

Quizlet 3: Context free grammars | CKY parsing

Kevin Liang

Ling 185A

Due: 08/23/2024, 11:59 PM PDT

Your name: Ricardo Varela Tellez

Total: 20
points

1 Defining a simple CFG

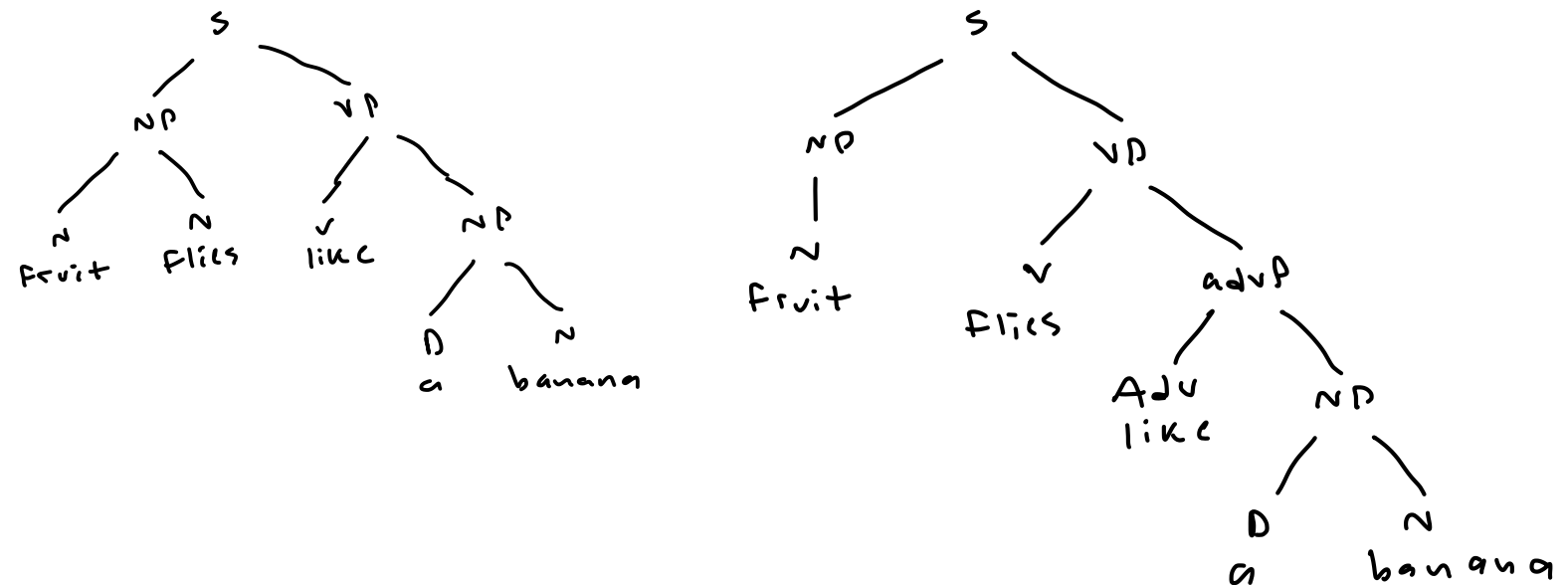
1. The string "Fruit flies like a banana" is ambiguous between two interpretations (one in interpretation involves insects, the other doesn't). Write a simple context-free grammar that assigns distinct analyses to this string, corresponding to its two different interpretations. Assume the very simple alphabet {"Fruit", "flies", "like", "a", "banana"}, and that the set of non-terminals are {S, V, VP, D, N, NP, Adv, AdvP}.

5 points

$S \rightarrow NP VP$ $VP \rightarrow V AdvP$ $N \rightarrow \text{"banana"}$
 $NP \rightarrow N N$ $AdvP \rightarrow Adv NP$ $Adv \rightarrow \text{"like"}$
 $NP \rightarrow N$ $N \rightarrow \text{"Fruit"}$
 $NP \rightarrow D N$ $N \rightarrow \text{"flies"}$
 $VP \rightarrow V NP$ $V \rightarrow \text{"like"}$
 $V \rightarrow \text{"flies"}$
 $D \rightarrow \text{"a"}$

2. Show the two analyses generated by your grammar in the form of tree representations.

5 points



2 CKY parsing

10 points

Given the CFG below, use CKY parsing to show "the police police buffalo" can be generated by filling in each value in the table below. Remember that CKY parsing is a chart-based parsing, from left-to-right, bottom-up.

