

A.  $\Sigma = \{0, 1\}$  일 때, 다음 언어들을 생성하는 Context-free Grammar를 만드시오. 단, 1개의 variable만을 사용하시오. ( $|V| = 1$ )

A.1  $\{w: 0 \leq n_0(w) < n_1(w)\}$

$S \rightarrow 1S \mid 0S_1 \mid S_0 \rightarrow 0 \sim 0$  이 포함 안됨 불가능

$S \rightarrow 1 \mid 1S \mid S_1 \mid 0S_1 \mid 1S_0 \mid 1S_1 \mid 01S \mid 10S \mid S_01 \mid S_10$

$01 \mid 01011$

$01S$

$0S_1$

$\downarrow$   
1이든 10S를 만들 수 있음

$1100011 \rightarrow$  불가능

$S \rightarrow 1 \mid 0SS \mid S_0S \mid SS_0 \mid SS$  가능

$S \rightarrow 1 \mid 1S \mid S_1 \mid 0SS \mid S_0S \mid SS_0$  가능

A.2  $\{w: 0 \leq n_0(w) = 2n_1(w)\}$

$S \rightarrow \varepsilon \mid S_{100} \mid S_{010} \mid S_{001} \mid S_{00} \mid 0S_{10} \mid 0S_{01} \mid 10S_0 \mid 01S_0 \mid \infty S_1$

$100S \mid 010S \mid 001S$

$\rightarrow \infty 111 \infty 00$  불가능

$S \rightarrow \varepsilon \mid 100 \mid 010 \mid 001 \mid SS \mid 1S_0 \mid 0S_{10} \mid 0S_{01} \mid 10S_0 \mid 01S_0 \mid \infty S_1$

$S \rightarrow \varepsilon \mid 0S_0S_1S \mid 0S_1S_0S \mid 1S_0S_0S \rightarrow$  가능

A.3  $\{w: 0 \leq n_0(w) = n_1(w)\}$

$S \rightarrow S_{01} \mid S_{10} \mid 0S_1 \mid 1S_0 \mid 01S \mid 10S \mid \varepsilon$

$0011 \mid 1100$

불가능

$S \rightarrow \varepsilon \mid 0S_1 \mid 1S_0 \mid SS \rightarrow$  가능

B. 다음 CFG  $G_8$ 을 Chomsky Normal Form으로 바꾸시오.

$$G_8: \begin{array}{l} A \rightarrow BAB | B | \varepsilon \\ B \rightarrow 00 | \varepsilon \end{array}$$

$$\left\{ \begin{array}{l} S \rightarrow A \\ A \rightarrow BAB | B | \varepsilon \\ B \rightarrow 00 | \varepsilon \end{array} \right.$$

$$\left\{ \begin{array}{l} S \rightarrow A \\ A \rightarrow BAB | B | \varepsilon | AB | BA \\ B \rightarrow 00 | \varepsilon \end{array} \right.$$

$$\left\{ \begin{array}{l} S \rightarrow A | \varepsilon \\ A \rightarrow BAB | B | \varepsilon | AB | BA | BB \\ B \rightarrow 00 \end{array} \right.$$

$$\left\{ \begin{array}{l} S \rightarrow A | \varepsilon \\ A \rightarrow BAB | B | AB | BA | BB | 00 \\ B \rightarrow 00 \end{array} \right.$$

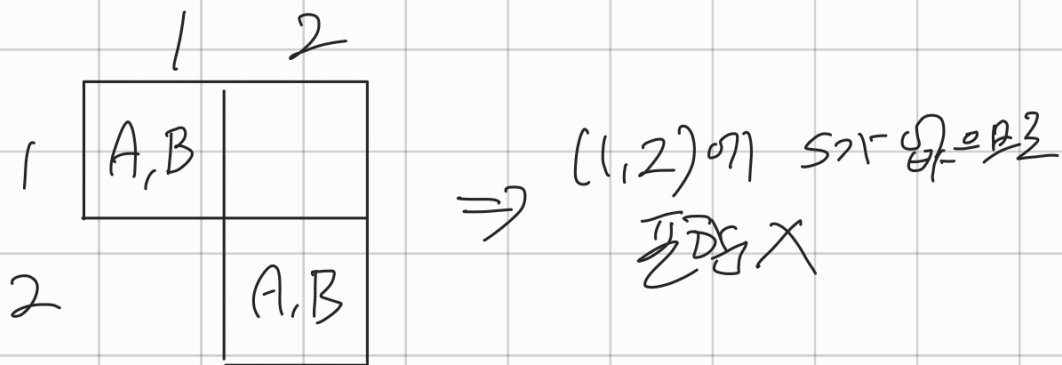
$$\left\{ \begin{array}{l} S \rightarrow A | \varepsilon | BAB | AB | BA | BB | 00 \\ A \rightarrow BAB | AB | BA | BB | 00 \\ B \rightarrow 00 \end{array} \right.$$

$$\left\{ \begin{array}{l} S \rightarrow \varepsilon | T | AB | BA | BB | UU \\ A \rightarrow TB | AB | BA | BB | UU \\ B \rightarrow UU \\ T \rightarrow BA \\ U \rightarrow 0 \end{array} \right.$$

