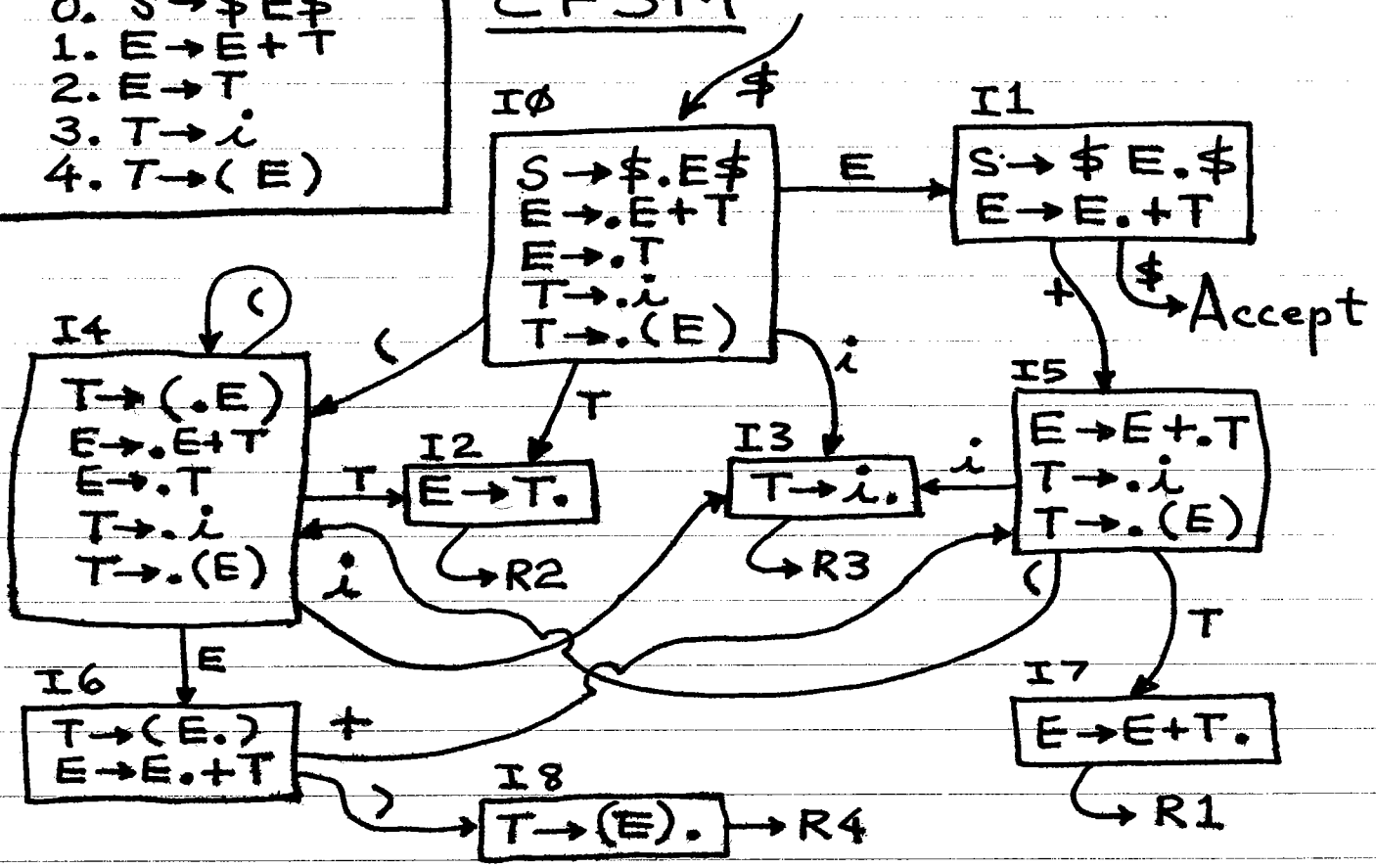
grammar

0. S' → $ E $
1. E → E + T
2. E → T
3. T → i
4. T → (E)

characteristic finite state machine

CFSM



Parse Table

state	action $	action +	action i	action (	action)	goto E	goto T
0	x	x	S3	S4	x	1	2
1	A	S5	x	x	x	–	–
2	R2	R2	R2	R2	R2	–	–
3	R3	R3	R3	R3	R3	–	–
4	x	x	S3	S4	x	6	2
5	x	x	S3	S4	x	–	7
6	x	S5	x	x	S8	–	–
7	R1	R1	R1	R1	R1	–	–
8	R4	R4	R4	R4	R4	–	–

