二.

1) $S \to SS \to S*S \to (S)*S \to (S+S)*S \to (a+S)*S \to (a+a)*S \to (a+a)*a$

2) $S \to SS \to Sa \to S*a \to (S)*a \to (S+S)*a \to (S+a)*a \to (a+a)*a$

3) ⑦提取左因子.   ⑪消除左递归.

$S \to SS' | (CS) | a$ $S \to (S)S'' | aS''$ ⇒ 最终文法.

$S' \to +S | S | *$ $S'' \to S'S'' | \varepsilon$ $S' \to +S | S | *$

4) 3)

4). 对于 $a+a*a$.

①

②
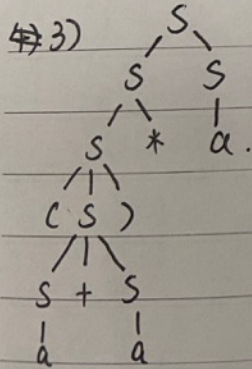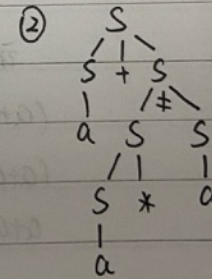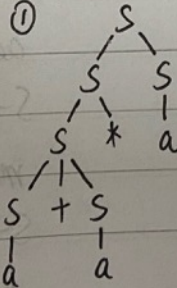
有两棵不同的语法树, 故有二义性.

6) ① 计算 nullable tokens

∵ S" → S'S" | ε ∴ S" 为 nullable token.

且 S → (S)S" | aS"

② First(S) = {(, a} First(S') = {+, (, a, *}. First(S") = {ε, +, (, a, *}.

First(() = {(} First()) = {)}. First(a) = {a}, First(+) = {+}. First(*) = {*}.

∴ First((S)S") = {(}. First(aS") = {a}. First(S'S") = {+, (, a, *}

First(ε) = {ε}. First(+S) = {+}, First(S) = {(, a}. First(*) = {*}.

对于 S → (S)S" | aS", First((S)S") ∩ First(aS") = ∅.

对于 S" → S'S" | ε, First(S'S") ∩ First(ε) = ∅.

对于 S' → +S | S | *, First(+S) ∩ First(S) ∩ First(*) = ∅.

③ First(S") = {ε, Follow(S") = {), $, +, (, a, *}.

∵ First(S") ∩ ~~First~~ Follow(S") = {+, (, a, *} ≠ ∅.

∴ 不为 LL(1) 文法.

7)

	a	(	)	*	+	$
S	S→aS"	S→(S)S"				
S'	S'→S	S'→S		S'→*	S'→+S	
S"	S"→S'S"	S"→S'S"	S"→ε	S"→S'S"	S"→S'S"	S"→ε
	S"→ε	S"→ε		S"→ε	S"→ε	

分析过程.

step	stack	input	action.
1	S$	(a+a)*a$	S→(S)S"
2	(S)S"$	(a+a)*a$	match
3	S)S"$	a+a)*a$	S→aS"
4	aS")S"$	a+a)*a$	match
5	S")S"$	+a)*a$	无产生式,无法分析. err.

S   S")S"$ +a)*a$ 多个产生式，无法分析 .err.

二.

1) 最右推导: $S \to SS+ \to SSS++ \to SSa++ \to SSS*a++ \to SSa*a++$
$\to Saa*a++ \to aaa*a++$.

∴与前 viable prefix: a Sa S SS SSa SSS SSS* SSS+ SS+.

增广文法: G': $S' \to S$, $S \to SS+ \mid SS* \mid a$.

