

CS3311
Nov. 2, 2012
Friday ①

Last time:

parsing



given a string, and a CFG

what is the derivation sequence that

leads to this string?

start with S ,
try everything
exponential

binary tree 2^n

n : length of the
string

a modi

start with the string, so
"backward"

CYK algorithm.

deterministic
parsing
with
lookheads
 $O(n)$

$O(n^2)$

$4\underline{n^3} + 2n^2 + 4$

$8n^3$

$O(n^3)$

$n \log n$

$$G: \begin{array}{l} S \rightarrow aS \mid cA \\ A \rightarrow bA \mid cB \mid \lambda \\ B \rightarrow aB \mid a \mid \lambda \end{array}$$

(2)

string: acbb

$$\begin{array}{c} S \xrightarrow{S \rightarrow aS} aS \xrightarrow{S \rightarrow cA} acA \xrightarrow{A \rightarrow bA} acbA \\ \downarrow \qquad \qquad \qquad \downarrow \qquad \qquad \qquad \downarrow \\ acbb \qquad acbb \qquad acbb \end{array}$$

$$\begin{array}{c} A \xrightarrow{A \rightarrow bA} acbbA \Rightarrow acbb\cancel{A} \\ \downarrow \qquad \qquad \qquad \downarrow \\ acbb \end{array}$$

with length - 1 looked we were always able to determine the next production rule that will be used.

$O(n)$

Hold many characters are needed for lookahead?

Example 19.1.1

$$G_1: S \rightarrow Aabd \mid cA bcd$$

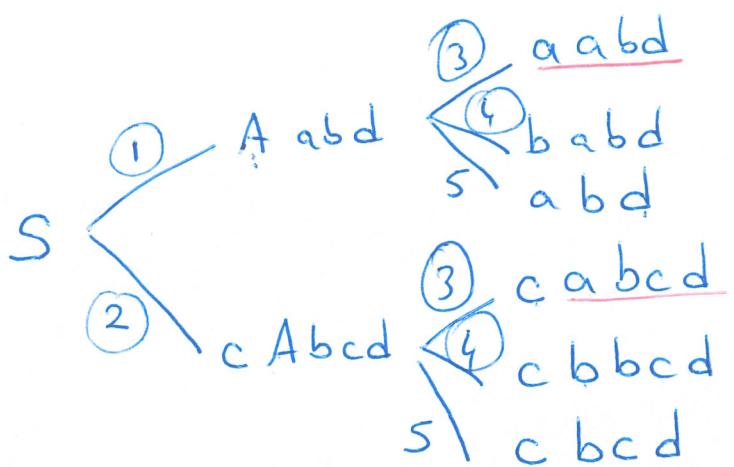
$$A \rightarrow a b \mid a$$

(3)

Grammar graph

- ① $S \rightarrow Aabd$
- ② $S \rightarrow cA bcd$
- ③ $A \rightarrow a$
- ④ $A \rightarrow b$
- ⑤ $A \rightarrow a$

do a leftmost derivation



$$\begin{aligned} LA(A \rightarrow a) &= \{ \underline{abcd}, \underline{aab}d \} \\ LA(A \rightarrow b) &= \{ \underline{ba}bd, \underline{bb}bcd \} \\ LA(A \rightarrow a) &= \{ \underline{abd}, \underline{bcd} \} \end{aligned}$$

looked-ahead 0

$$\begin{aligned} LA(S \rightarrow Aabd) &= \{ aabd, babd, abd \} \\ LA(S \rightarrow cAbcd) &= \{ cabcd, cbcd \} \end{aligned}$$

A looked-ahead of length 1 is sufficient to determine which S rule should be used.

ab	aa	abc	acb
ba	bb	bab	bba
ab	bc	abd	bcd

length - 3

looked-ahead is sufficient.

LL(k)

