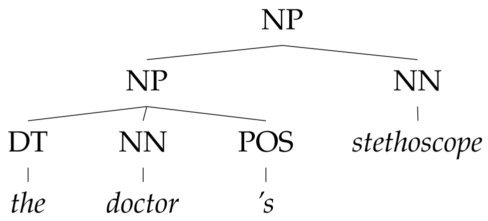
CS224N/Ling 237 Homework #7 – The final one!

Due Wed, 19 May 2003, 5pm

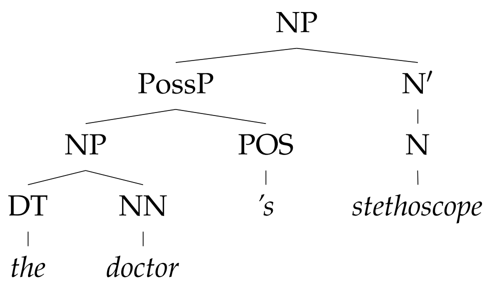
Syntax and Logical Semantics. For these questions you should provide a consistent set of grammatical rules and lexical entries that can generate the given sentences. You may reuse or just refer to ones in the Computational Semantics handout, where they are adequate.

1. Possesive or genitive noun phrases are things like *Kate's* in *Kate's room is messy*. The relation of possession is complex in natural language, as it includes not only true possession (like *my backpack*), but many rather different relations such as in *Autumn's beautiful colors*, *Bill's idea*, *I made Steve's lamb curry*. But let's ignore that and say that we'll translate a genitive noun phrase as a straightforward possession relationship: $\mathbf{own}(y)(x)$. Under this assumption, we'd like to incorporate possessive phrases into the grammar fragment of the handout.

   The Penn Treebank separates off the possesive *'s* as a separate "word":

   An analysis something like this is frequent in linguistics, because the perception is that although a *'s* is just sounded at the end of the previous word, semantically, it relates two noun phrases. Indeed, let's indicate this more clearly with a tree representation like this (which meshes well with the rest of the grammar fragment in the semantics handout):

   (a) Write grammar rules complete with semantic translations that could be added to the grammar fragment, which will parse the above sentence and generate a semantic representation using the **own** predicate.

   (b) Show that you produce a good semantic representation for *Kathy sees the doctor's stethoscope*. (Hint: the main thing to make sure of is that the whole noun phrase ends up having a quantifier introduced, so that one ends up with an appropriate semantics for the whole sentence.)

(c) Show a derivation (and check that things work!) for *Kathy buys every doctor's stethoscope*.

2. Work out a semantic representation for *Which customers purchased red leather jackets?*. Write lexical entries for the necesssary words in this sentence, draw the syntactic tree, and show the corresponding semantic forms that are derived at each stage. (You should follow the examples in the slides/handouts. Note in particular that in these examples, the gap is initially assumed, in a structure like conditional proof, but is then discharged in the S $\rightarrow$ S/NP rule by doing lambda abstraction.)

3. Consider the sentence:

   Who does Kathy respect Fong

   Is it well-formed or ill-formed according to the fragment grammar in the handout. (Show the derivation or attempted derivation, and either show that it is good, or explain clearly what in the syntax or semantics rules it out.)

4. As discussed briefly in the lectures on computational semantics, the distribution of *wh-* phrases such as *who*, *what*, and *which books* in sentences is often handled by linking them to a position lower in the syntactic tree, corresponding to the role that the *wh-* phrase plays as an argument of the verb. From the correspondence between, for example,

   (i) Kathy respects Fong

   and

   (ii) Who does Kathy respect *e*?

   we can assume that *who*, like *Fong*, has category NP, and that there is a gap (=empty category) of the same category (denoted here by *e*). The semantics of the phrase can be built up by assigning appropriate semantics to *who*, *e*, and the S′ expansion rule.

   (a) Along the same lines of reasoning, what might we say about the syntactic category of *where* in sentences such as

   (iii) Where does Kathy run?

   (b) Using the same semantics as shown in the handout for lexical items *Kathy*, *does*, and *run*, assign appropriate semantics for *where* (and any other lexical items and syntactic rules necessary). Show the syntactic structure for (iii), and annotate it with appropriate semantics at each node.