Chapter 1

Exercises

1. Perform manual tokenization for the following sentences.

1) I'm a student.

Answer: I 'm a student .

2) He didn't return Mr. Smith's book.

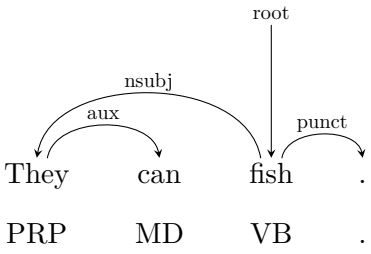
Answer: He did n't return Mr. Smith 's book .

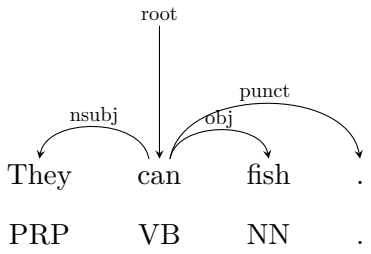
3) "We have no useful information on whether users are at risk," said James A. Talcott of Boston's Dana-Farber Cancer Institute.

Answer: " We have no useful information on whether users are at risk ," said James A. Talcott of Boston 's Dana-Farber Cancer Institute .

2. Assign POS tags to the sentence "They can fish." How many valid POS sequences can be assigned? Draw the dependency tree structure of each interpretation.

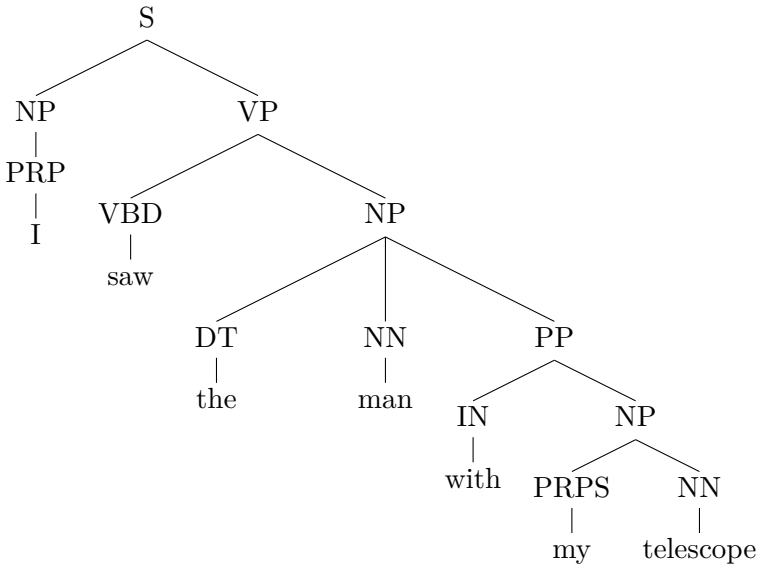
Answer: They/PRP can/MD fish/VB They/PRN can/VB fish/NN

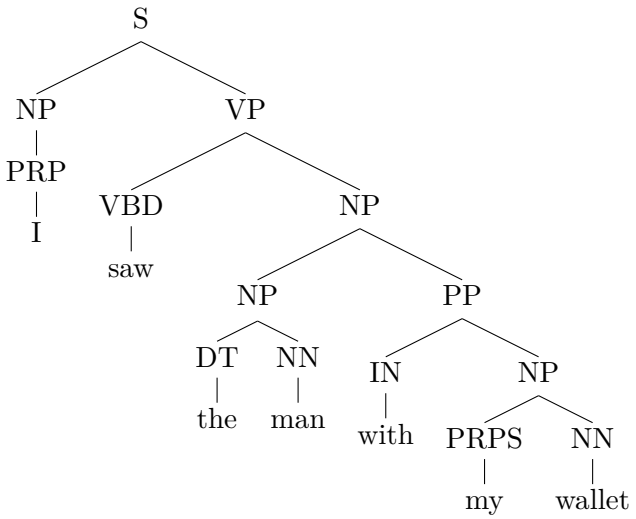




3. Draw the constituent tree structures of "I saw the man with my telescope." and "I saw the man with my wallet.", respectively. What are the main differences? Think about the main sources of information that can be used to resolve the ambiguities.

