

Department of Computer Science
CSC 247/447 and BCS 235/535
Fall 2006

Assignment 4 (non-Lisp portion)
Due: 3:15pm, Tuesday, Nov. 21

Problem 1 - Logical forms and scoping

For the sentence

A snowstorm brought down all power lines,

- (a) Show a phrase structure tree (keeping features to a minimum for clarity), and annotate the nodes of the tree with the (unscoped) LFs obtained if we use a rule-by-rule approach to LF computation, and treat predicates as “curried” functions. Treat “*down*” as a particle (specified by the subcat feature of “*bring*”), and treat “*power line*” as a single lexical entry with an atomic LF. *Ignore situation/event arguments for parts (a-d).*

Separately show the phrase structure rules and lexical rules, pairing these with appropriate semantic rules, sufficient to determine the LFs above.

- (b) Show what changes to the phrase structure/lexical rules are required if we wish to obtain an LF where predicates have their “conventional” interpretation as relations, rather than curried functions. You can use either of the approaches mentioned in class (and covered in various parts of Ch. 9 in the text), i.e., make the changes at the level of lexical entries, or at the level of VP semantic rules. Show the final (unscoped) LF obtained for this variant of the rules.
- (c) Show all scopings of the final LF in (b) that have the PAST operator outermost. Give careful paraphrases of these scoped LFs, designed to make clear what the relative scopes of the quantifiers are. (You may find the phrase “*such that*” useful for producing scopally unambiguous paraphrases.)
- (d) Redo the rules in (a), this time embedding the semantic rules as SEM features into the phrase structure rules and lexical entries. But make the SEM rules deliver “conventional” LFs as per (b), not as in (a). You can again keep the syntactic features to a minimum.
- (e) Show the changes needed to the rules in (d) in order to introduce Davidsonian event variables into appropriate predicates. Comment on any difficulties you encounter. *Note:* You may use a λ -abstracted event variable, or avail yourself of the extra VAR feature (as used in the text) for this part.

Problem 2 - Handling postmodifiers of nouns

- (a) Carry out steps analogous to (a), (b), and (d) above, for the complex noun phrase

A snowstorm in Buffalo;

You don't need to repeat rules already covered in part (a), and you don't need to incorporate the above NP into a complete sentence.

- (b) Carry out steps analogous to (a), (b), and (d) above, for the complex noun phrase

A snowstorm in Buffalo that surprised everyone;

Again, you don't need to repeat rules already covered previously, and don't need to incorporate the NP into an S.

- (c) Discuss the implicit reference classes involved in the occurrences of “*power lines*” and “*everyone*” in problem (1) and in 2(a,b), and speculate how they might be determined computationally in a NLU system; i.e., how more exact LFs might be obtained. (This is not a question asking you to recall any specific technical ideas covered in class so far, but rather to come up with your own.)

Problem 3 - (Neo-)Davidsonian event representations

- (a) Show a lexical entry, including a logical form (LF), for the verb in the sentence in question (1), with the verb meaning regarded as a relation (as in (1b)) but one that includes a Davidsonian event variable, and show the unscoped and scoped sentential LF this leads to (for the scoped LF the tense should end up as a predication about the event).
- (b) In a neo-Davidsonian approach to the sentence in problem (1), we need to assign thematic roles to the entities involved in the “bringing-down” event. Refer to the roles listed in the text on p.248, and decide which ones fit best. Accordingly, provide new lexical entries (with lambda-abstraction) for the verbs (in past tense) involved, which would deliver the desired neo-Davidsonian LF for the sentence in (1). Without showing intermediate results, write down the sentence LF in unscoped and scoped form.

Problem 4 - Interpreting questions and gaps

- (a) (i) Show the phrase structure tree and the (preliminary) LF at each node for the question “*What happened?*”. Use a Davidsonian event variable in the interpretation of “*happened*”, and take the interpretation of “*what*” to be $\langle Wh\ Thing \rangle$, i.e., take it to mean “*what thing*”.
- (ii) Show the scoped version of the question.
- (iii) Assuming that only events can “happen”, what should we take to be the relationship between the (questioned) subject of the sentence and the Davidsonian event variable? Given your answer to this, what, if anything does the verb “*happened*” contribute to the meaning of the sentence? (Note: this is not a question testing specific technical knowledge we have learned, but a question intended to make you think about meaning.)
- (iv) If you were to “play dumb” when someone asks you “*What happened?*” (in some appropriate circumstance), you might say things like “*The dinosaurs died out. Caesar conquered Gaul. Or do you mean more recently?*”. What does this indicate to you about additional work that needs to be done by an interpretive routine, beyond computing an LF like that in (ii), in order to derive a formula that truly and unambiguously represents the meaning of the question? (Note: as in (iii).)
- (b) Show the phrase structure tree and the (preliminary) LF at each node for the question “*What did you see?*”. Take the interpretation of “*did*” to be $(\lambda P \langle PAST\ P \rangle)$, i.e., it simply applies the unscoped past tense operator to its argument (presumed to be a predicate). Assume that gaps are interpreted as (the “hole variable” h , where this is λ -abstracted and converted at an appropriate level in the PST.
- (c) Indicate how the use of a SEM feature in the grammar would avoid a “hole variable” for the gap, by “piggybacking” the semantics of the gap filler within categories containing the GAP (or ‘/’) feature. Show only enough to make clear you know how this works – no complete, semantically annotated PST required.

Final Note: Lisp assignment 4 is still under construction and will be provided next week.