Introduction to Part of Speech Tagging

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Many slides adapted from Brendan O’Connor Chris Manning

Where are we going with this?

- Text classification: bags of words

- Sequence tagging
  - Parts of Speech
  - Named Entity Recognition
  - Other areas: bioinformatics (gene prediction), etc…

What’s a part-of-speech (POS)?

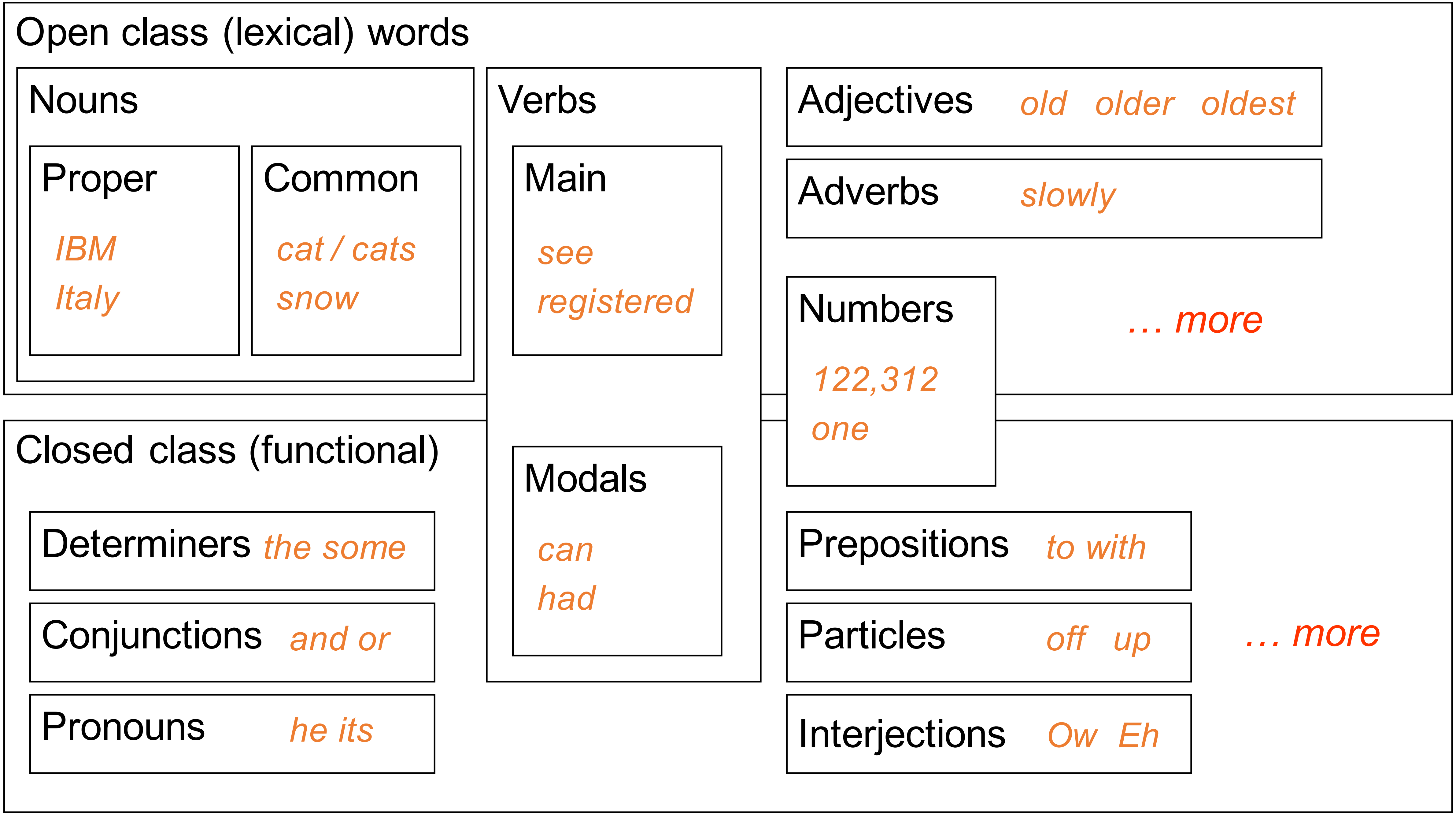
- Syntax = how words compose to form larger meaning bearing units
- POS = syntactic categories for words
  - You could substitute words within a class and have a syntactically valid sentence
  - Gives information how words combine into larger phrases