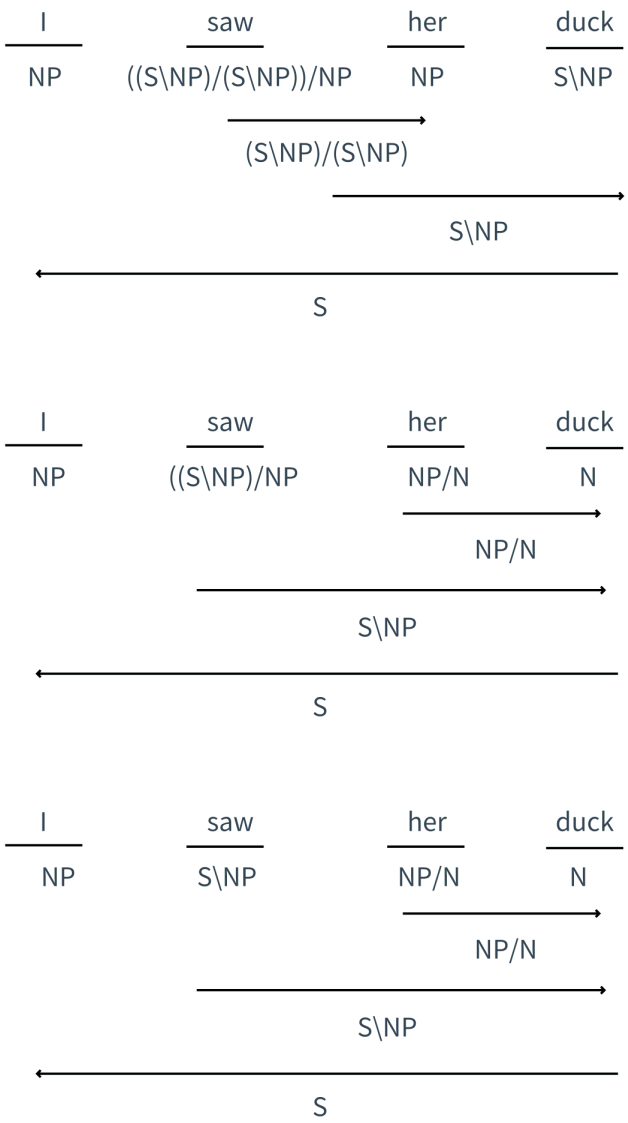
Answer:





In the first sentence, "with my telescope" means using the telescope. The telescope is a tool for seeing the man. The second sentence means the man is holding the wallet, which indicates that he can be a thief. There is only one word that is different in the two sentences, but the meaning and sentence structure are different. To resolve the ambiguities, we need to understand the semantic correlations between "see", "man", "with", "telescope" and "wallet".

4. Assign CCG supertags to the sentence "I saw her duck." How many different sequences can be assigned? Draw the CCG derivation of each. (Note: the lexical category of di-transitive verbs is $(S\backslash NP)/NP/NP$, transitive verbs $(S\backslash NP)/NP$ and adjectives NP/NP.)



5. What are the similarities and differences between noun phrase (NP) chunking and named entity recognition?

Answer: NP-chunking search identifies chunks from sentences corresponding to individual noun phrases, which is similar to named entity recognition. Both can be solved as a sequence labeling task.

NP-chunks are often smaller pieces than complete noun phrases. Any prepositional phrases or subordinate clauses that modify a nominal will not be included in the corresponding NP-chunk. NP-chunks is a fundamental NLP task concerning syntax,. In contrast, NER is a task in informatin extraction.

6. Look up a dictionary for the senses of the words "bank" and "saw", noting the correlation between senses and POS. The *citation form* of each word in a dictionary is called a **lemma**, which can be different from **word forms** in a sentence. How many lemmas can the word form "saw" have?

Answer:
saw
see

7. What contexts do antonyms commonly co-occur in? Can you define some simple regular expressions to mine out antonyms from large-scale text data?

Answer:
Antonym co-occurrences often happen in sentences where the antonymic adjectives are syntactically paired. They are commonly found in conjoined phrases that are identical or nearly identical. There is a strong trend for antonyms to occur in syntactically parallel and usually lexically identical structures.

