

Big picture
Algorithms for CFL's / PDA's

Fast

CFG \hookrightarrow PDA

$w \in L(G)$?

CFG \rightarrow CNF
GNF

$L(G)$ empty?
finite?

slow

get all
parsers
of w

undecidable

G ambiguous?

$L(G)$ inherently
ambiguous?

$L(G_1) = L(G_2)$?

$L(G) = \Sigma^*$

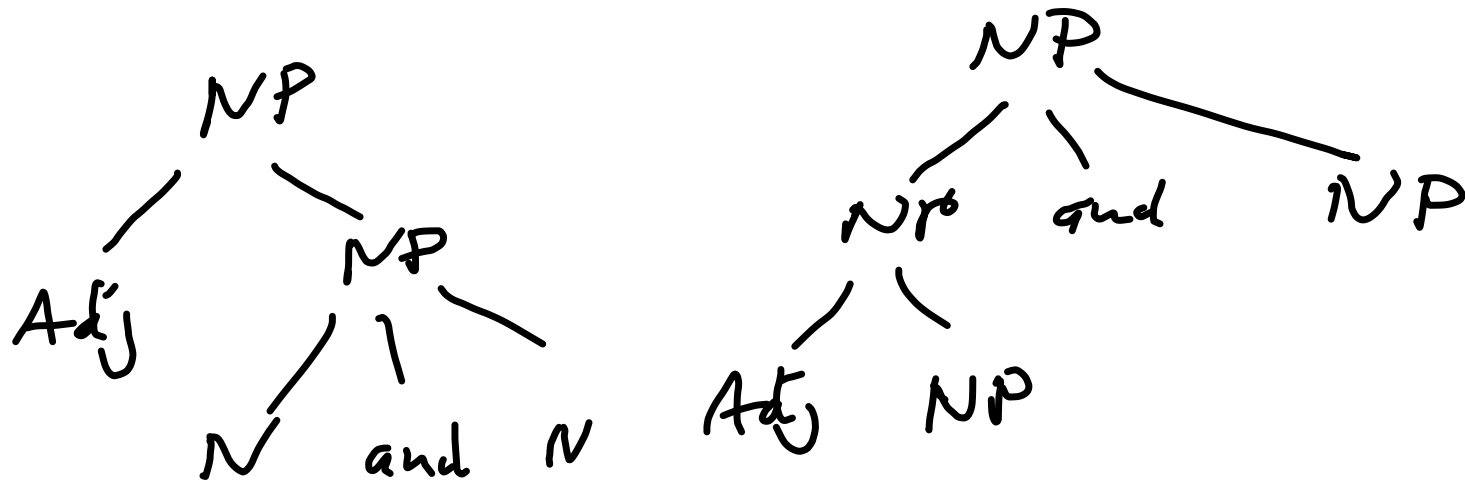
$L(G_1) \cap L(G_2)$
 $= \emptyset$?

Is $w \in L(G)$?

$|w| = n$ and G is CNF

parse trees for w have 2^{n-1}
variable nodes

Lenny eat green eggs and ham,
 grades hard exams and hw's,
 Throws wild parties and receptions.



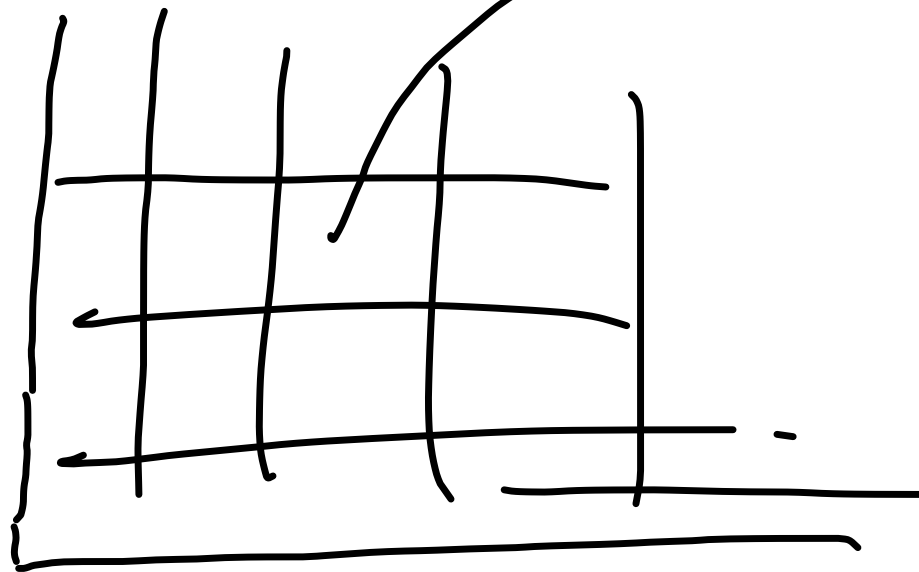
Dr Blum shot Prof Plum
with the revolver
in the kitchen
at midnight

Good news
w has $\frac{n(n+1)}{2}$ substrings

Dynamic programming

chart

length



starting

$P_{s,l}$

CYK algorithm

$S \rightarrow NP VP$

$VP \rightarrow V VP$

$NP \rightarrow NP NP$

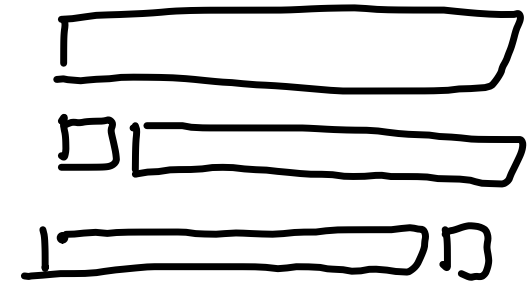
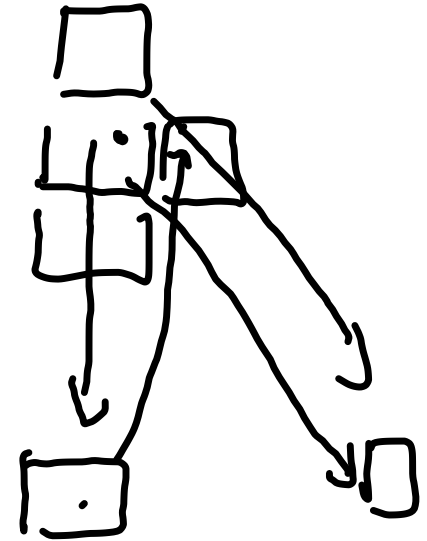
$NP \rightarrow \text{Jeff} \mid \text{geometry} \mid \text{students} \mid \text{trains}$

$V \rightarrow \text{trains}$

1 2 3 4

4	S				
3	NP ⁱ 's	VP NP			
2	NP ⁱ S ⁱ	NP ⁱ VP ⁱ	NP ⁱ		
1	NP ⁱ	NP _j	NP ⁱ	NP	

1² Jeff 2² trains 3³ Geometry 4⁴ Students



- zero table $P_{start, length}$
- fill bottom row

for length 2 to n

for start 1 to $n - length + 1$

for break 1 to $length - 1$

if $A \rightarrow BC$ str.

$B \in P_{start, break}$

$C \in P_{start + break, length - break}$

add A to $P_{start, length}$