- I saw the **dog**
- I saw the **cat**
- I saw the ___

Parts of Speech is an old idea

- Perhaps starting with Aristotle in the West (384–322 BCE), there was the idea of having parts of speech
- School grammar: noun, verb, adjective, adverb, preposition, conjunction, pronoun, interjection
- Many more fine grained possibilities

https://www.youtube.com/watch?v=ODGA7ssL-6g&index=1&list=PL6795522EAD6CE2F7



Open class (lexical) words

Nouns

Proper *IBM* *Italy*

Common *cat / cats* *snow*

Verbs

Main *see* *registered*

Modals *can* *had*

Adjectives *old older oldest*

Adverbs *slowly*

Numbers *122,312* *one*

… more

Closed class (functional)

Determiners *the some*

Conjunctions *and or*

Pronouns *he its*

Prepositions *to with*

Particles *off up*

Interjections *Ow Eh*

… more

Open vs. Closed classes

- Open vs. Closed classes
  - Closed:
    - determiners: ***a, an, the***
    - pronouns: ***she, he, I***
    - prepositions: ***on, under, over, near, by, …***
    - Why “closed”?
  - Open:
    - Nouns, Verbs, Adjectives, Adverbs.

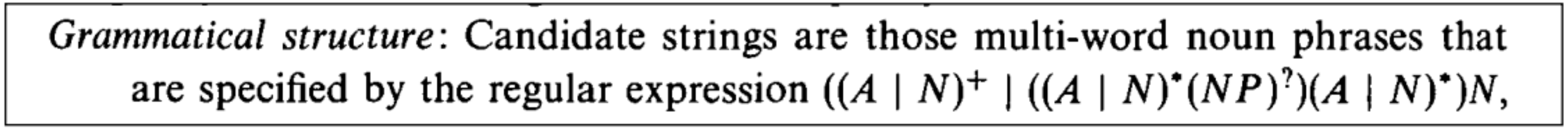
Many Tagging Standards

- Penn Treebank (45 tags) … this is the most common one
- Brown corpus (85 tags)
- Coarse tagsets
    - Universal POS tags (Petrov et. al. https://github.com/slavpetrov/universal-pos-tags)
    - Motivation: cross-linguistic regularities

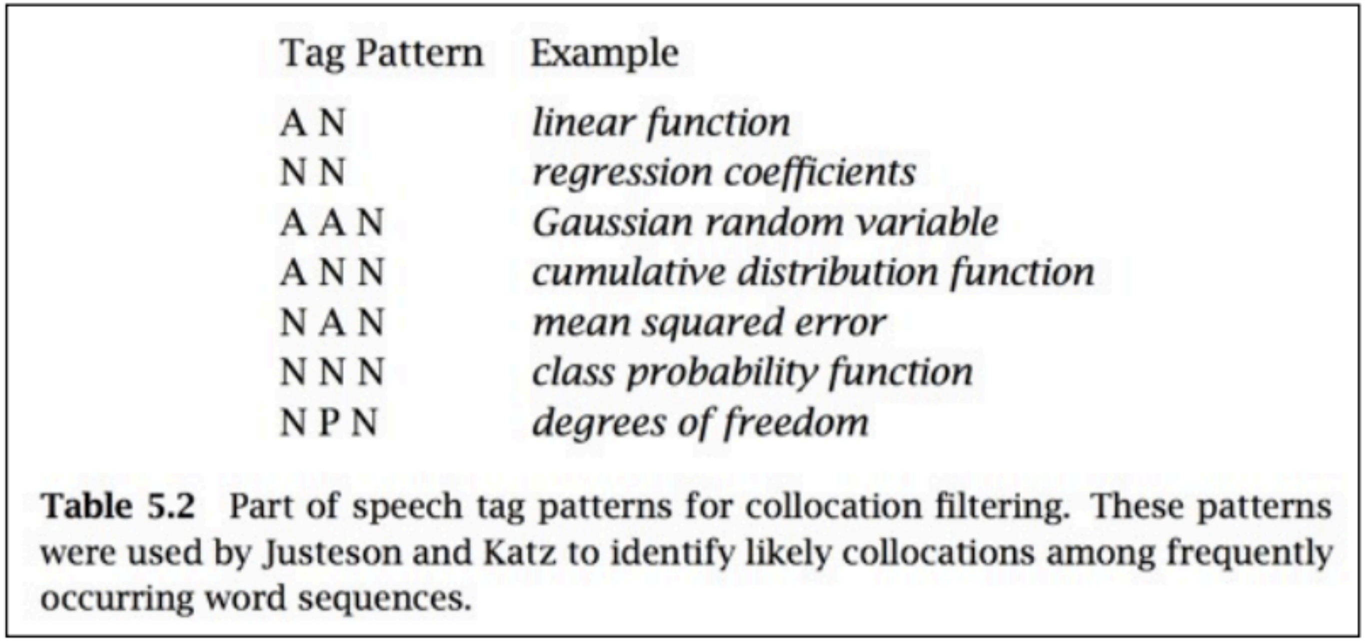
What are parts of speech useful for?

