

Formal Language Selected Homework Chapter 6.3

2. Use the CYK algorithm to find a parsing of the string aab , using the grammar of Example 6.11.

Example 6.11

Determine whether the string $w = aabbb$ is in the language generated by the grammar

$$\begin{aligned} S &\rightarrow AB, \\ A &\rightarrow BB|a, \\ B &\rightarrow AB|b. \end{aligned}$$

4. Use the CYK method to determine if the string $w = aaabbbbab$ is in the language generated by the grammar $S \rightarrow aSb|b$.

Sub

2. Since aab is a prefix of the string in Example 6.11, we can use the V_{ij} computed there. Since $S \in V_{13}$, the string aab is in the language generated by the grammar and can therefore be parsed.

For parsing, we determine the productions that were used in justifying $S \in V_{13}$:

$S \in V_{13}$ because $S \rightarrow AB$, with $A \in V_{11}$ and $B \in V_{23}$,

$A \in V_{11}$ because $A \rightarrow a$,

$B \in V_{23}$ because $B \rightarrow AB$, with $A \in V_{22}$, $B \in V_{33}$,

$A \in V_{22}$ because $A \rightarrow a$,

$B \in V_{33}$ because $B \rightarrow b$.

This shows all the productions needed to justify membership; these can then be used in the parsing

$$S \Rightarrow AB \Rightarrow aB \Rightarrow aAB \Rightarrow aaB \Rightarrow aab.$$

Sol 4:

① Convert the grammar to Chomsky normal form.

$$S \rightarrow aSb \mid b \Rightarrow S \rightarrow ASB \mid b$$

$$A \rightarrow a$$

$$B \rightarrow b$$

$$\Rightarrow S \rightarrow AD \mid b$$

$$D \rightarrow SB$$

$$A \rightarrow a$$

$$B \rightarrow b$$

② CYK algo:

$$V_{11} = \{A\}, V_{22} = \{A\}, V_{33} = \{A\}, V_{44} = \{S, B\}, V_{55} = \{S, B\}, V_{66} = \{S, B\},$$

$$V_{77} = \{S, B\}, V_{88} = \{A\}, V_{99} = \{S, B\}$$

$$V_{12} = \emptyset, V_{23} = \emptyset, V_{34} = \emptyset, V_{45} = \{D\}, V_{56} = \{D\}, V_{67} = \{D\}, V_{78} = \emptyset, V_{89} = \emptyset$$

$$V_{13} = \emptyset, V_{24} = \emptyset, V_{35} = \{S\}, V_{46} = \emptyset, V_{57} = \emptyset, V_{68} = \emptyset, V_{79} = \emptyset$$

$$V_{14} = \emptyset, V_{25} = \emptyset, V_{36} = \{D\}, V_{47} = \emptyset, V_{58} = \emptyset, V_{69} = \emptyset$$

$$V_{15} = \emptyset, V_{26} = \{S\}, V_{37} = \emptyset, V_{48} = \emptyset, V_{59} = \emptyset$$

$$V_{16} = \emptyset, V_{27} = \{D\}, V_{38} = \emptyset, V_{49} = \emptyset$$

$$V_{17} = \{S\}, V_{28} = \emptyset, V_{39} = \emptyset$$

$$V_{18} = \emptyset, V_{29} = \emptyset$$

$$V_{19} = \emptyset$$

$\therefore w = a^3 b^4 a b \in L(G).$