61A Lecture 37

Wednesday, December 3

Announcements

- Homework 10 due Wednesday 12/3 @ 11:59pm
- Quiz 3 released Wednesday, due Thursday 12/4 @ 11:59pm
- No videos for Lecture 38 on Friday 12/5
  - Come to class and take the final survey
  - There will be a screencast of live lecture (http://goo.gl/hyUTca)
- Final exam held on Thursday 12/18 3pm-6pm
  - 30 hours of review sessions next week! Monday - Friday 11am-6pm (mostly in 271 Soda)

Ambiguity

Syntactic Ambiguity in English

Sentence

Noun Phrase

Verb Phrase

Subordinate Clause

`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

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Noun Phrase | Verb Phrase | Verb Phrase

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

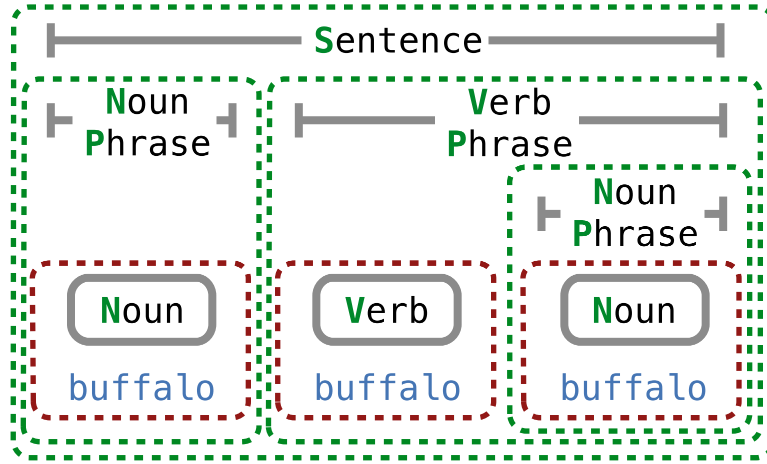
must (noun)
  dampness or mold

Definitions from the New Oxford American Dictionary

Syntax Trees

Representing Syntactic Structure

Photo by Vince O'Sullivan licensed under http://creativecommons.org/licenses/by-nc-nd/2.0/



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

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

(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 **S**entence ...

... can be expanded as ...

... a **N**oun **P**hrase then a **V**erb **P**hrase.

Grammar

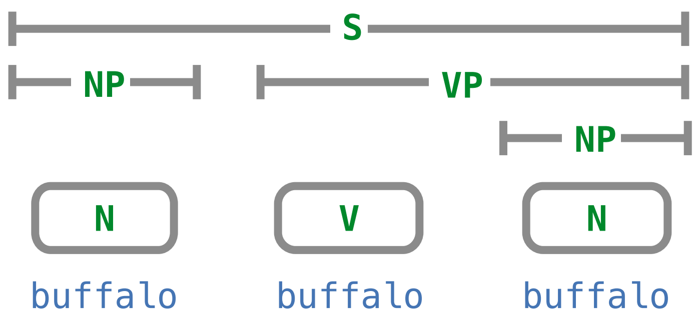
S ⟶ **NP VP**

NP ⟶ **N**

N ⟶ buffalo

VP ⟶ **V NP**

V ⟶ buffalo

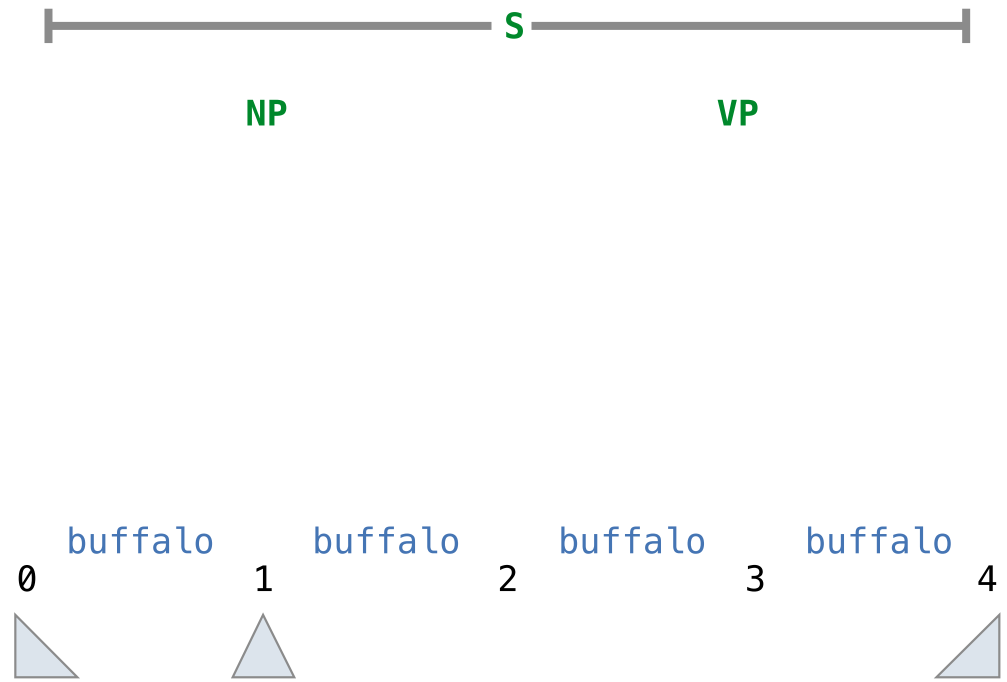


(Demo)