cmps104a ETF-CFSM SLR(1)

grammar

0. S′ → $ E $
1. E → E + T
2. E → T
3. T → T * F
4. T → F
5. F → i
6. F → (E)

LR(0) conflicts

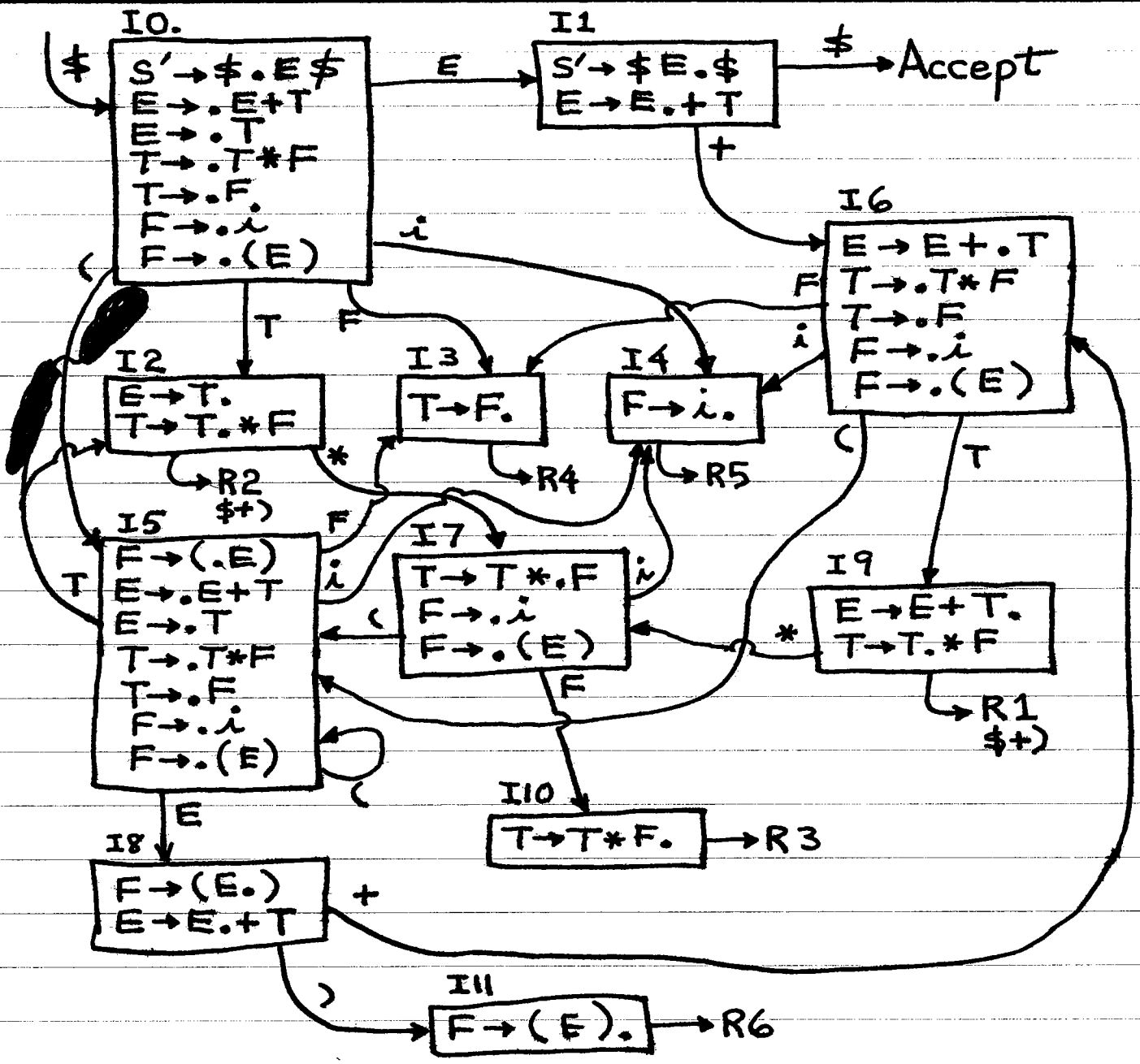
S/R in I2
S/R in I9

∴ not LR(0)

Follow sets

E: $ +)	$ +)
T: R_2 * R_1	* $ +)
F: R_4 R_3	* $ +)

no conflicts
∴ is SLR(1)



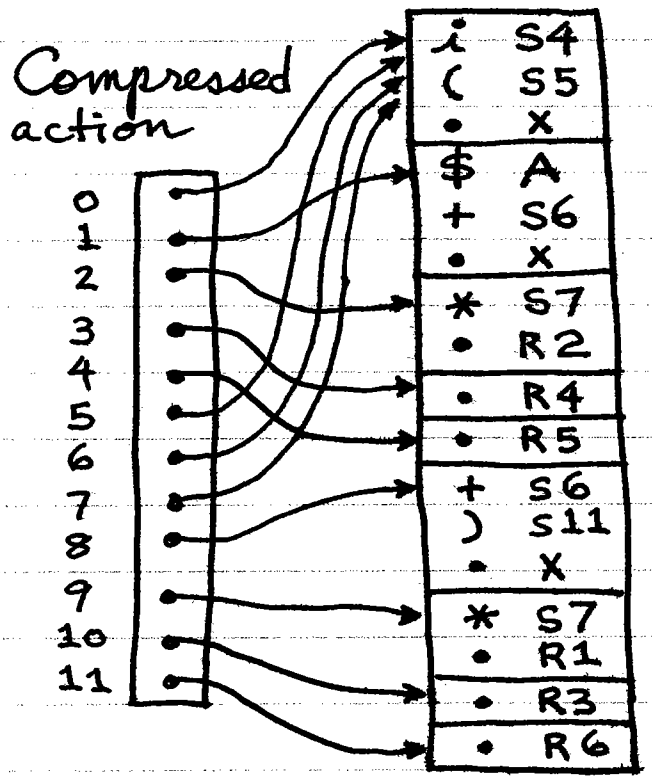
Parse table for ETF CFSM

	action						goto		
	$	+	*	i	(	)	E	T	F
0	x	x	x	S4	S5	x	1	2	3
1	A	S6	x	x	x	x	–	–	–
2	R2	R2	S7	–	–	R2	–	–	–
3	R4	R4	R4	–	–	R4	–	–	–
4	R5	R5	R5	–	–	R5	–	–	–
5	x	x	x	S4	S5	x	8	2	3
6	x	x	x	S4	S5	x	–	9	3
7	x	x	x	S4	S5	x	–	–	10
8	x	S6	x	x	x	S11	–	–	–
9	R1	R1	S7	–	–	R1	–	–	–
10	R3	R3	R3	–	–	R3	–	–	–
11	R6	R6	R6	–	–	R6	–	–	–

Table size = 12×9 = 108

note: action many rows same
repeated reduce
goto: rep in cols

Compressed action



Compressed goto

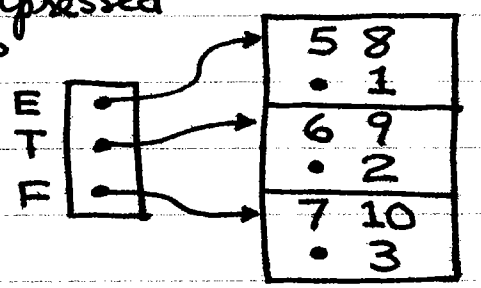


table size = 12 + 2×17
+ 3 + 2×6
= 61

compression $\frac{61}{108}$ = 56%

SLR(1)