$N = \{S, NP, VP, V, D, N\}$

$\Sigma = \{\text{the, police, buffalo}\}$

$I = \{S\}$

nonterminal symbols

alphabet

Initial $S \rightarrow NP VP$

$NP \rightarrow \text{police}$

$NP \rightarrow \text{buffalo}$

non $NP \rightarrow D N$

terminal $VP \rightarrow V NP$

$N \rightarrow \text{police}$

$N \rightarrow \text{buffalo}$

police, police, buffalo police, police buffalo

$D \rightarrow \text{the}$

$VP \rightarrow \text{police}$

$VP \rightarrow \text{buffalo}$

$V \rightarrow \text{police}$

$V \rightarrow \text{buffalo}$

$x_1 x_2 x_3 = \text{police police buffalo}$

$S \rightarrow NP VP$

$NP \rightarrow \text{police police (c)}$

$VP \rightarrow \text{buffalo}$

$NP \rightarrow \text{police (c)}$

$VP \rightarrow \text{police buffalo (c)}$

the ...

$NP \rightarrow D N$

$D \rightarrow \text{police police (c)}$

$N \rightarrow \text{buffalo}$

$D \rightarrow \text{police (c)}$

police ...

$N \rightarrow \text{police buffalo}$

$VP \rightarrow V NP$

$V \rightarrow \text{police police (c)}$

$NP \rightarrow \text{buffalo}$

$V \rightarrow \text{police (c)}$

police ...

$NP \rightarrow \text{police buffalo (c)}$

buffalo ...

S: 0 NP: 0 VP: 0 V: 0 D: 1 N: 0	S: 0 NP: 1 VP: 0 V: 0 D: 0 N: 0	S: 1 NP: 0 VP: 0 V: 0 D: 0 N: 0	S: 1 NP: 0 VP: 0 V: 0 D: 0 N: 0
	S: 0 NP: 1 VP: 1 V: 1 D: 0 N: 1	S: 1 NP: 0 VP: 1 V: 0 D: 0 N: 0	S: 1 NP: 0 VP: 0 V: 0 D: 0 N: 0
		S: 0 NP: 1 VP: 1 V: 1 D: 0 N: 1	S: 1 NP: 0 VP: 1 V: 0 D: 0 N: 0
			S: 0 NP: 1 VP: 1 V: 1 D: 0 N: 1

$VP \rightarrow V NP$
 $V \rightarrow \text{the police (c)}$
 $NP \rightarrow \text{police}$

$V \rightarrow \text{the (c)}$
 $NP \rightarrow \text{police police (c)}$

$x_1 x_2 = \text{the police}$

the, police

$S \rightarrow NP VP$

$NP \rightarrow D N$

$VP \rightarrow V NP$

$x_1, x_2 = \text{police police}$
 police, police

$S \rightarrow NP VP$

$NP \rightarrow D N$

$VP \rightarrow V NP$

$x_1, x_2 = \text{police buffalo}$
 police, buffalo

$S \rightarrow NP VP$

$NP \rightarrow D N$

$VP \rightarrow V NP$

$x_1 x_2 x_3 = \text{the police police}$
 $\text{the police, police}$
 $\text{the, police police}$

$S \rightarrow NP VP$

$NP \rightarrow \text{the police (c)}$

$VP \rightarrow \text{police (c)}$

$NP \rightarrow D N$
 $D \rightarrow \text{the police (c)}$
 $N \rightarrow \text{police (c)}$

$D \rightarrow \text{the (c)}$
 $N \rightarrow \text{police police (c)}$

$X_1 X_2 X_3 X_4 =$ the police police buffalo

The police police, buffalo
The police, police buffalo
The, police police buffalo

$S \rightarrow NP VP$

$NP \rightarrow$ the police police (0)

$VP \rightarrow$ buffalo

$NP \rightarrow$ the police (1)

$VP \rightarrow$ police buffalo (1)

$NP \rightarrow$ the (0)

$VP \rightarrow$ police police buffalo

$NP \rightarrow D N$

$D \rightarrow$ the police police (0)

$N \rightarrow$ buffalo

$D \rightarrow$ the police (0)

$N \rightarrow$ police buffalo

$D \rightarrow$ the (1)

$N \rightarrow$ police police buffalo (0)

$VP \rightarrow V NP$

$V \rightarrow$ the police police (0)

$NP \rightarrow$ buffalo

$V \rightarrow$ the police (0)

$NP \rightarrow$ police buffalo

$V \rightarrow$ the (0)

$NP \rightarrow$ police police buffalo