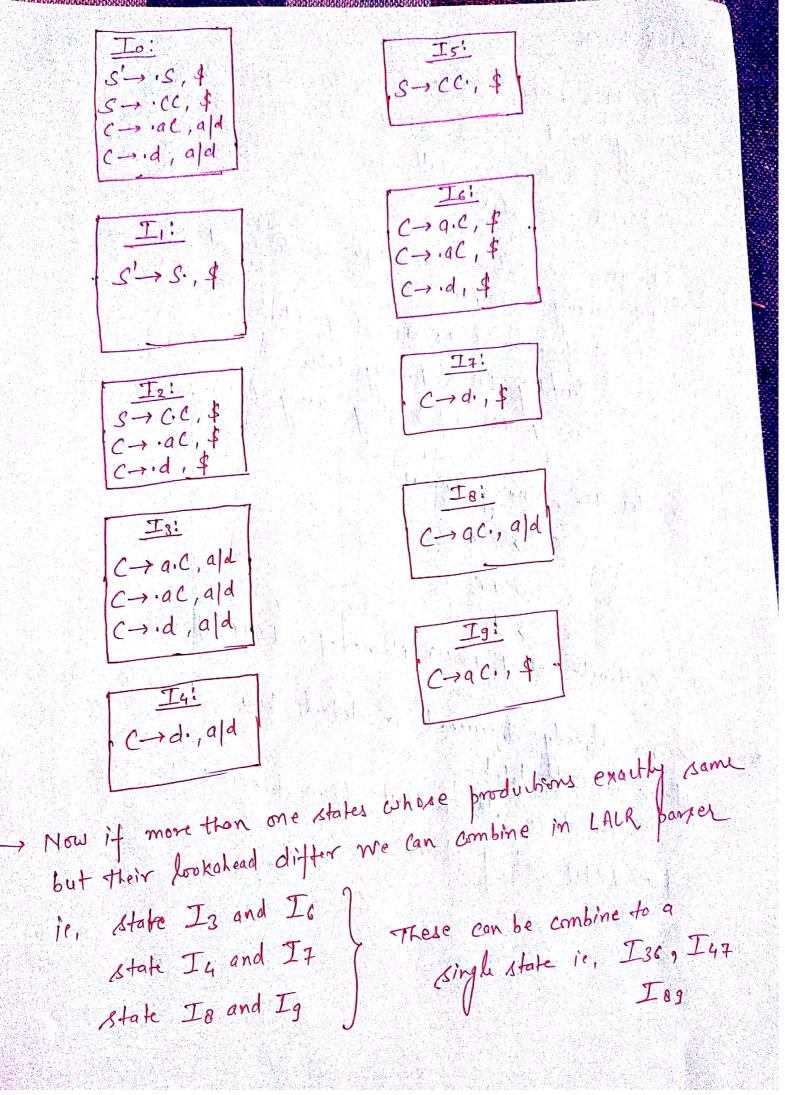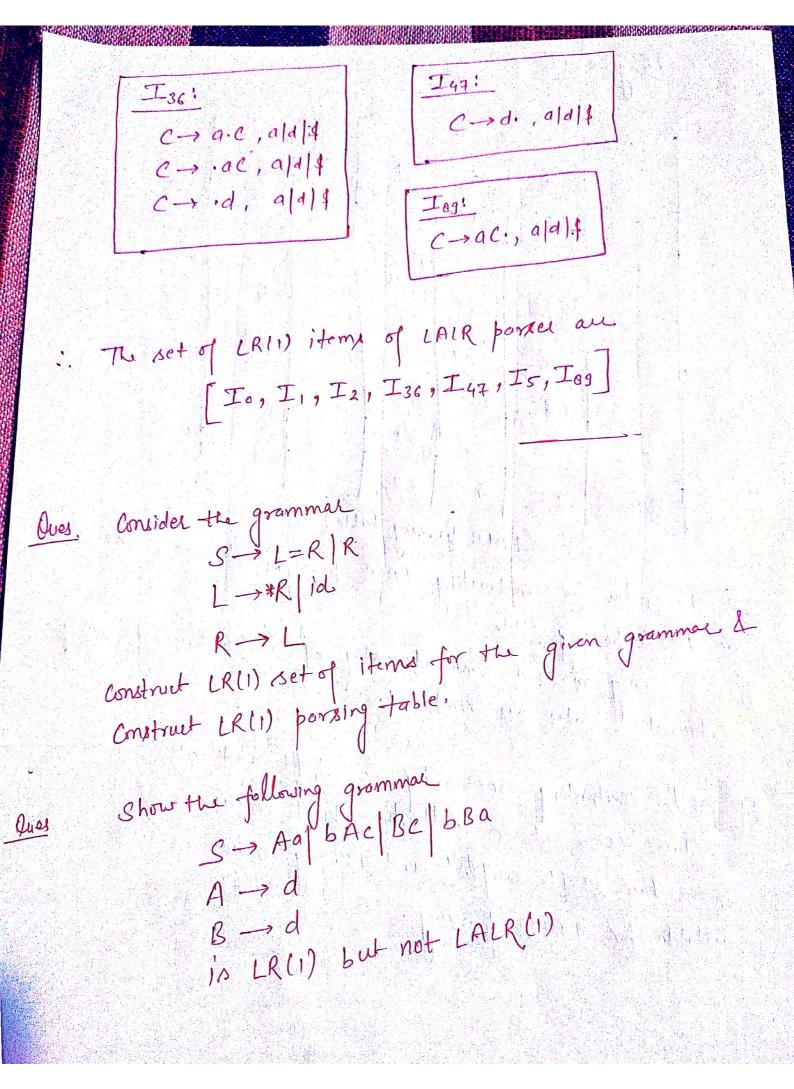## LALR parser

