دانشگاه صنعتی اصفهان

دانشکده مهندسی برق و کامپیوتر

درس کامپایلر

تکلیف تئوری سوم

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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

$$\mathbf{1}: S \to A\ B\ C$$
$$\mathbf{2-3}: A \to a\ q\ A \mid \epsilon$$
$$\mathbf{4-5}: B \to b\ B\ q\ A \mid \epsilon$$
$$\mathbf{6-7}: C \to c\ C \mid \epsilon$$

A) draw the $\mathbf{SLR(1)}$ **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**

$$a\ q\ b\ q\ c\ c\ \$$$

Q4) consider the following grammar

$$S' \to S$$
$$S \to 0A0 \mid 1A1 \mid 0B1 \mid 1B0$$
$$A \to 2$$
$$B \to 2$$

A) draw the $\mathbf{LR(1)}$ **state automata**

B) build the $\mathbf{LR(1)}$ **parsing table** of this grammar

C) is this grammar $\mathbf{LALR(1)}$?

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

$$S' \rightarrow S$$
$$S \rightarrow L = R \; ; \mid R$$
$$L \rightarrow id \mid * R$$
$$R \rightarrow L$$

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

B) using the answer for part A, tell which states should be **merged** together to get to $LALR(\mathbf{1})$

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 $SLR(\mathbf{1})$,** you don't need to draw the whole state diagram, start from state 0 and reach a conflict.