Problem with textbook SLR(1) definition: shift-reduce

conflict for: $A \to \alpha \cdot$ and $A \to \beta \cdot \gamma$ when $\text{FIRST}(\gamma) \cap \text{FOLLOW}(A) \neq \emptyset$.

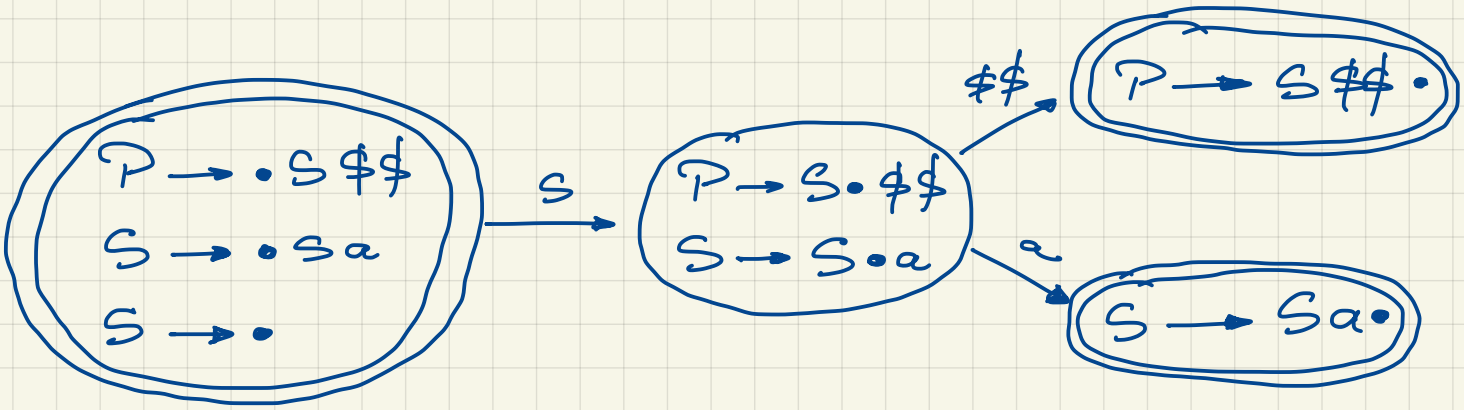
Counterexample:

$P \to S\ \$\$$

$S \to Sa$

$S \to \varepsilon$

X	FIRST(X)	FOLLOW(X)
P	a	$\emptyset$
S	a	a, $\$\$$

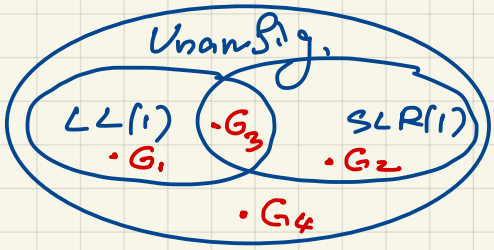


thus is no conflict here

even if $a \in \text{FIRST}(Sa) \cap \text{FOLLOW}(S)$

(thus is no shift on a, only reduce)

(G1) **LL(1), not SLR(1)**



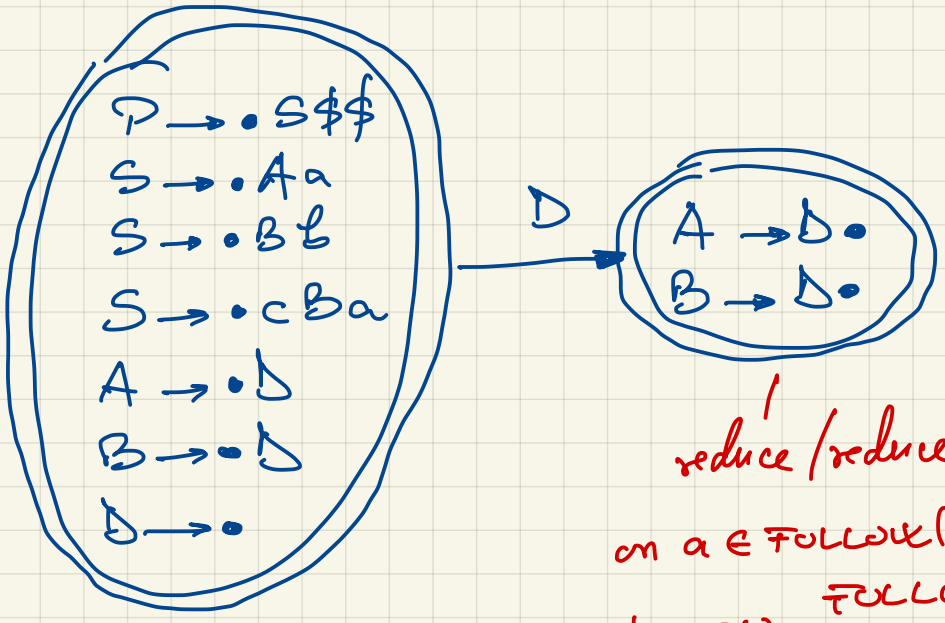
1. $P \to S\,\$\$$
2,3,4 $S \to Aa \mid Bb \mid cBa$
5. $A \to D$
6. $B \to D$
7. $D \to \varepsilon$