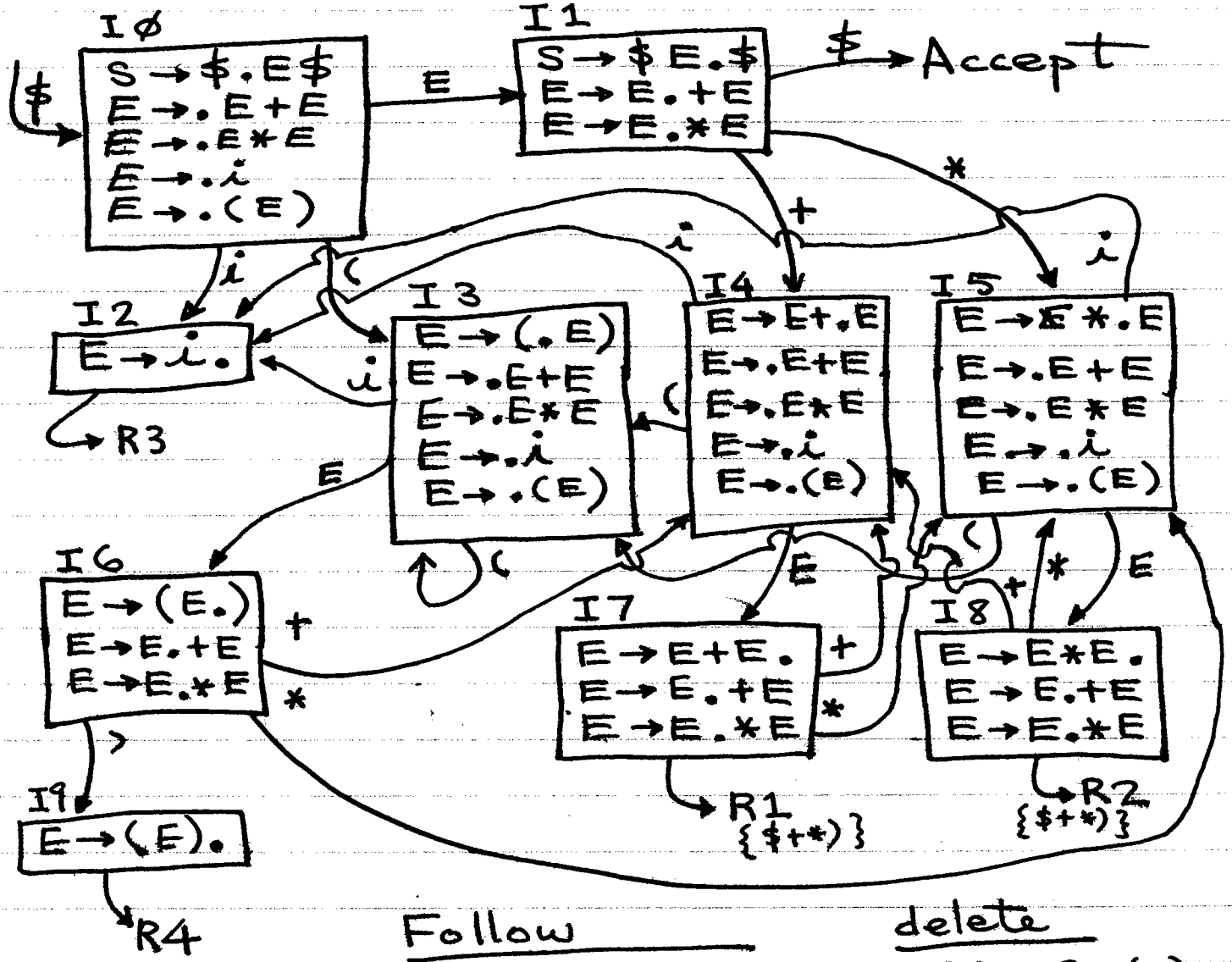
ambiguous ETF with precedence

0. S → $ E $
1. E → E + E
2. E → E * E
3. E → i
4. E → (E)

	+	*
+	>	<
*	>	>

conflicts

state	LR(0)	SLR(1)
7	SR	SR * SR +
8	SR	SR * SR +



Follow

S:
E: $ + *) R1 R2

delete

I8: S4(+)
S5(*)

