61A Lecture 37

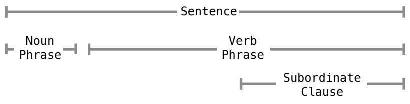
Wednesday, April 29

Announcements

- Homework 9 (4 pts) due Wednesday 4/29 @ 11:59pm
- Quiz 4 due Thursday 4/30 @ 11:59pm
- No videos on Friday 5/1; Come to lecture (and fill out the HKN course survey at the end)
  - If at least 60% of students respond, everyone gets an extra credit point
- Next week: 18 hours of review sessions Monday, Tuesday, & Wednesday 11-5 in 271/273 Soda
  - Two TAs are available every hour
  - One room will be a review session going over topic-specific problems
  - The other room is unstructured; staff will answer any questions you have

Ambiguity

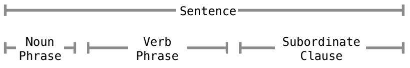
Syntactic Ambiguity in English



Programs must be written for people to read[1]

[1] Preface of **Structure and Interpretation of Computer Programs** by Harold Abelson and Gerald Sussman with Julie Sussman

Syntactic Ambiguity in English



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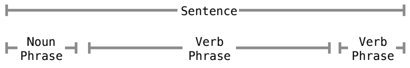
Syntactic Ambiguity in English



Programs must be written for people to read[1]

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Syntactic Ambiguity in English

pro•gram (noun)
a series of coded software instructions

pro•gram (verb)
provide a computer with coded instructions

Programs must be written for people to read

must (verb)
be obliged to

must (noun)
dampness or mold

Definitions from the New Oxford American Dictionary

Syntax Trees

Representing Syntactic Structure

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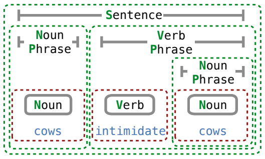


A Tree represents a phrase:

- tag -- What kind of phrase (e.g., S, NP, VP)
- branches -- Sequence of Tree or Leaf components

A Leaf represents a single word:

- tag -- What kind of word (e.g., N, V)
- word -- The word

```
cows = Leaf('N', 'cows')
intimidate = Leaf('V', 'intimidate')
S, NP, VP = 'S', 'NP', 'VP'
Tree(S, [Tree(NP, [cows]),
         Tree(VP, [intimidate,
                   Tree(NP, [cows])])])
```

(Demo)

Grammars

Context-Free Grammar Rules

A grammar rule describes how a tag can be expanded as a sequence of tags or words

S ⟶ NP VP

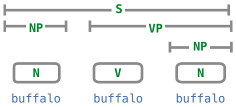
A Sentence ...

... can be expanded as ...

... a Noun Phrase then a Verb Phrase.

Grammar

S ⟶ NP VP
NP ⟶ N
N ⟶ buffalo
VP ⟶ V NP
V ⟶ buffalo

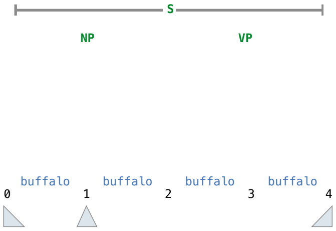


(Demo)

Parsing

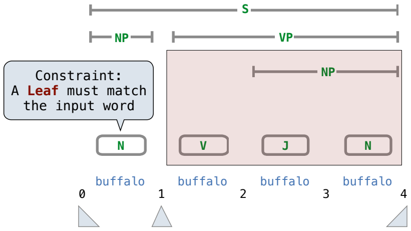
Exhaustive Parsing

Expand all tags recursively, but constrain words to match input



Exhaustive Parsing

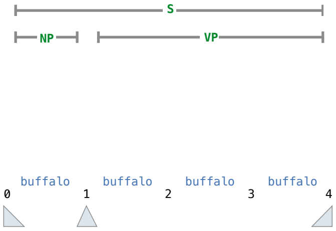
Expand all tags recursively, but constrain words to match input



Constraint:
A Leaf must match
the input word

Exhaustive Parsing

Expand all tags recursively, but constrain words to match input



Exhaustive Parsing

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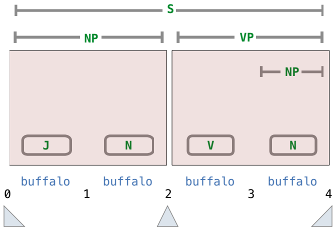


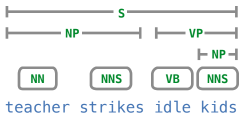
(Demo)

Learning

(Demo)

Scoring a Tree Using Relative Frequencies

Not all syntactic structures are equally common

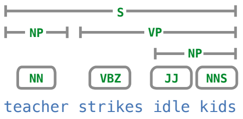


Rule frequency per 100,000 tags

S ⟶ NP VP	25372	NN ⟶	teacher	5
NP ⟶ NN NNS	1335	NNS ⟶	strikes	25
VP ⟶ VB NP	6679	VB ⟶	idle	26
NP ⟶ NNS	4282	NNS ⟶	kids	32

Scoring a Tree Using Relative Frequencies

Not all syntactic structures are equally common



Rule frequency per 100,000 tags

S ⟶ NP VP	25372		NN ⟶	teacher	5	
NP ⟶ NN	~~1335~~	4358	VBZ ⟶	strikes	~~25~~	19
VP ⟶ VBZ NP	~~6679~~	3160	JJ ⟶	idle	~~26~~	18
NP ⟶ JJ NNS	~~4282~~	2526	NNS ⟶	kids	32	

(Demo)