X	FIRST(X)	FOLLOW(X)
P	a, b, c	∅
S	a, b, c	$\$\$$
A	∅	a
B	∅	a, b
D	∅	a, b

i	PREDICT(i)
1.	a, b, c
2.	a
3.	b
4.	c
5.	a
6.	a, b
7.	a, b

no conflict ⇒ LL(1)

not SLR(1):



reduce/reduce conflict on $a \in FOLLOW(A) \cap FOLLOW(B)$

⇒ not SLR(1)

G_2 — SLR(1), not LL(1)

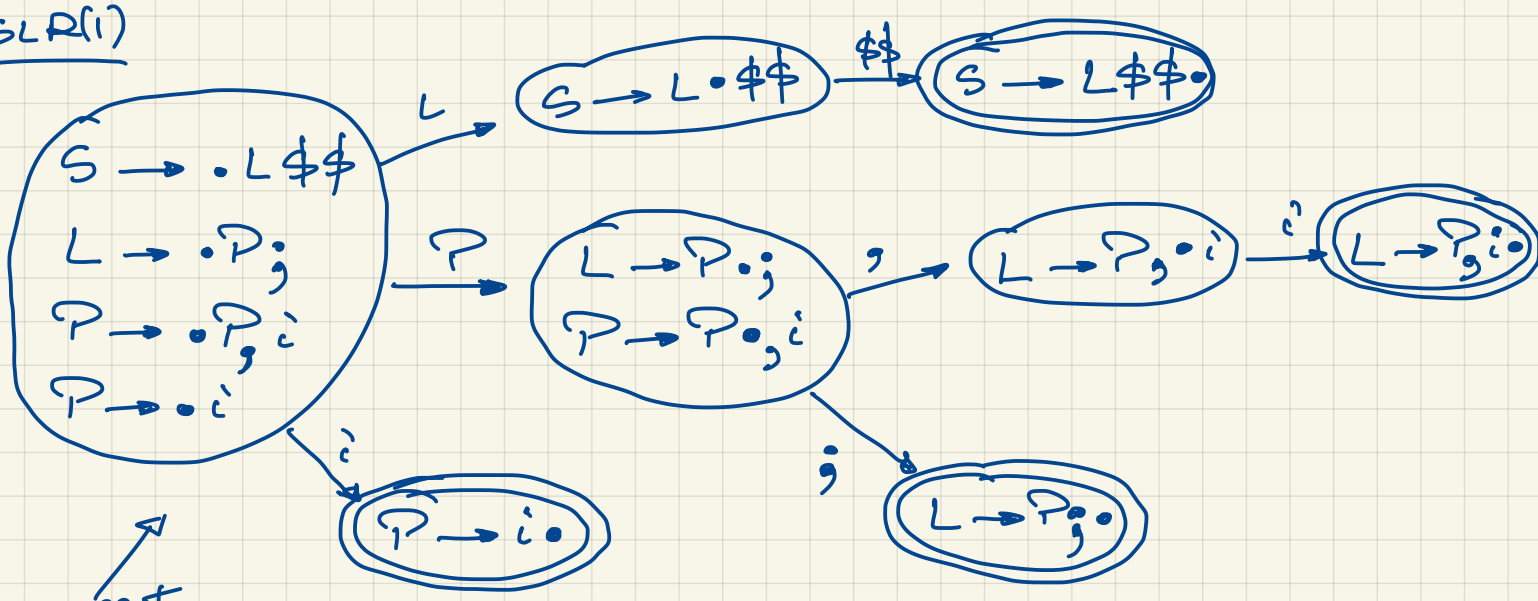
1. $S \to L\$\$$
2. $L \to P;$
3. $P \to P, i$
4. $P \to i$