I7: S4(+)
[redacted]
R1: LA(*)

LALR(1) ex (not SLR(1))

0. A → $ S $
1. S → L = R
2. S → R
3. L → * R
4. L → i
5. R → L

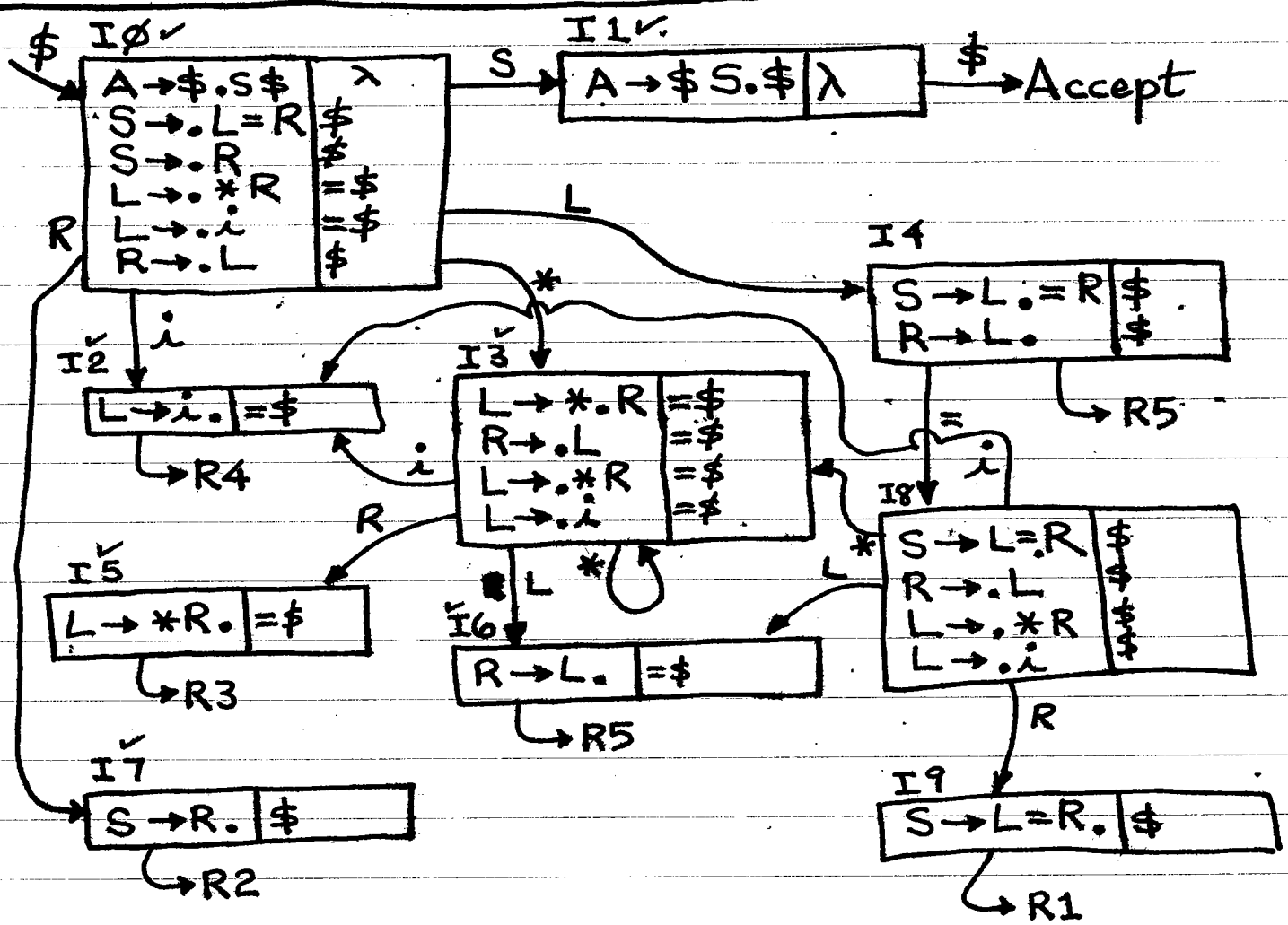
state 4: LR(0) S/R conf (=)