→ looked-ahead length

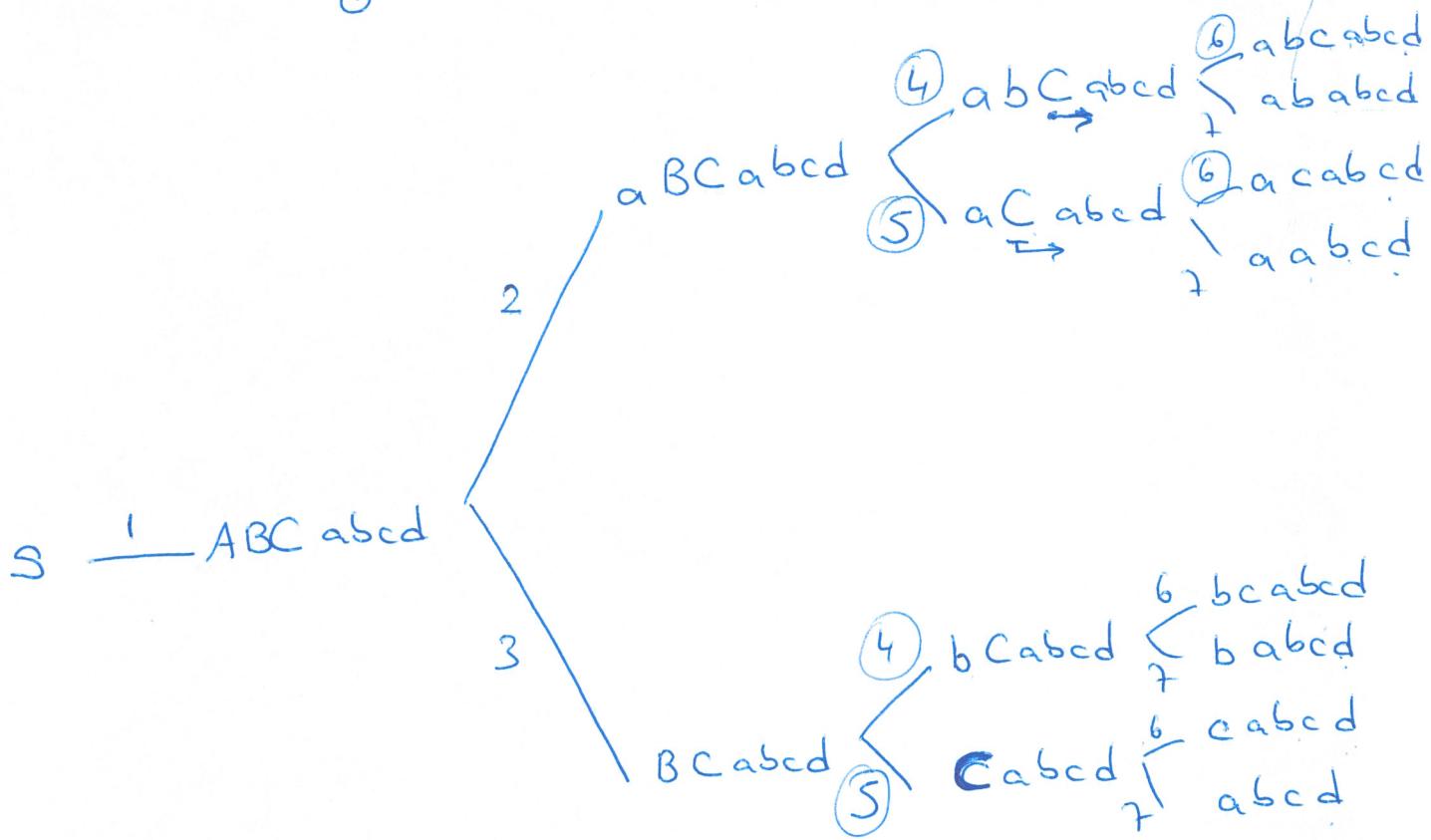
↓ → parser generates a leftmost derivation

the input is scanned from left to right

Example 19.1.2

(4)

$G_2: S \rightarrow A \underset{①}{BC} abcd \quad A \xrightarrow{②③} a \underset{④}{l} \underset{⑤}{a} \quad B \xrightarrow{⑥⑦} b \underset{⑧}{l} \underset{⑨}{a} \quad C \xrightarrow{⑩⑪} c \underset{⑫}{l} \underset{⑬}{a}$



$$LA(S) = \{ \text{everythly} \}$$

$$LA(A \rightarrow a) = \{ abcabcd, ababcd, acabcd, aabcdn \} \quad 4$$

$$LA(A \rightarrow l) = \{ bcabcd, babcd, cabcd, abcd \}$$

$$LA(B \rightarrow b) = \{ \}$$

$$LA(B \rightarrow l) = \{ \}$$

$$LA(\beta \rightarrow b) = \{ bc \cancel{abcd}, ba \cancel{bcd}, \cancel{beabcd}, \cancel{babcd} \} \quad (5)$$

crossed out
because they were
in the set

$$LA(\beta \rightarrow \bar{a}) = \{ cabcd, ab \cancel{cd} \}$$

$$L(A(C \rightarrow c)) = \{ cabcd \}$$
$$L(A(C \rightarrow a)) = \{ abcd \}$$

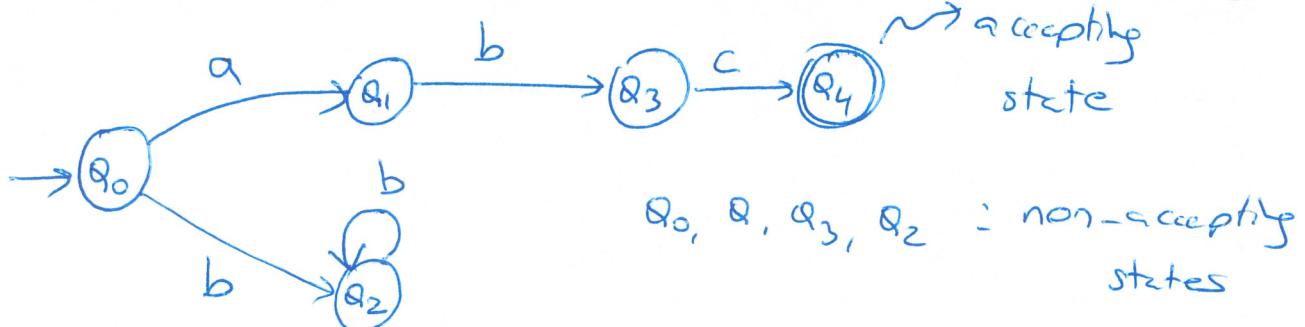
~~lookahead~~

lookahead of 1

(G)

Finite Automata

(7)



state machines

a	b	c
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input tape