X	FIRST(X)	FOLLOW(X)
S	i	∅
L	i	$$
P	i	, , ;

i	PREDICT(i)
1	i
2	i
3	i
4	i

conflict — not LL(1)

SLR(1)



no conflicts → SLR(1)

G_3 — LL(1), SLR(1)

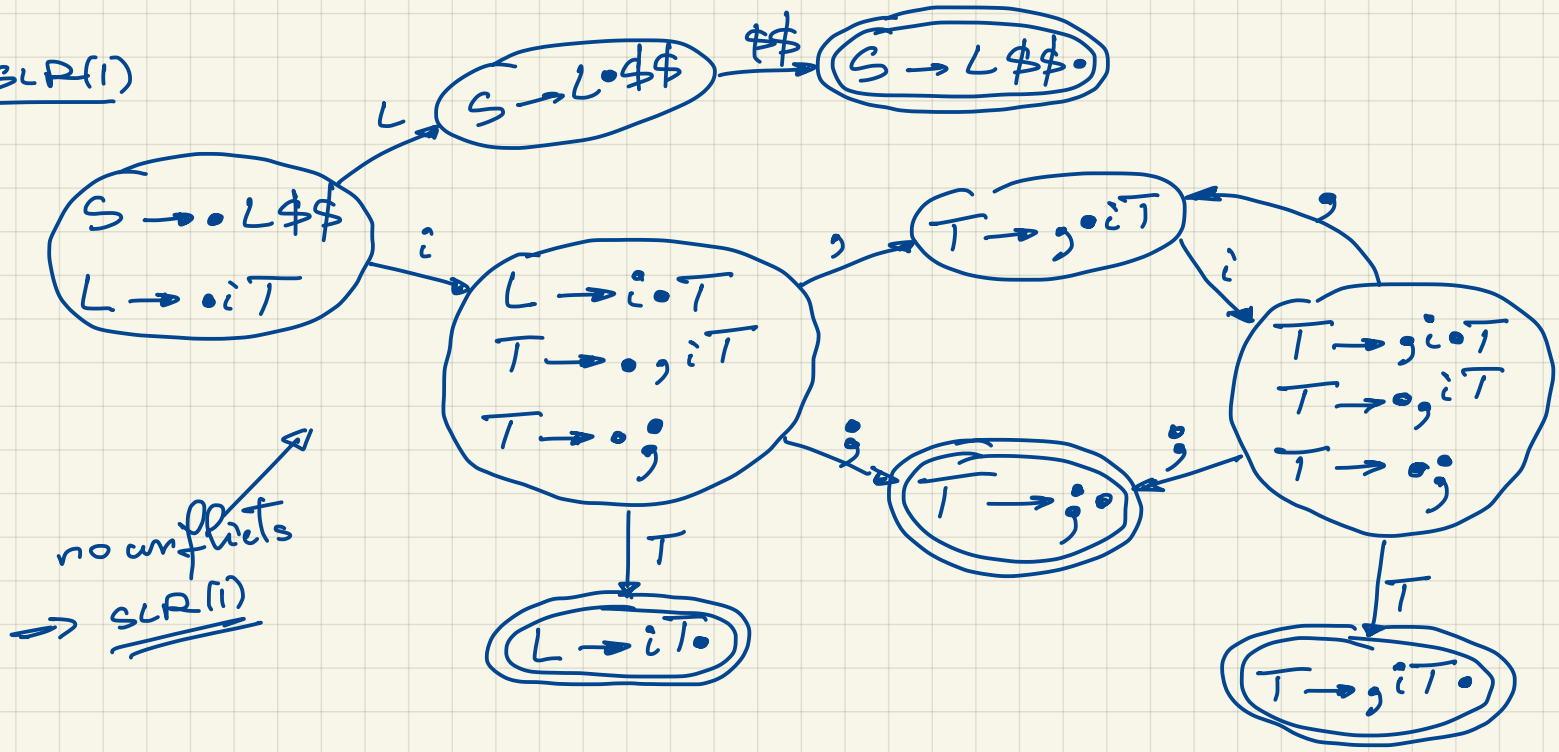
1. $S \to L\$\$$
2. $L \to iT$
3. $T \to ,iT$
4. $T \to ;$

