# COCKE-KASAMI-YOUNGER



CFG G

GIVEN AND A STRING $x \in \Sigma^*$

HOW CAN YOU TELL IF $x \in L(G)$ ?

CASE I

$L(G)$ IS DETERMINISTIC CFL AND WE ARE GIVEN A DPDA FOR IT.

WRITE PROGRAM TO SIMULATE THE DPDA.

CASE II

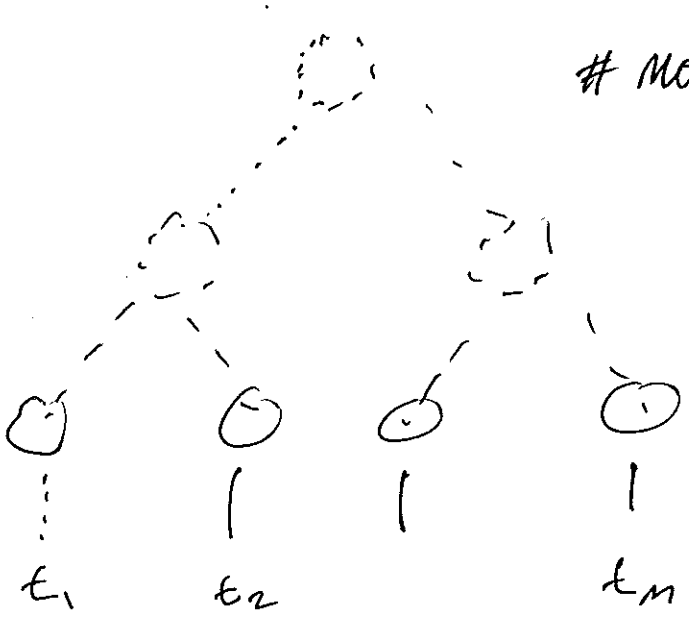
A IS NOT A DETERMINISTIC CFL OR EVEN IF IT IS, WE DO NOT HAVE A DPDA FOR IT.

USE CKY ALGORITHM

CONVERT G TO CNF.

CONSIDER ALL POSIBLE DERIVATION TREES FOR $x$ . OF LENGTH $2|a|-1$

THE UPPER BOUND FOR NUMBER OF THESE IS $\#VARS^{2|x|-1}$, I.E., EXPONENTIAL.




DERIVE EQUIVALENT NPDA AND TRY ALL POSSIBILITIES, STILL EXPONENTIAL

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CKY CUBIC $O(pm^3)$

$p$ # OF PRODUCTIONS

$M = |x|$ LENGTH OF STRING

DYNAMIC PROGRAMMING.