→ In this LALR (lookahead-LR) technique lookahead symbol is generated for each set of item. The table obtained by this method are smaller in size than Canonical LR parser ie. LR(1).

→ In this we follow same steps as discussed in Canonical LR parsing technique

(a) Construction of LR(1) set of items

(b) Building LALR parsing table

(c) Parsing the input string using LR(1) parsing table.

→ Consider the same grammar

$$S \rightarrow CC$$

$$C \rightarrow aC$$

$$C \rightarrow d$$

(i) Construct set of LR(1) items for LALR parser.

* As we already discussed in detail how set of LR(1) items are calculated.
   so take all output from previous parser for LR(1) set of items

I_0:
$S' \rightarrow \cdot S, \$$
$S \rightarrow \cdot CC, \$$
$C \rightarrow \cdot aC, a/d$
$C \rightarrow \cdot d, a/d$

I_5:
$S \rightarrow CC\cdot, \$$

I_1:
$S' \rightarrow S\cdot, \$$

I_6:
$C \rightarrow a\cdot C, \$$
$C \rightarrow \cdot aC, \$$
$C \rightarrow \cdot d, \$$

I_2:
$S \rightarrow C\cdot C, \$$
$C \rightarrow \cdot aC, \$$
$C \rightarrow \cdot d, \$$

I_7:
$C \rightarrow d\cdot, \$$

I_3:
$C \rightarrow a\cdot C, a/d$
$C \rightarrow \cdot aC, a/d$
$C \rightarrow \cdot d, a/d$

I_8:
$C \rightarrow aC\cdot, a/d$

I_9:
$C \rightarrow aC\cdot, \$$

I_4:
$C \rightarrow d\cdot, a/d$

→ Now if more than one states whose productions exactly same but their lookahead differ we can combine in LALR parser

i.e, state I_3 and I_6
state I_4 and I_7 These can be combine to a
state I_8 and I_9 single state i.e, I_{36}, I_{47}
                                                        I_{89}

I_{36}:

$C \rightarrow a \cdot C$, $a|d|\$$

$C \rightarrow \cdot aC$, $a|d|\$$

$C \rightarrow \cdot d$, $a|d|\$$

I_{47}:

$C \rightarrow d \cdot$, $a|d|\$$

I_{89}:

$C \rightarrow aC \cdot$, $a|d|\$$

∴ The set of LR(1) items of LALR parser are

$$\left[I_0, I_1, I_2, I_{36}, I_{47}, I_5, I_{89} \right]$$

_____

Ques. Consider the grammar

$$S \rightarrow L = R | R$$

$$L \rightarrow *R | id$$

$$R \rightarrow L$$

Construct LR(1) set of items for the given grammar &
Construct LR(1) parsing table.

Ques Show the following grammar

$$S \rightarrow Aa | bAc | Bc | bBa$$

$$A \rightarrow d$$

$$B \rightarrow d$$

is LR(1) but not LALR(1)

(ii) Building LALR parsing-table

State	Action			GOTO	
	a	d	$	S	C
				1	2
0	s36	s47			
1			Accept		
2	s36	s47			5
36	s36	s47			89
47	r3	r3	r3		
5			r1		
89	r2	r2	r2		

(LALR parsing table)

→ All the rules for constructing LALR parsing table is same as LR(1) parsing table only make a Combined entry of states & shift entry where the states are combined.

→ If while constructing one entry is shift and other is reduce then it is called shift-reduce conflict or reduce-shift conflict and the grammar is not suitable for LALR parsing.