

第13章

13.1.

P1. 例

P2. $\text{subtr}(x, 0) = x$

$$\text{greater}(x, y) = \text{subtr}(1, \text{subtr}(1, \text{subtr}(x, y)))$$

P3. $\text{equals}(x, y) = \text{subtr}(1, \text{add}(\text{subtr}(x, y), \text{subtr}(y, x)))$

P5. $\text{div}(x, y) = \text{div}(x - y, y) + \text{greater}(x - y, y)$

$$\text{div}(0, y) = 0$$

$$\text{rem}(x, y) = \text{min}(y, \text{rem}(x - y, y))$$

$$\text{rem}(0, y) = y$$

P4. $f(x, y) = f(x - 1, y) + 1 - \text{equals}(x, y)$

$$f(0, 0) = 0$$

P6. $f(x) = \text{mult}(2, f(x - 1))$

$$f(0) = 1$$

P7. $g(x, y) = \text{mult}(x, g(x, y - 1))$

$$g(x, 0) = 1$$

P8. 例

P10. 例

P9. $A(1, y) = A(0, A(1, y - 1))$

$$= A(0, A(0, \dots A(0, 0) \dots))$$

$$= y + 1$$

$$A(2, y) = A(1, A(1, \dots A(1, 1) \dots))$$

$$= A(1, A(1, \dots, 2) \dots)$$

$$= 2^{y+2}$$

$$A(4, y) = A(2, A(2, \dots A(2, 1) \dots))$$

从 $A(2, 1)$ 开始

$$2+3$$

$$2 \times 2 + 2 \times 3 + 3$$

$$2 \times 2 \times 2 + 2 \times 2 \times 3 + 2 \times 3 + 3$$

$$\vdots$$

$$A(3, y) = 2^{y+1} \cdot 3 (2^{y+1} - 1)$$

$$= 2^{y+3} - 3$$

P11 $A(4, y) = A(2, A(2, \dots A(2, 1) \dots))$

从 $A(2, 1)$ 开始

$$2^4 - 3$$

$$2^{2^4} - 3$$

\vdots

$$\underbrace{2^2}_{y \text{ 个 } 2} - 3$$

P12. 对

P13 显然, 有证明必要么?

P14 对

P15 (1) $y > 0$

(4) $ny(g(x, y)) = \{x \text{ 的因数} - 1\}$

(2) $y = 3 - 2^x \quad x \leq 1$
 $\text{不成立} \quad x > 2$

(3) $y = x - 1$

P16 $\text{pred}(y+1) = \text{pred}(y) + \text{Counter}(y, 0)$
 $\text{pred}(0) = 0$

13.2.

P1 (a) $P = \{v, b \rightarrow a \vee b \quad a \vee b \rightarrow ab \vee c\}$
 $A = \{b, ac\}$

(b) $C_N = \{q\} \quad A = \{q\}$

$P = \{v, q \rightarrow a \vee q \mid b \vee q \mid (c \vee q, \\ v, q \rightarrow v, v_1)\}$

(c) $A = \{q, q_1, q_2\} \quad C_N = \{q, q_1, q_2\}$

$$P = \{ v_1 q_1 v_2 q_2 v_3 q_3 \rightarrow a v_1 q_1 b v_2 c v_3 q_3, \\ v_1 q_1 v_2 q_2 v_3 q_3 \rightarrow v_1 v_2 v_3 \}$$

$$P_2. A = \{a\} \quad P_2 = \{ v_1 q v_1 \rightarrow a v_1 q v_1, a | b v_1 q v_1 b, \\ v_1 v_1 \}$$

$$C_A = \{q\}$$

$$P_3. a^{2^n}$$

$$P_4. L(a^{2^n} + (ab)^{2^n})$$

$$P_5. P = \{ v_1 \times v_2 = v_3 \rightarrow |v_1 \times v_2 = v_2 v_3| \\ v_1 \times |v_2 = v_1 v_3 \}$$

P6. 一个波斯特系统存在一个对应的无限制文法。

$$P_7. L_n = a L_{n-1}^2 \text{ 且 } L_0 = ab.$$

$$P_8. \text{若存在产生式 } x_1 v_1 x_2 v_2 \dots v_n x_{n+1} \rightarrow y_1 w_1 \dots w_n y_{n+1}$$

设 $w_i \notin X$, 引入非终止常量 q_{w_i}

原产生式中 w_i 改为 q_{w_i} , 引入产生式 $v_1 q_{w_i} v_2 \rightarrow v_1 w_i v_2$

P3.3.

$$P_1 \quad S \rightarrow S_1 S_2 \mid S_1 \rightarrow a S_1, S_2 \rightarrow a S_2 \mid S_1 \rightarrow b S_1, S_2 \rightarrow b S_2$$

$$S_1 \rightarrow \lambda, S_2 \rightarrow \lambda$$

p2. ww^R

p3. 该文法无法完全消去非终结变量. 无法产生语言.

p4. $abcb \rightarrow sab \rightarrow .ab$ 无法完全消去.

p5. $ab \rightarrow S \quad sb \rightarrow bs \quad sc \rightarrow \lambda$

p6. $ab \rightarrow sb \quad sb \rightarrow bs \quad sa \rightarrow \lambda \quad b \rightarrow S$

p7. $a \rightarrow aa \quad a \rightarrow a$

p8. aa^*