

1.
(1)

(1)

$$S \rightarrow a/\wedge/(T)$$
$$T \rightarrow T, S/S$$

消除左递归: $T \rightarrow ST'$

$$T' \rightarrow .ST'/\epsilon$$
$$S \rightarrow a/\wedge/(T)$$
$$\text{FIRST}(S) = \{a, \wedge, (\}$$
$$\text{FIRST}(T) = \{a, \wedge, (\}$$
$$\text{FIRST}(T') = \{., \epsilon\}$$
$$\text{FIRST}(a) = \{a\} \quad \text{FIRST}(\wedge) = \{\wedge\} \quad \text{FIRST}((T)) = \{(\}$$
$$\text{FIRST}(ST') = \{a, \wedge, (\}$$
$$\text{FIRST}(., ST') = \{., \}$$
$$\text{FIRST}(\epsilon) = \{\epsilon\}$$
$$\text{FOLLOW}(S) = \{#, \}$$
$$\text{FOLLOW}(T) = \{)\}$$
$$\text{FOLLOW}(T') = \{)\}$$

P(S)

```
IF ch = 'a' THEN read(ch);
ELSE IF ch = '\wedge' THEN read(ch);
ELSE IF ch = '('
BEGIN
  read(ch);
  P(T);
  IF ch = ')' THEN read(ch);
  ELSE ERROR
END
ELSE ERROR;
```

```
P(T)
BEGIN
  P(S);
  P(T');
END
```

```
P(T')
BEGIN
  IF ch = ','
  BEGIN
    read(ch);
    P(S);
    P(T');
  END
  ELSE IF ch = ')' THEN return;
  ELSE ERROR;
```

(2)

2) 根据其 FIRST 集和 FOLLOW 集判断, 是 LL(1) 的

预测分析表

	a	^	()	,	#
S	a	^	(T)			
T	ST'	ST'	ST'			
T'				ε	,ST'	

2.

(1)

2.

$$\text{FIRST}(E) = \text{FIRST}(T) - \{\epsilon\}$$

$$\text{FIRST}(E') = \{+, \epsilon\}$$

$$\text{FIRST}(T) = \text{FIRST}(F) - \{\epsilon\}$$

$$\text{FIRST}(T') = (\text{FIRST}(T) - \{\epsilon\}) \cup \{\epsilon\}$$

$$\text{FIRST}(F) = \text{FIRST}(P) - \{\epsilon\}$$

$$\text{FIRST}(F') = \{*, \epsilon\}$$

$$\text{FIRST}(P) = \{[, a, b, \wedge\}$$

$$\text{FIRST}(E) = \text{FIRST}(T) - \{\epsilon\}$$

$$\text{FIRST}(E') = \{+, \epsilon\}$$

$$\text{FIRST}(T) = \text{FIRST}(F) - \{\epsilon\}$$

$$\text{FIRST}(T') = (\text{FIRST}(T) - \{\epsilon\}) \cup \{\epsilon\}$$

$$\text{FIRST}(F) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(F') = \{*, \epsilon\}$$

$$\text{FIRST}(P) = \{[, a, b, \wedge\}$$

$$\rightarrow \text{FIRST}(E) = \text{FIRST}(T) - \{\epsilon\}$$

$$\text{FIRST}(E') = \{+, \epsilon\}$$

$$\text{FIRST}(T) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(T') = \{c, a, b, \wedge, \epsilon\}$$

$$\text{FIRST}(F) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(F') = \{*, \epsilon\}$$

$$\text{FIRST}(P) = \{[, a, b, \wedge\}$$

$$\rightarrow \text{FIRST}(E) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(E') = \{+, \epsilon\}$$

$$\text{FIRST}(T) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(T') = \{c, a, b, \wedge, \epsilon\}$$