X	FIRST(X)	FOLLOW(X)
S	i	∅
L	i	$$
T	, ;	$$

i	PREDICT(i)
1.	i
2.	i
3.	,
4.	;

no conflicts → LL(1)

SLR(1)



no conflicts → SLR(1)

G_4 Unambiguous, not LL(1), not SLR(1)

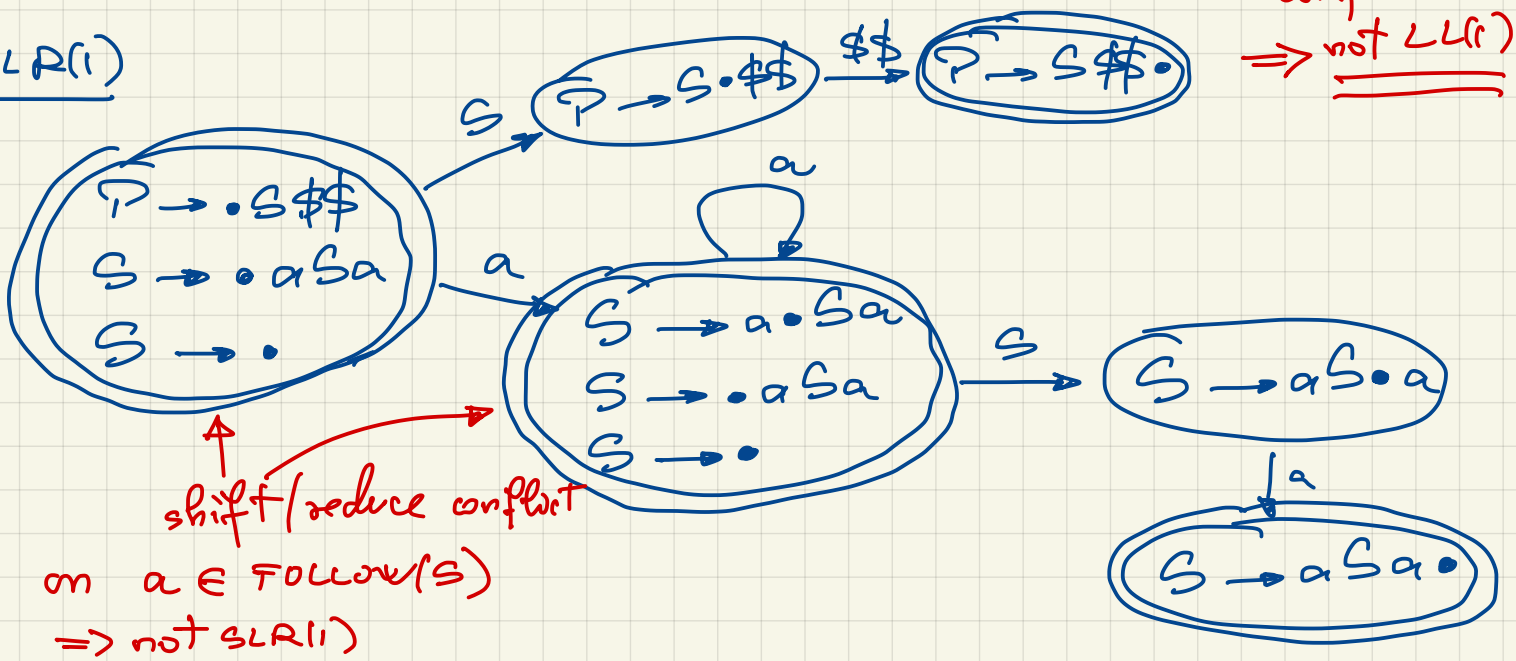
1. $P \to S\$\$$
2. $S \to aSa$
3. $S \to \varepsilon$