Follow

S: $	$	$
L: = R5		$ =
R: R3 R2 R1	$ = R5	$ =

state 4: SLR(1) S/R conf (=)

∴ not LR(0)
not SLR(1)



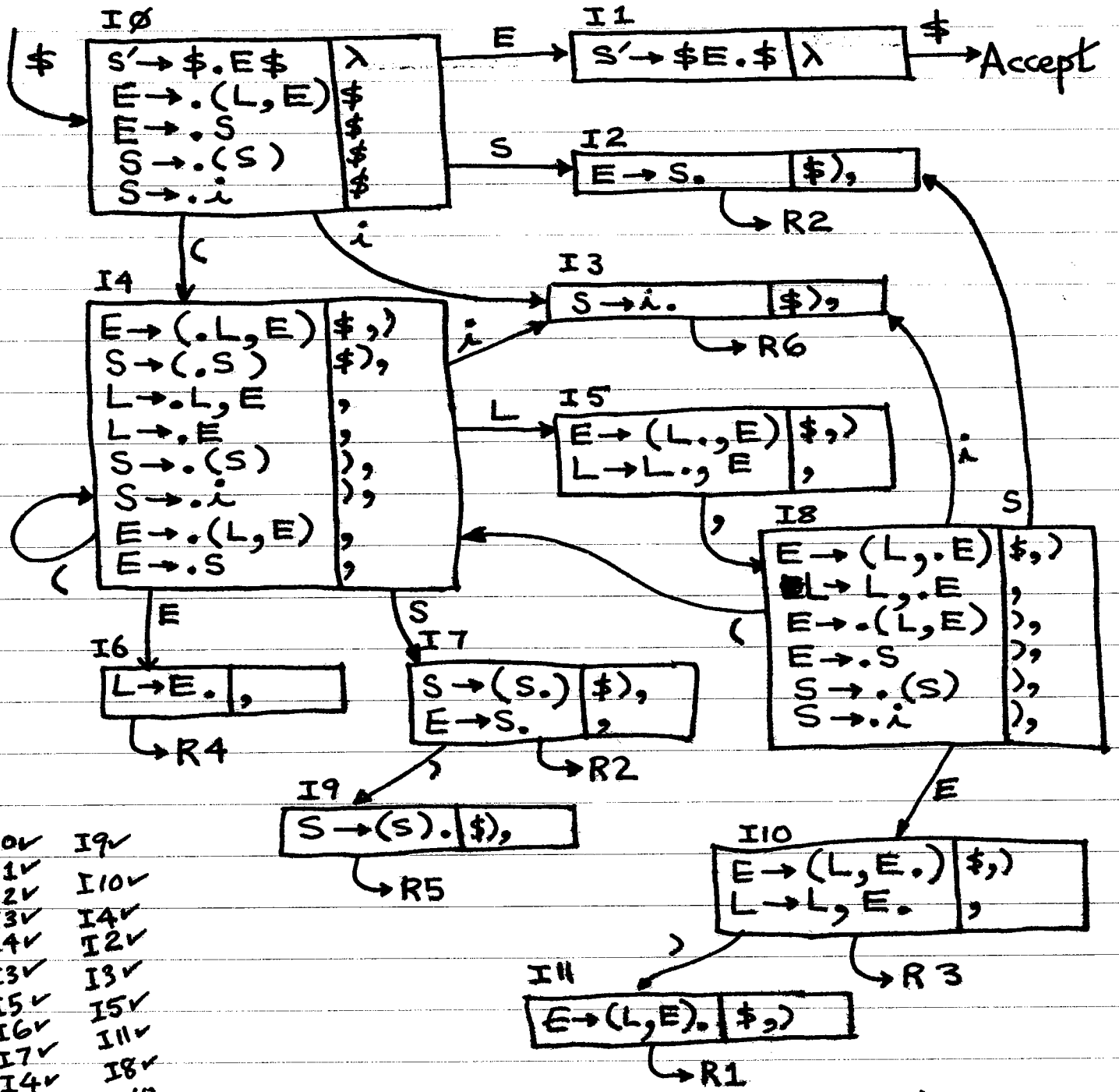
~~I0 I3~~
~~I1 I6~~
~~I2 I7~~
~~I5 I8~~
~~I4 I9~~
~~I7~~