$$\text{FIRST}(F) = \{c, a, b, \wedge\}$$

$$\text{FIRST}(F') = \{*, \epsilon\}$$

$$\text{FIRST}(P) = \{[, a, b, \wedge\}$$

$$\text{FOLLOW}(E) = \{\#, \}) \cup \text{FOLLOW}(E')$$

$$\text{FOLLOW}(E') = \text{FOLLOW}(E)$$

$$\text{FOLLOW}(T) = \{+, \# \} \cup \text{FOLLOW}(E) \cup \text{FOLLOW}(T')$$

$$\text{FOLLOW}(T') = \text{FOLLOW}(T)$$

$$\text{FOLLOW}(F) = \{c, a, b, \wedge \} \cup \text{FOLLOW}(T)$$

$$\text{FOLLOW}(F') = \text{FOLLOW}(F)$$

$$\text{FOLLOW}(P) = \{*\} \cup \text{FOLLOW}(F)$$

↓

$$\text{FOLLOW}(E) = \{\#, \})$$

$$\text{FOLLOW}(E') = \{\#, \})$$

$$\text{FOLLOW}(T) = \{+, \#, \})$$

$$\text{FOLLOW}(T') = \{+, \#, \})$$

$$\text{FOLLOW}(F) = \{c, a, b, \wedge, +, \#, \})$$

$$\text{FOLLOW}(F') = \{c, a, b, \wedge, +, \#, \})$$

$$\text{FOLLOW}(P) = \{*, c, a, b, \wedge, +, \#, \})$$

(2)

(2) E 仅有一个产生式, 满足

$$E': \text{FIRST}(E') = \{+, \epsilon\} \quad \text{FOLLOW}(E') = \{\#, \}) \quad \text{FIRST}(E') \cap \text{FOLLOW}(E') = \emptyset \quad \text{满足}$$

T 仅有一个产生式, 满足

$$T': \text{FIRST}(T') = \{c, a, b, \wedge, \epsilon\} \quad \text{FOLLOW}(T') = \{+, \#, \}) \quad \text{FIRST}(T') \cap \text{FOLLOW}(T') = \emptyset \quad \text{满足}$$

F 仅有一个产生式, 满足

$$F': \text{FIRST}(F') = \{*, \epsilon\} \quad \text{FOLLOW}(F') = \{c, a, b, \wedge, +, \#, \}) \quad \text{FIRST}(F') \cap \text{FOLLOW}(F') = \emptyset \quad \text{满足}$$

$$P: \text{FIRST}(P) = \{*\} \quad \text{FIRST}(a), \text{FIRST}(b), \text{FIRST}(\wedge) \text{ 两两相交为 } \emptyset, \text{ 满足}$$

∴ 是 LL(1) 文法

(3)

13) 预测分析表

	+	*	()	a	b	^	#
E		E → TE'	E → TE'	E → TE'	E → TE'	E → TE'	E → TE'	
E'	E' → +E			E' → ε				E' → ε
T			T → FT'		T → FT'	T → FT'	T → FT'	
T'	T' → ε		T' → T	T' → ε	T' → T	T' → T	T' → T	T' → ε
F			F → PF'		F → PF'	F → PF'	F → PF'	
F'	F' → ε	F' → *F'	F' → ε	F' → ε	F' → ε	F' → ε	F' → ε	F' → ε
P			P → (E)		P → a	P → b	P → ^	

(4)

```

P(E)
BEGIN
  P(T);
  P(E');
END

```

```

1/3/3/
BEGIN P(E')
  IF ch = '+' THEN
    BEGIN
      read ch;
      P(E);
    END
  ELSE IF ch = '#' or ch = ')' THEN
    return;
  ELSE ERROR;

```

```
P(T)
BEGIN
  P(F);
  P(T);
END
```

```
P(T')
IF ch IN {c, a, b, ^} THEN
  P(F) P(T);
ELSE IF ch IN {t, # } THEN
  return;
ELSE ERROR;
```

```
P(F)
BEGIN
  P(D);
  P(F');
END
```

```
P(F)
BEGIN
  P(D);
  P(F');
END
```


P(F')

IF ch = '*' THEN

BEGIN

read ch;

P(F');

END

ELSE IF ch IN {(, a, b, ^, +, #,)} THEN

return;

ELSE ERROR;

P(P)

IF ch = '(' THEN

BEGIN

read ch;

P(E);

IF ch = ')' THEN

read ch;

ELSE ERROR;

END

ELSE IF ch = 'a' THEN

read ch;

ELSE IF ch = 'b' THEN

read ch;

ELSE IF ch = '^' THEN

read ch;

ELSE ERROR;