

Formal Languages week4

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1 Chap3: 1(abc), 2(abc), 4(ab), 12, 15, 21, 25

1(abc) Let G be the grammar

$$S \rightarrow abSc|A$$

$$A \rightarrow cAd|cd$$

(a) Give a derivation of $ababccddcc$.

$$S \rightarrow abSc$$

$$\rightarrow ababScc$$

$$\rightarrow ababAcc$$

$$\rightarrow ababcAdcc$$

$$\rightarrow ababccddcc$$

(b) Build the derivation tree for the derivation in part (a).

I did above? \uparrow

(c) Use set notation to define $L(G)$

Base is cd .

otherwise you will have $c^*cd d^*$

Once you get to A you cannot return to S , so you will have 0 or more ab 's and 0 or more c 's at the end

$$\{ab^n c^m d^m c^n | n \geq 0, m > 0\}$$

2(abc) Let G be the grammar

$$S \rightarrow ASB|\lambda$$

$$A \rightarrow aAb|\lambda$$

$$B \rightarrow bBa|ba$$

- Give a leftmost derivation of $aabbba$.

AAAS

$$\begin{aligned}
 S &\rightarrow ASB \\
 &\rightarrow ASba \\
 &\rightarrow A\lambda ba \\
 &\rightarrow aAbba \\
 &\rightarrow aaAbbba \\
 &\rightarrow aa\lambda bbbba \\
 &\rightarrow aabbba
 \end{aligned}$$

- Give a rightmost derivation of $abaabbbabbaa$.

AAAASBAASBS

$$\begin{aligned}
 S &\rightarrow ASB \\
 &\rightarrow ASbBa \\
 &\rightarrow ASbbaa \\
 &\rightarrow AASBbbaa \\
 &\rightarrow aAbASBbbaa \\
 &\rightarrow a\lambda bASBbbaa \\
 &\rightarrow abASbabbbaa \\
 &\rightarrow abA\lambda babbbaa \\
 &\rightarrow abaAbbabbaa \\
 &\rightarrow abaaAbbbabbbaa \\
 &\rightarrow abaa\lambda bbbabbbaa \\
 &\rightarrow abaabbbabbbaa
 \end{aligned}$$

- ...

4(ab) Let DT be the derivation tree (in book)

- (a) Give a leftmost derivation that generates the tree DT .

10 Construct a grammar over $\{a, b\}$ whose language is $\{a^m b^n \mid 0 \leq n \leq m \leq 3n\}$.

$$S \rightarrow bSa \mid bSaaa \mid \lambda$$

12 Construct a grammar over $\{a, b\}$ whose language contains precisely the strings with the same

numbers of a 's and b 's

$$S \rightarrow aASb|\lambda$$

$$A \rightarrow aAb|aabb$$

- 15 The set of strings over $\{a, b, c\}$ in which all the a 's precede the b 's, which in turn precede the c 's. It is possible that there are no a 's, b 's, or c 's.

$$S \rightarrow ABC|\lambda$$

$$A \rightarrow aA|a|\lambda$$

$$B \rightarrow bB|b|\lambda$$

$$C \rightarrow cC|c|\lambda$$

- 21 The set of strings over $\{a, b\}$ that do not contain the substring aba .

$$S \rightarrow AaB$$

$$A \rightarrow aAa|a$$

$$B \rightarrow bBb|b$$

- 25 The set of strings over $\{a, b\}$ with an even number of a 's or an odd number of b 's.

$$S \rightarrow AB$$

$$A \rightarrow aAa|aa$$

$$B \rightarrow bBb|b$$