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[^A-Za-z][Rr]ight[^A-Za-z]|[^A-Za-z][Ww]rong[^A-Za-z]
[^A-Za-z][Gg]ood[^A-Za-z]|[^A-Za-z][Bb]ad[^A-Za-z]
[^A-Za-z][Hh]appy[^A-Za-z]|[^A-Za-z][Ss]ad[^A-Za-z]
[^A-Za-z][Hh]igh[^A-Za-z]|[^A-Za-z][Ll]ow[^A-Za-z]
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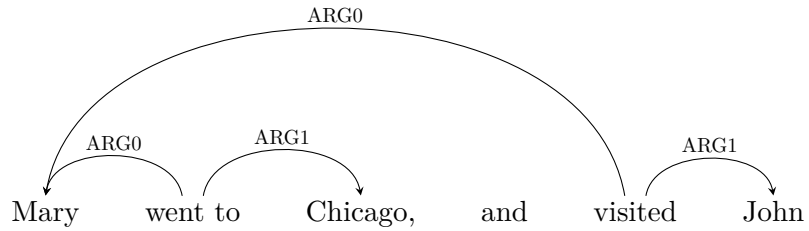
8. Draw the predicate-argument structures of the sentence "Mary went to Chicago, and visited John." How many predicates are there in the sentence? Do the predicate-argument relations form a tree structure over the sentence? Discuss similarities and differences between predicate-argument structures and dependency tree structures.

Answer:



The predicate-argument relations cannot form a tree structure because unlike dependency tree structure, the same word can form multiple predicate-argument relations with other words. The correlation between predicate-argument structures and syntactic structures is 1-to-many.

The similarity between predicate-argument structures and dependency

tree structures is that they analyze sentences in word-pair relations, there are head words and dependent words, with dependency arcs labelled and directed. The difference between predicate-argument structures and dependency tree structures is that dependency tree structures always form tree structures, while predicate-argument structures don't.

9. Consider the logical form of Figure 1.2(b). If both "Tim" and "book" are treated as variables rather than functions, what is the logic form of the same sentence?

Answer:

$$buy(Tim, book) \wedge price(book, \$1)$$

10. Draw the logical forms of "Not all of Jason's classmates like Jason." and "None of Jason's classmates like Jason.", respectively. What are the main differences? The semantic difference is related to **negation scope** ambiguities.

Answer:
$\neg(\exists x \forall y(Jason(x) \wedge classmates(y) \wedge like(classmates(y), Jason(x))))$
$\exists x \forall y(Jason(x) \wedge classmates(y) \wedge \neg like(\ classmates(y), Jason(x)))$

11. State the main differences between anaphora resolution and coreference resolution.

Answer:
Anaphora resolution resolves what a pronoun or noun phrase refers to, while coreference resolution is to find all expressions that refer to the same entities in a text document.

12. Which of the tasks below can benefit from knowledge of POS in an input sentence?
1) named entity recognition
2) discourse segmentation
3) morphological analysis
4) machine translation

Answer:
1) 2) 3) and 4)

13. Which of the tasks below can benefit from dependency syntax information of input sentences
1) POS tagging
2) named entity recognition

3) semantic role labelling
4) relation extraction

Answer:
1) 2) 3) and 4)

14. *Open domain targeted sentiment analysis* is the task to monitor a stream of text, detecting named entity mentions and the sentiment polarities towards each mention. Hence it consists of two sub-tasks, namely NER and targeted sentiment classification. What other tasks can be performed jointly? Discuss the advantage of doing the two tasks jointly as compared to a pipeline method.

Answer:
Word segmentation, POS tagging and parsing
Semantic parsing and syntactic parsing
Discourse segmentation and discourse parsing

Reduce error in propagation.
Allow mutual benefit using joint information.

15. Summarisation can be solved using *abstractive* and *extractive* methods. The former synthesises a summary using text generation techniques, while the latter makes a summary from excerpts of the original articles. Think of the relative advantages and challenges of each method.

Answer:
Abstractive method use text generation techniques, the advantage is that the generated sentences are more coherent with each other, and it can extract more information from the original text. While the challenge of this method is that the quality of generated sentences might not be that good, certain grammar mistakes might happen; the information it convey might be differ form the original text, it lose its fidelity in some details.

Extractie method use orginal sentences or phrases to make a summary, this guarantees the quality of sentences, the expressions stick to origin text and make no mistake on details. The challenge of this method is that it might not be able to show the big picture, the sentences it selected might be irrelevant to the main idea, thus makes the summarisation incomplete.

16. Automatic essay scoring is useful for students. Automatic stock prediction is useful for traders. Can you think of downstream NLP applications that are useful in other areas, such as entertainment?

Answer:

Automatic lyrics generation
Automatic script writing
Automatic auditing