1 Nested Cooper Storage

Consider the following sentence.

(1) [NP Every [N student [PP at [NP a university]]]] presents a paper.

This sentence is scopally ambiguous (it has five distinct readings).

Derive two readings of the sentence using the Nested Cooper Storage technique from the lecture, and β-reduce the result as usual; you may ignore those parts of the derivation that are not needed for the computation of the two readings.

(a) One reading in which the quantifier that corresponds to "every student" takes scope over "a university."

(b) Another reading in which "a university" takes scope over "every student."

Hints: The preposition "at" translates into

$$\lambda Q \lambda P \lambda x (P(x) \wedge Q(\lambda y (\mathit{at}_*(y)(x))))$$

of type $\langle\langle\langle e,t\rangle,t\rangle,\langle\langle e,t\rangle,\langle e,t\rangle\rangle\rangle$.

Recall that nodes can have more than one semantic value (at NP-nodes, you have the choice between applying the storage rule, or do functional application).

You might use abbreviations for complex λ-expressions during the derivation – for instance *every-student'* for $\lambda P \forall x(\mathit{student'}(x) \to P(x))$; in this case, replace the abbreviations by the λ-terms they stand for and β-reduce the result in a final step.

2 Scope Islands

One limitation of Nested Cooper Storage is that it is insensitive towards so-called *scope islands*: it will derive three different readings for the sentence

(2) Some professors believe-that every student is-intelligent

whereas the sentence arguably is not ambiguous, because the universal quantifier "every student" cannot take scope over the sentence embedding verb "believe."

(a) Pick a formula that is not a good semantic representation for this sentence, and show how to derive it with Nested Cooper Storage. To keep things simple, you might treat "believe-that" (type: $\langle t, \langle e, t \rangle \rangle$) and "is-intelligent" (type $\langle e, t \rangle$) as single words. "some" translates into $\lambda P \lambda Q \exists x (P(x) \land Q(x))$.

(b) Fix the problem by modifying the rules of Nested Cooper Storage, in such a way that the quantifier store must be emptied at each sentence node. Then show that your analysis in (a) would not be possible with your modified rule system.

To be turned in by Tuesday, May 27, 10:00