

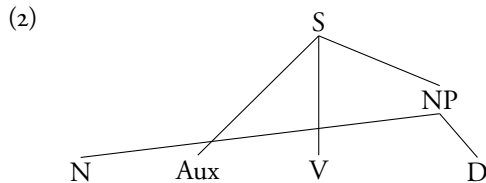
Formal methods, Fall 2008  
 Problem set 4 – structures  
 Assigned: 10/2, Due: 10/9

1 Trees

In class we discussed the formalization of trees developed in chapter 16 of the textbook. The historic context this theory of constituent structures originated from is one where the vast majority of syntactic analysis centered around English, Romance, Germanic, and other Indo-European languages. Consider now the following sentence from Warlpiri (Pama-Nyungen, Australia):

- (1) Wawirri kapi-rna panti-rni yalumpu  
 kangaroo AUX spear-NONPAST that  
 'I will spear that kangaroo.'

The puzzle, from our perspective, is that the noun is separated from its determiner, though the interpretation is the same as in English. Because of this (and other reasons), the sentence has been assigned the following constituency structure:



For the sake of simplicity, we are ignoring the lexical leaves. Also for the sake of simplicity, since there are no duplicate labels, let the set of nodes be equal to the set of labels, and let the labeling function be the identity function.

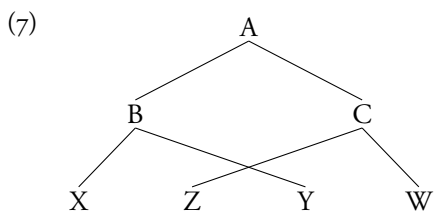
- (3) Let  $N = Q = \{S, \text{Aux}, V, \text{NP}, N, D\}$   
 (4) Let  $L$  be a function  $f : N \rightarrow N$   
 such that  $f(x) = x$  for any  $x \in N$ .

Let us interpret this diagram as implicating the following dominance and precedence relations:

- (5)  $D = \{\langle S, \text{Aux} \rangle, \langle S, V \rangle, \langle S, \text{NP} \rangle, \langle S, \text{Det} \rangle, \langle S, N \rangle, \langle S, S \rangle, \langle \text{NP}, \text{NP} \rangle, \langle N, N \rangle, \langle \text{Aux}, \text{Aux} \rangle, \langle V, V \rangle, \langle \text{Det}, \text{Det} \rangle\}$   
 (6)  $P = \{\langle N, \text{Aux} \rangle, \langle N, V \rangle, \langle N, D \rangle, \langle \text{Aux}, V \rangle, \langle \text{Aux}, \text{NP} \rangle, \langle \text{Aux}, D \rangle, \langle V, \text{NP} \rangle, \langle V, D \rangle\}$

[A] Which of the constraints on trees does this structure violate?

[B] The tree in (2) involves a fairly particular kind of violation. We might want to allow structures like that one, but still disallow many related violations. How could you modify the constraints on tree structures to allow (2), but disallow cases where children of sisters intermingle:



2 Operational structures

Do chapter 9 ex. 1, chapter 10 ex. 9.