GIVEN CNF GRAMMAR G ← KOZEN EXAMPLE p. 192

$S \to AB \mid BA \mid SS \mid AC \mid BD$

$A \to a$

$B \to b$

$C \to SB$

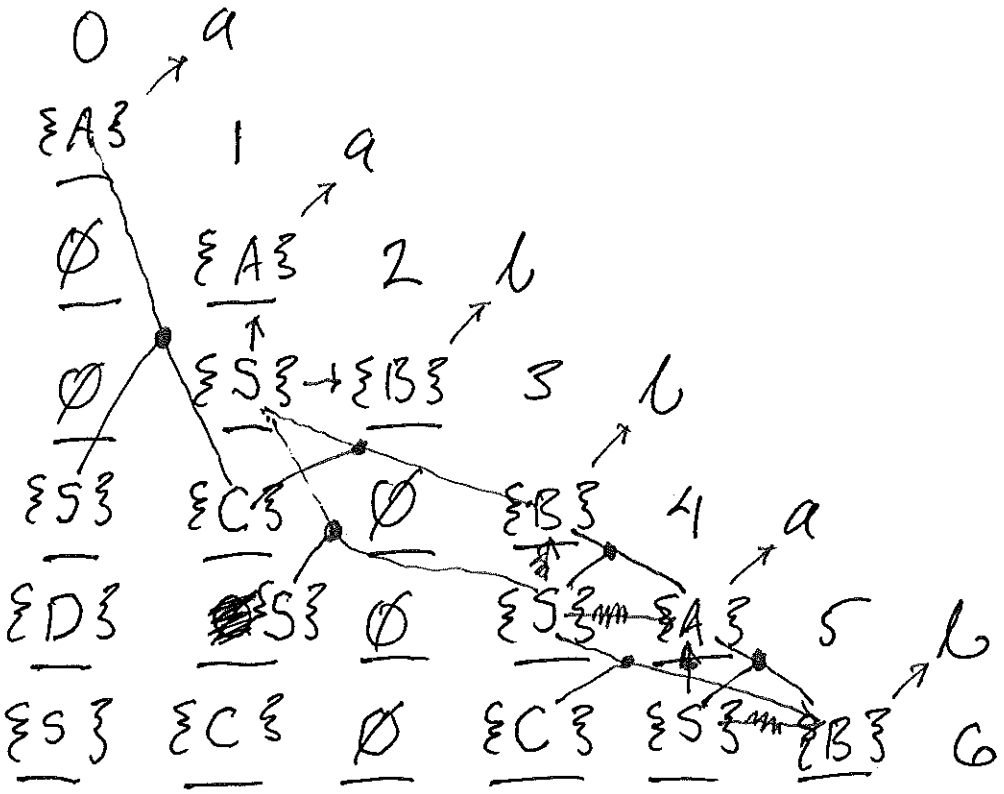
$D \to SA$

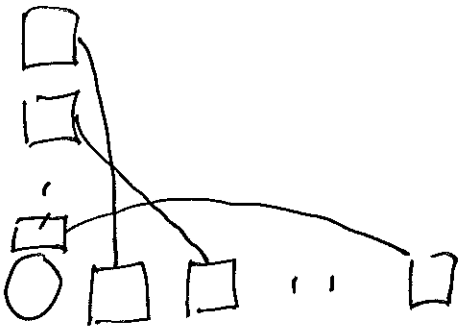
IS STRING $aabbab \in L(G)$ ?

FOR EACH SUBSTRING OF $x$

WHAT SET OF ~~TERMINAL~~ VARS COULD GENERATE IT.

| a | a | b | b | a | b |
0 1 2 3 4 5 6



FIRST DIAGONAL

| | | |
|---|---|---|
| $t_{01}$ | ? → a | {A} |
| $t_{12}$ | ? → a | {A} |
| $t_{23}$ | ? → b | {B} |
| $t_{34}$ | ? → b | {B} |
| $t_{45}$ | ? → a | {A} |
| $t_{56}$ | ? → b | {B} |

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| 2ND | DIAGONAL | QUESTION | ANSWER |
|---|---|---|---|
| $t_{02}$ | $t_{01}$ $t_{12}$ | ? → {A} {A} | ∅ |
| $t_{13}$ | | ? → {A} {B} | S |
| $t_{24}$ | | ? → {B} {B} | ∅ |
| $t_{35}$ | | ? → {B} {A} | S |
| $t_{46}$ | | ? → {A} {B} | S |

3RD DIAGONAL

$t_{03}$ $\{A\}\{S\} \cup \emptyset \{B\}$
$\emptyset \qquad \emptyset$

$t_{14}$ $\{A\} \emptyset \cup \{S\}\{B\}$
$\emptyset \cup \{C\}$

$t_{25}$ $\{B\}\{S\} \cup \emptyset \{A\}$
$\emptyset \cup \emptyset$

$t_{36}$ $\{B\}\{S\} \cup \{S\}\{B\}$
$\emptyset \qquad \{C\}$

4 TH DIAGONAL

$t_{04}$ $\{A\}\{C\} \cup \emptyset\emptyset \cup \emptyset\{B\}$

$S \cup \emptyset \cup \emptyset$

$t_{15}$ $\{A\}\emptyset \cup \{S\}\{S\} \cup \{C\}\{A\}$

$\emptyset \cup S \cup \emptyset$

$t_{26}$ $\{B\}\{C\} \cup \emptyset\{S\} \cup \emptyset\{B\}$

$\emptyset \cup \emptyset \cup \emptyset$

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5 TH DIAGONAL

$t_{05}$ $\{A\}\{S\}\emptyset \cup \emptyset\emptyset \cup \emptyset\{S\} \cup \{S\}\{A\}$

$\emptyset \quad \emptyset \quad \emptyset \quad D$

$\{S\}$

$t_{16}$ $\{A\}\emptyset \cup \{S\}\{C\} \cup \{C\}\{S\} \cup \{B\}$

$\emptyset \cup \emptyset \cup \emptyset \cup C$

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6 TH DIAGONAL

$t_{06}$ $\{A\}\{C\} \cup \emptyset\emptyset \cup \emptyset\{C\} \cup \{S\}\{S\} \cup \{D\}\{B\}$

$\{S\} \cup \emptyset \cup \emptyset \cup \{S\} \cup \emptyset$

$\{S\}$