- Phrase identification (chunking)
- Named entity recognition
- Information Extraction
- Parsing

Quick and Dirty Noun Phrase Identification



Grammatical structure: Candidate strings are those multi-word noun phrases that are specified by the regular expression $((A \mid N)^{+} \mid ((A \mid N)^{*}(NP)^{?})(A \mid N)^{*})N$,



Tag Pattern	Example
A N	*linear function*
N N	*regression coefficients*
A A N	*Gaussian random variable*
A N N	*cumulative distribution function*
N A N	*mean squared error*
N N N	*class probability function*
N P N	*degrees of freedom*

Table 5.2 Part of speech tag patterns for collocation filtering. These patterns were used by Justeson and Katz to identify likely collocations among frequently occurring word sequences.

POS Tagging

- Words often have more than one POS: *back*
  - The *back* door = JJ
  - On my *back* = NN
  - Win the voters *back* = RB
  - Promised to *back* the bill = VB
- The POS tagging problem is to determine the POS tag for a particular instance of a word.

POS Tagging

- Input: Plays well with others
- Ambiguity: NNS/VBZ UH/JJ/NN/RB IN NNS
- Output: Plays/VBZ well/RB with/IN others/NNS
- Uses:
  - Text-to-speech (how do we pronounce "lead"?)
  - Can write regexps like (Det) Adj* N+ over the output for phrases, etc.
  - As input to or to speed up a full parser
  - If you know the tag, you can back off to it in other tasks

Penn Treebank POS tags

POS tagging performance

- How many tags are correct? (Tag accuracy)
  - About 97% currently
  - But baseline is already 90%
    - Baseline is performance of stupidest possible method
      - Tag every word with its most frequent tag
      - Tag unknown words as nouns
  - Partly easy because
    - Many words are unambiguous
    - You get points for them (*the*, *a*, etc.) and for punctuation marks!

Deciding on the correct part of speech can be difficult even for people

- Mrs/NNP Shaefer/NNP never/RB got/VBD around/RP to/TO joining/VBG

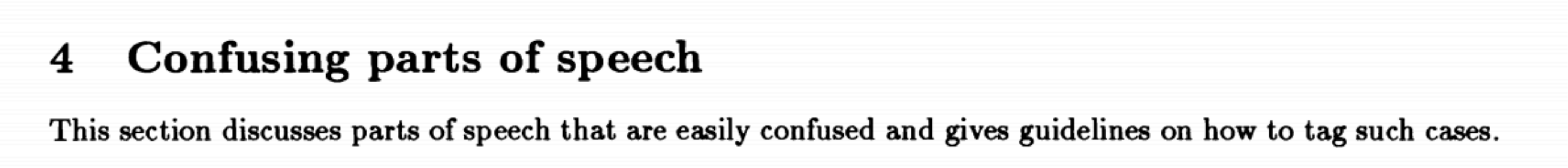
- All/DT we/PRP gotta/VBN do/VB is/VBZ go/VB around/IN the/DT corner/NN

- Chateau/NNP Petrus/NNP costs/VBZ around/RB 250/CD

How difficult is POS tagging?

