Assignment 7

L545

Due Monday, April 8

1. Given the following feature structures (f, g, and h), answer the questions in (a) and (b):

$$f\text{:}\begin{bmatrix} \text{A} & \boxed{1} \\ \text{B} & \begin{bmatrix} \text{C} & \boxed{1} \\ \text{D} & x \end{bmatrix} \end{bmatrix} \quad g\text{:}\begin{bmatrix} \text{B} & \begin{bmatrix} \text{C} & w \end{bmatrix} \\ \text{D} & y \end{bmatrix} \quad h\text{:}\begin{bmatrix} \text{A} & z \\ \text{B} & \begin{bmatrix} \text{D} & x \end{bmatrix} \end{bmatrix}$$

   (a) Give the feature structure which is the result of unifying each of the following:

      i. $f \sqcup g$
      ii. $f \sqcup h$
      iii. $g \sqcup h$
      iv. $(f \sqcup g) \sqcup h$

   (b) Does h subsume f? Why or why not?

2. (a) Draw a tree for the following sentence, using whatever features are necessary to make subcategorization and the long-distance dependency work out:

      (1) Kim_i Dana believes Chris knows Sandy trusts $\__i$

   (b) Describe how subcategorization is handled here.

   (c) Describe how the trace is linked to *Kim*.

3. Here's a set of CFG rules that don't use feature structures:

   - $\text{NP}_{1sg} \rightarrow \text{Det N}_{1sg}$
   - $\text{NP}_{2sg} \rightarrow \text{Det N}_{2sg}$
   - $\text{NP}_{3sg} \rightarrow \text{Det N}_{3sg}$
   - $\text{NP}_{1pl} \rightarrow \text{Det N}_{1pl}$
   - $\text{NP}_{2pl} \rightarrow \text{Det N}_{2pl}$
   - $\text{NP}_{3pl} \rightarrow \text{Det N}_{3pl}$

And here's the same set using a feature structure notation:

NP	$\rightarrow$	Det N
<NP PERSON>	=	<N PERSON>
<NP NUMBER>	=	<N NUMBER>

Assume we're using the Earley parser, and we've already processed the input from position 0 to position 1, using the rule Det $\rightarrow$ *the*.

(a) Describe the current state of the Earley parser for the CFG rules without feature structures.

(b) Describe the current state of the Earley parser for the CFG rules with feature structures.

4. Is the language $a^n b^2 a^n$ context-free? (Jurafsky and Martin, question 16.1)

5. Write a context-free grammar which recognizes even-length palindromes for the vocabulary $\{a, b\}$. That is, if x^R means 'the string x reversed,' you have to write a CFG for:

   (2) $L = \{xx^R | x \in a, b*\}$

   (adaptation of Jurafsky and Martin, question 16.4)