALR(1)$**
- C) construct $LALR(1)$ **parsing table**
- D) **parse** the following input and show the step-by-step status of **stack, input line** and **actions taken**

$id = id ;$

- E) show that this grammar is **not $SLR(1)$** , you don't need to draw the whole state diagram, start from state 0 and reach a conflict.