I4 R5 {$}
shift {=}.

is LALR(1) ✓

0. S′→$ E $
1. E→(L,E)
2. E→S
3. L→L,E
4. L→E
5. S→(S)
6. S→i

Follow		
E: $ R4 R3)	$,)	I7: S/R: R2{$,)} vs S{)}
L: ,	,	
S: R2)	$,)	∴ not SLR(1)

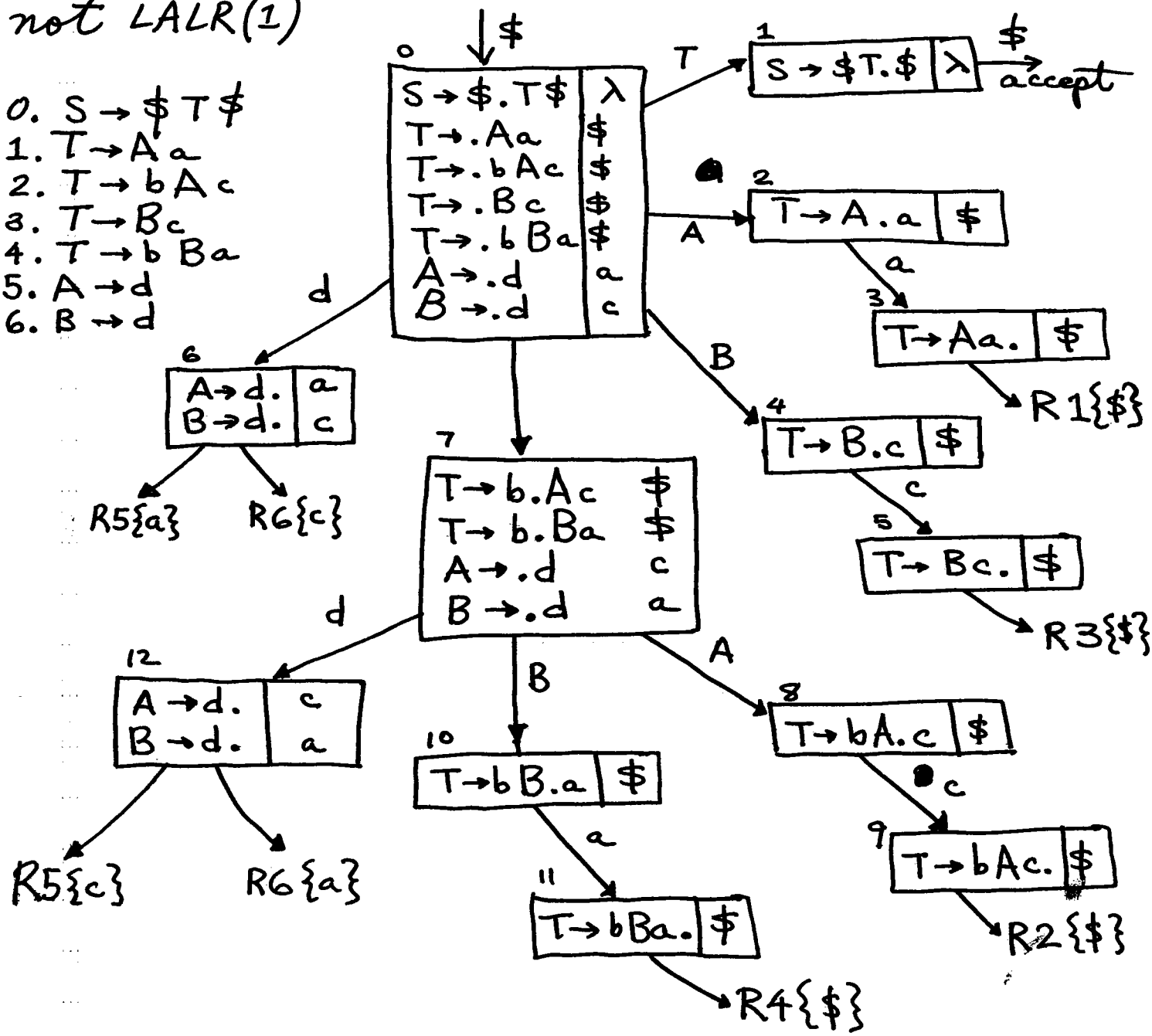


I0✓	I9✓
I1✓	I10✓
I2✓	I4✓
I3✓	I2✓
I4✓	I3✓
I5✓	I5✓
I6✓	I11✓
I7✓	I8✓
I4✓	I10
I8✓	I11

I7 solved: R2{,} ∴ is LALR(1)

is LR(1)
not LALR(1)

0. S → $ T $
1. T → A a
2. T → b A c
3. T → B c
4. T → b B a