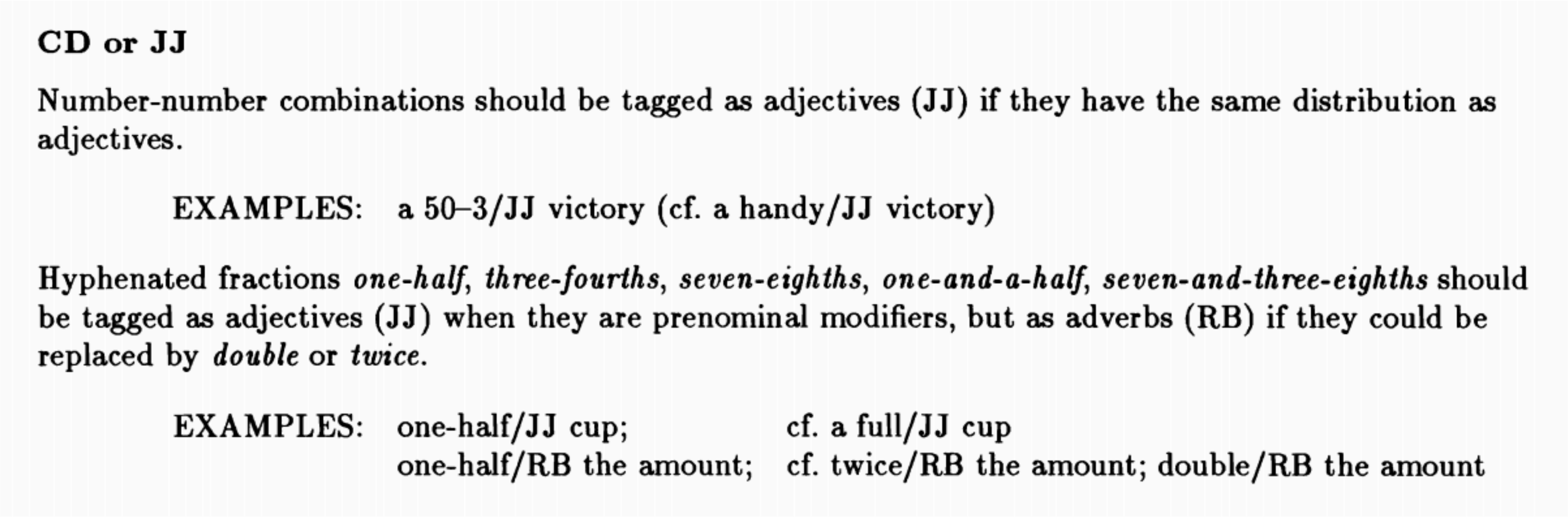
- About 11% of the word types in the Brown corpus are ambiguous with regard to part of speech
- But they tend to be very common words. E.g., *that*
  - I know *that* he is honest = IN
  - Yes, *that* play was nice = DT
  - You can’t go *that* far = RB
- 40% of the word tokens are ambiguous

It’s hard for people too!



4 Confusing parts of speech

This section discusses parts of speech that are easily confused and gives guidelines on how to tag such cases.



CD or JJ

Number-number combinations should be tagged as adjectives (JJ) if they have the same distribution as adjectives.

EXAMPLES: a 50–3/JJ victory (cf. a handy/JJ victory)

Hyphenated fractions *one-half*, *three-fourths*, *seven-eighths*, *one-and-a-half*, *seven-and-three-eighths* should be tagged as adjectives (JJ) when they are prenominal modifiers, but as adverbs (RB) if they could be replaced by *double* or *twice*.

EXAMPLES: one-half/JJ cup; cf. a full/JJ cup
one-half/RB the amount; cf. twice/RB the amount; double/RB the amount