Parsing

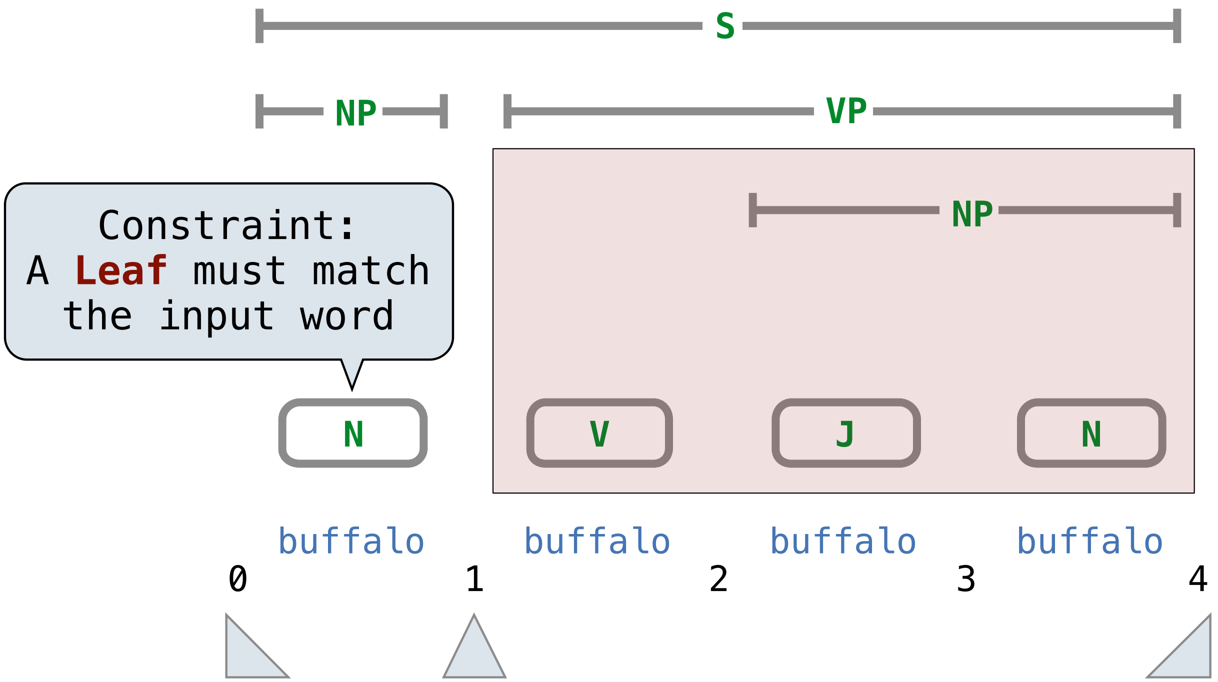
Exhaustive Parsing

`Expand all tags recursively, but constrain words to match input`



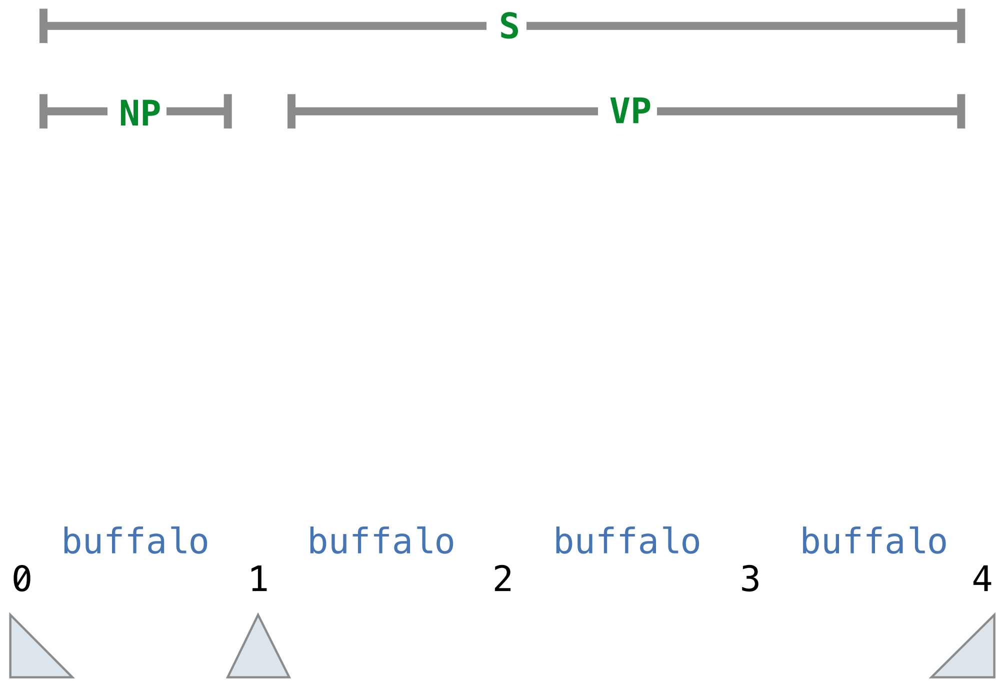
Exhaustive Parsing

Expand all tags recursively, but constrain words to match input



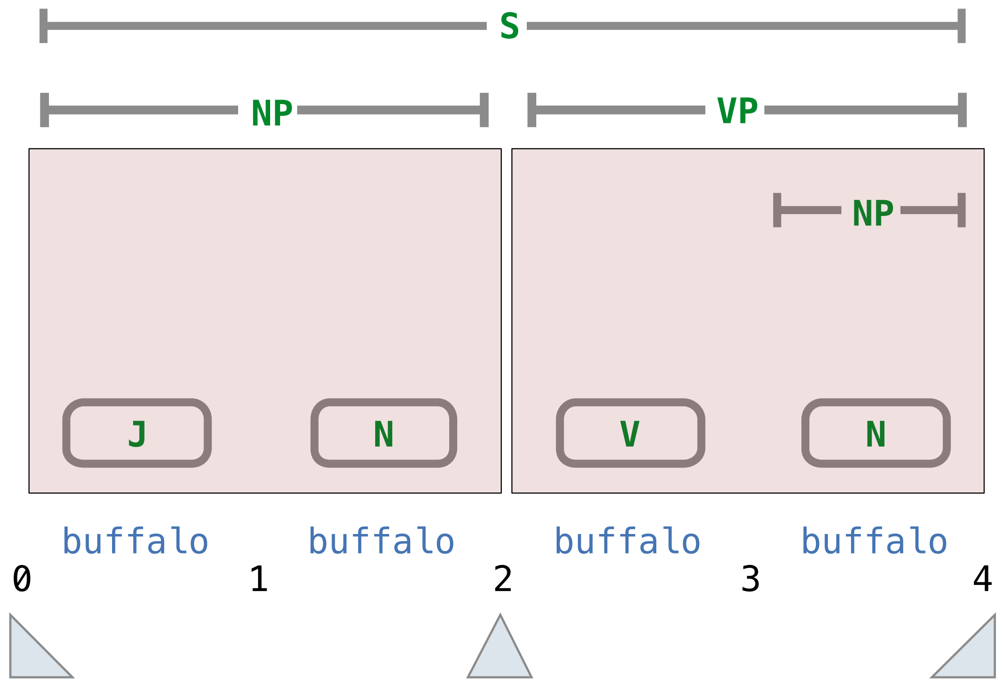
Exhaustive Parsing

```
Expand all tags recursively, but constrain words to match input