5. A → d
6. B → d



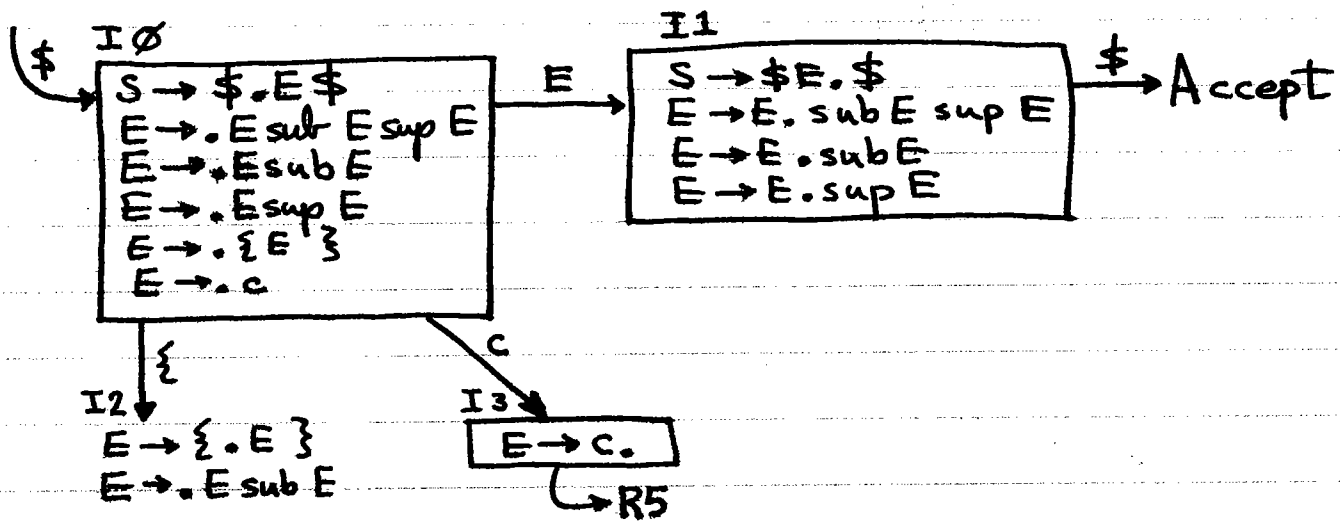
note: LALR(1) would merge states 6 and 12 and get a R/R conflict.

EQN (a_i^2)

ambiguous

0. S → $ E $
1. E → E sub E sup E
2. E → E sub E
3. E → E sup E
4. E → { E }
5. E → c

%right sub sup



%right sub sup
%right SUBSUP

```
expr : expr SUB expr SUP expr  %prec SUBSUP
     | expr SUB expr
     | expr SUP expr
     | '{' expr '}'
     | TOKEN
     ;
```