

## ECE467 – Pset 2

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1. Consider the context-free grammar (CFG) shown in Figure 12.3 on page 235 of the current draft of the textbook, and also shown on slide 9 of my PowerPoint presentation on Phase Structure Grammars and Dependency Grammars. Figure 12.2 shows a related lexicon. Now consider the following sentence, which is valid according to the grammar and lexicon, ignoring case and punctuation: “You need a flight to Chicago”. Draw a valid parse tree for this sentence, according to the grammar.

```
[S
  [NP [Pronoun you]]
  [VP
    [Verb need]
    [NP
      [Det a]
      [Nominal [Noun flight]]]
    [PP
      [Preposition to]
      [NP [Proper-Noun Chicago]]]]]
```

2. Briefly explain the difference between a prescriptive grammar and a descriptive grammar. Which do most modern linguists strive to develop?

A prescriptive grammar attempts to formalize a language into a series of rules that all the syntax follows. While this is a cleaner approach and may be applied to more formal grammars, it is hard to make everything conform to a small set of rules in a natural language. Therefore most modern linguists strive to develop a descriptive grammar, which attempts to describe how the language is actually used (e.g., how a native speaker would use the language), including all of its peculiarities. Descriptive grammars do not attempt to make everything conform to these rules.

3. Consider a CFG representing a phrase structure grammar for a natural language such as English, including the following rule (the period is part of the rule):  $S \rightarrow NP VP$ .

In this rule, S, NP, and VP are non-terminal symbols, but we will assume that the period is a terminal symbol specifically representing a period (as opposed to some other end-of-sentence marker). So, we can interpret this rule as stating that a sentence can have the form of a noun phrase followed by a verb phrase followed by a period. (To implement a parser for grammars with rules like this, the tokenizer would have to treat periods as separate tokens.)

Assume that you need to convert this grammar to Chomsky normal form (CNF), perhaps with the CKY parsing algorithm in mind. Using the procedure discussed in class, show the rules that might result from the conversion.

Two possible CNF grammars:

- (a)  $S \rightarrow \_Dummy1 \text{ Period}$   
     $Dummy1 \rightarrow NP VP$   
     $Period \rightarrow .$
- (b)  $S \rightarrow NP \_Dummy2$   
     $\_Dummy2 \rightarrow VP Period$   
     $Period \rightarrow .$

4. Explain any serious shortcoming of first-order logic as a meaning representation.

It only handles things in absolutes: an element is in a set, or it is not; it is related to another element, or it is not. There is no part of the formulation to account for uncertainty.

5. Invent your own Winograd schema! Circle the ambiguous pronoun in both sentences, and underline the correct antecedent in each.

The ambiguous pronoun is “she,” which could be referring to “my sister” or “our dog.” The ambiguity is resolved by the verb “wagged” or “pet.”

My sister came to see **our dog**. **She** *wagged* her tail.

**My sister** came to see our dog. **She** *pet* her tail.