```



Exhaustive Parsing

Expand all tags recursively, but constrain words to match input



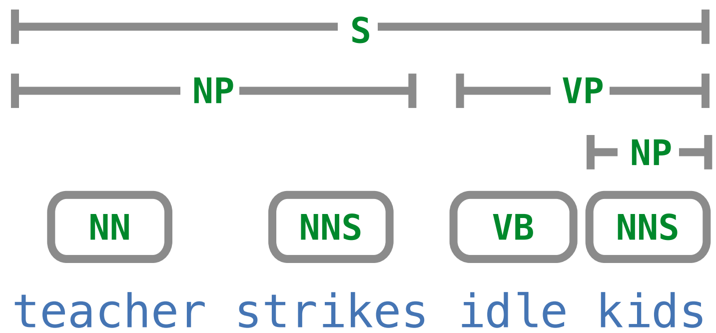
(Demo)

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

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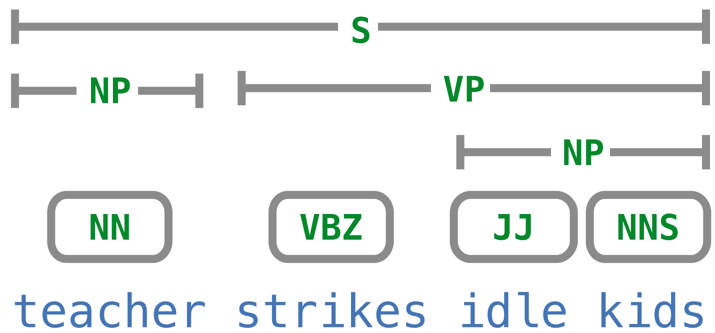

Rule frequency per 100,000 tags

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)