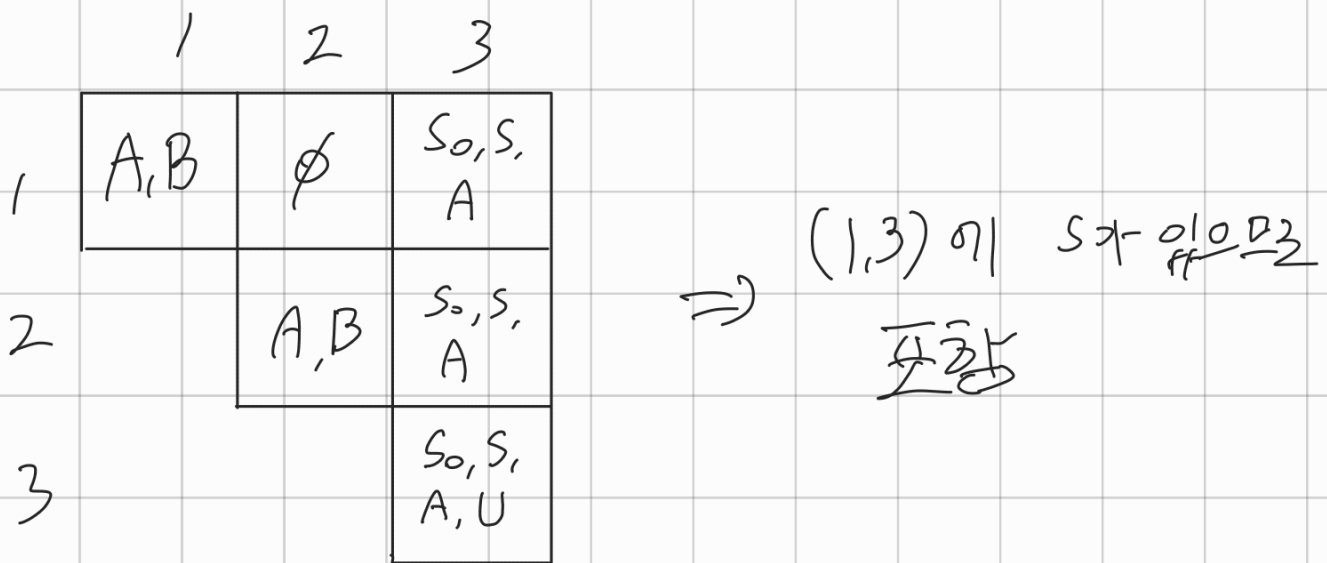
C. 강의자료 p10-11 및 위의 B. 에서 Chomsky Normal Form으로 바꾼 CFG  $G_7, G_8$  과 p12 의 결정 알고리즘을 이용하여 다음 단어  $w$  가 해당 언어에 포함되는지 여부를  $|w|$  행  $|w|$  열 테이블을 채워 결정하시오.

$$G_7 = \begin{array}{lcl} S_0 & \rightarrow & AA_1 \mid UB \mid a \mid SA \mid AS \\ S & \rightarrow & AA_1 \mid UB \mid a \mid SA \mid AS \\ A & \rightarrow & AA_1 \mid UB \mid a \mid SA \mid AS \mid b \\ B & \rightarrow & b \\ A_1 & \rightarrow & SA \\ U & \rightarrow & a \end{array}$$

C-1:  $bb \in L(G_7)$ ?



C-2:  $bba \in L(G_7)$ ?



C. 강의자료 p10-11 및 위의 B. 에서 Chomsky Normal Form으로 바꾼 CFG  $G_7, G_8$  과 p12 의 결정 알고리즘을 이용하여 다음 단어  $w$  가 해당 언어에 포함되는지 여부를  $|w|$  행  $|w|$  열 테이블을 채워 결정하시오.

$$G_8 = \begin{cases} S \rightarrow \varepsilon \mid TB \mid AB \mid BA \mid BB \mid UU \\ A \rightarrow TB \mid AB \mid BA \mid BB \mid UU \\ B \rightarrow UU \\ T \rightarrow BA \\ U \rightarrow \emptyset \end{cases}$$

C-3:  $000 \in L(G_8)$ ?

	1	2	3
1	U	S, A, B	$\emptyset$
2		U	S, A, B
3			U

$\Rightarrow$

(1,3)에 S가 있으므로 포함 X

C-4:  $0000 \in L(G_8)$ ?

	1	2	3	4
1	U	S, A, B	$\emptyset$	S, A, T
2		U	S, A, B	$\emptyset$
3			U	S, A, B
4				U

$\Rightarrow$

(1,4)에 S가 있으므로 포함