X	FIRST(X)	FOLLOW(X)
P	a, $$	∅
S	a	a, $$

i	PREDICT(i)
1.	a, $$
2.	a
3.	a, $$

conflict ⇒ not LL(1)

not SLR(1)



on $a \in FOLLOW(S)$ ⇒ not SLR(1)

unambiguous: $L(G) = \{ a^{2n}\$\$ \mid n \geq 0 \}$

- there is only one derivation for each $a^{2n}\$\$$:

$$P \to S\$\$ \Rightarrow aSa\$\$ \Rightarrow a^2Sa^2\$\$ \overset{n-2}{\Rightarrow} a^nSa^n\$\$$$

$$\Rightarrow a^{2n}\$\$$$

LL(1), SLR(1) – with ε

start with SLR(1), not LL(1):

$S \to L\,\$\$$

$L \to P;$

$P \to P;i$

$P \to i$

left-rec. elim. ⟹

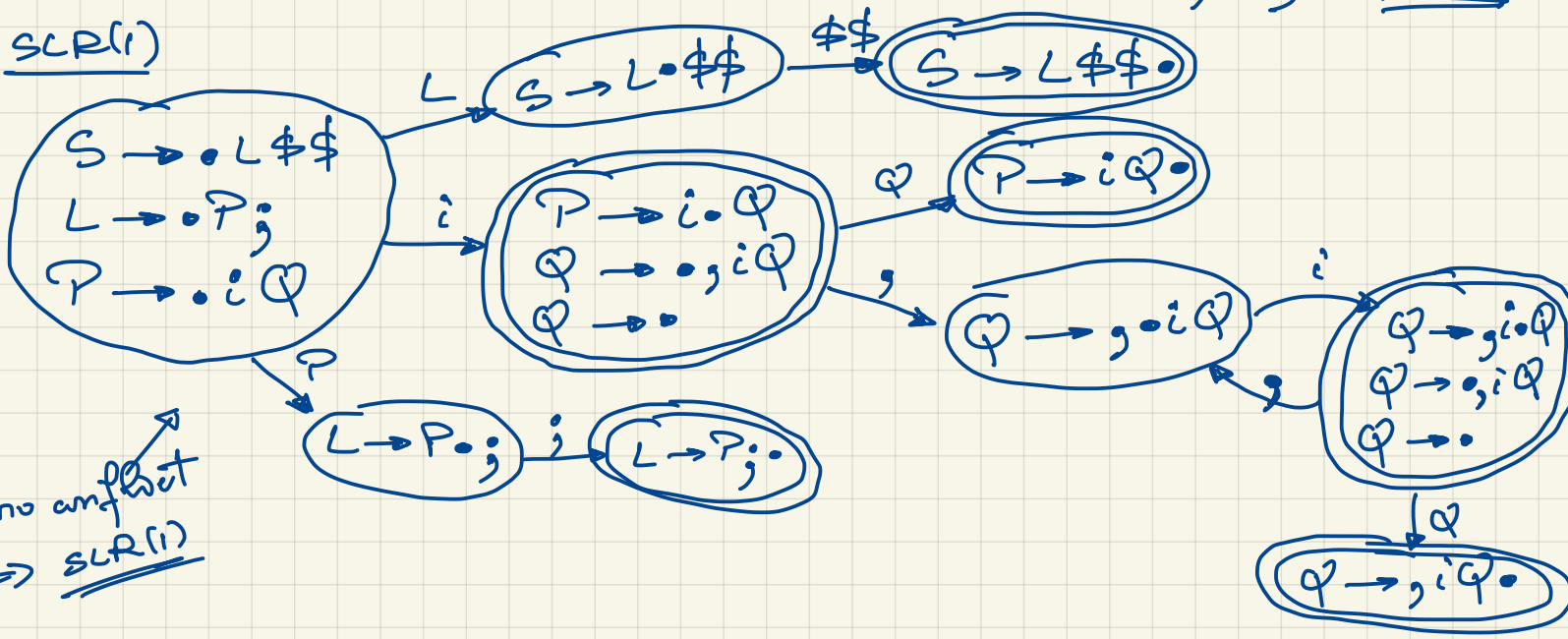
1. $S \to L\,\$\$$
2. $L \to P;$
3. $P \to i\,Q$
4. $Q \to ;i\,Q$
5. $Q \to \varepsilon$

X	FIRST(X)	FOLLOW(X)
S	i	∅
L	i	$$
P	i	;
Q	;	;

i	PREDICT(i)
1	i
2	i
3	i
4	;
5	;

no conflict ⇒ LL(1)

SLR(1)



no conflict ⇒ SLR(1)

parsing i;i;i; – shows the creation of a stack (out of the blue)