2)

I₀ $S' \to \cdot S$
$S \to \cdot SS+$
$S \to \cdot SS*$
$S \to \cdot a$

$\xrightarrow{\;S\;}$

I₁ $S' \to S\cdot$
$S \to S\cdot S+$
$S \to S\cdot S*$
$S \to \cdot SS+$
$S \to \cdot SS*$
$S \to \cdot a$

$\xrightarrow{\;S\;}$

I₃ $S \to SS\cdot +$
$S \to SS\cdot *$
$S \to S\cdot S+$
$S \to S\cdot S*$
$S \to \cdot SS+$
$S \to \cdot SS*$
$S \to \cdot a$

I₂ $S \to a\cdot$

$\xrightarrow{\;+\;}$ I₄ $S \to SS+\cdot$

$\xrightarrow{\;*\;}$ I₅ $S \to SS*\cdot$
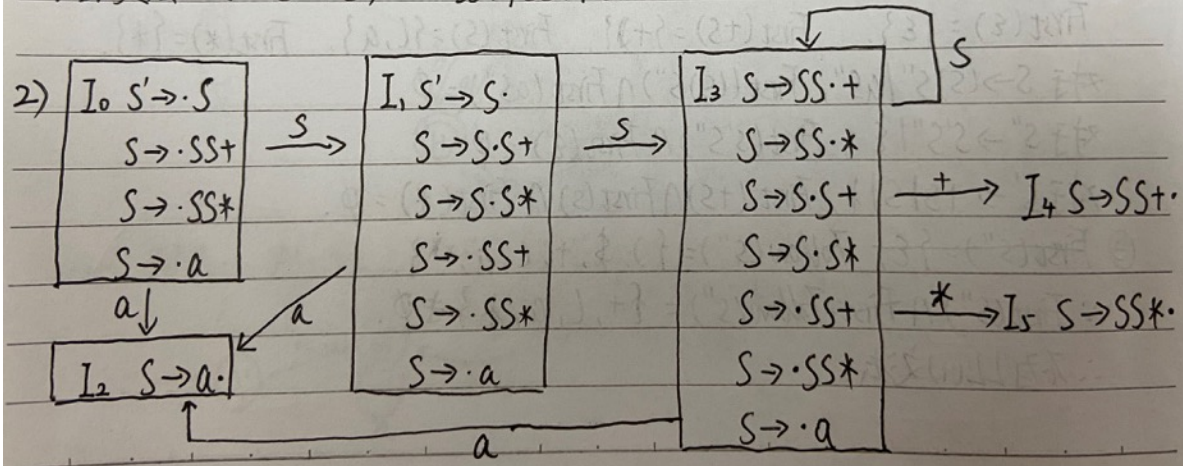
3) G': ① $S' \to S$ ② $S \to SS+$ ③ $S \to SS*$ ④ $S \to a$.

$Follow(S') = \{\$\}$ $Follow(S) = \{\$, +, *, a\}$.

	a	+	*	$	state S (Goto)
0	S2				1
1	S2			acc	3
2	r4	r4	r4	r4	
3	S2	S4	S5		3
4	r2	r2	r2	r2	
5	r3	r3	r3	r3	

4)

4)

step	stack	~~符号~~ input	Action	Goto
1	$0	aaa*a++$	S2	
2	$0a2	aa*a++$	r4	1
3	$0S1	aa*a++$	S2	
4	$0S1a2	a*a++$	r4	3
5	$0S1S3	a*a++$	S2	
6	$0S1S3a2	*a++$	r4	3
7	$0S1S3S3	*a++$	S5	
8	$0S1S3S3*5	a++$	r3	3
9	$0S1S3	a++$	S2	
10	$0S1S3a2	++$	r4	3
11	$0S1S3S3	++$	S4	
12	$0S1S3S3+4	+$	r2	3
13	$0S1&S3	+$	S4	
14	$0S1S3+4	$	r2	1
15	$0S1	$	acc	

三.

1) 判定是否为 LL(1) : First(AaAb) = {a}. First(BbBa) = {b}. First(A)=First(B)={ε}

First(AaAb) ∩ First(BaBb) = ∅. Follow(A) = {a,b}. Follow(B)={a,b}.

∴ First(A) ∩ Follow(A) = ∅.   First(B) ∩ Follow(B) = ∅.

∴ 此文法为 LL(1)文法.

2) 判断是否为 SLR(1)   Follow(S) = {$}. Follow(A)= {a,b}. Follow(B)= {a,b}.

∵ Follow(A) ∩ Follow(B) ≠ ∅. ∴ 产生 reduce - reduce 冲突. 不为 SLR(1)文法.