Computational Semantics (SCA-UE-908C3)

Friday 21st January 2011

For every question, we remind you ***to explain*** *and* ***to precisely justify*** *all the reasonings that lead you to the answer. The quality, the clarity and the precision of these elements will be taken into account (remember that clarity and concision often go hand in hand). Don't forget to say what the formula you write down stands for and what the relations between the formula are.*

And don't forget to read all the examination questions before starting to answer.

Two sentences are called *contradictory* in a given theory if whenever one of them denotes 1 in the theory, the other denotes 0 (*e.g. Mary is not tall* and *Mary is tall*). We may also talk about two contradictory readings/structures of sentences, which is especially useful when sentences are structurally ambiguous.

Consider the following abstract syntax together with its associated Montague-like semantics:

$$
\begin{array}{rlrl}
\text{ALICE} : & np & [\![\text{ALICE}]\!] = & \lambda P.P\ \mathbf{alice} \\
\text{EVERYONE} : & np & [\![\text{EVERYONE}]\!] = & \lambda P.\forall x.P\ x \\
\text{RUN}, \text{RAN} : & np \rightarrow s & [\![\text{RUN}]\!] = [\![\text{RAN}]\!] = & \lambda S.S(\lambda x.\mathbf{run}\ x) \\
\text{WAS STANDING} : & np \rightarrow s & [\![\text{WAS STANDING}]\!] = & \lambda S.S(\lambda x.\mathbf{stand}\ x) \\
\text{WAS LYING} : & np \rightarrow s & [\![\text{WAS LYING}]\!] = & \lambda S.S(\lambda x.\mathbf{lie}\ x) \\
\text{DIDN'T} : & (np \rightarrow s) \rightarrow np \rightarrow s & [\![\text{DIDN'T}]\!] = & \lambda r.\lambda x.\neg(r\ x)
\end{array}
$$

where:

$$
\begin{array}{rlrl}
\mathbf{alice} : & e & \forall : & (e \rightarrow t) \rightarrow t \\
\mathbf{stand}, \mathbf{lie}, \mathbf{run} : & e \rightarrow t & \neg : & t \rightarrow t
\end{array}
$$

1. Consider the sentences *Alice was standing (Alice était debout)* and *Alice was lying (Alice était couchée)*.
   (a) Can you think of a theoretical assumption that would make these sentences contradictory?
   (b) How do you then express their denotations?
   (c) Are these denotations *arbitrary*? Why?
2. What is the semantic interpretation of the syntactic type *np*? Of the syntactic type *s*?
3. We now consider the sentence *everyone didn't run* whose abstract syntax is given by t such that:

$$t = ((\text{DIDN'T})\ \text{RUN})\ \text{EVERYONE}$$

   (a) Is $[\![\text{DIDN'T}]\!]$ well-typed?
   (b) What is the interpretation u of t?
   (c) What can you say about the respective scopes of the universal quantifier and of the negation in u?
   (d) What would be a reading inverting these scopes? Which one is the strongest reading (that implies the other one)? With its weakest reading, are *everyone didn't run* and *everyone ran* still contradictory?
   (e) Propose another interpretation for DIDN'T that inverse the scope. Check that it is well-typed and compatible with the given type definitions and that the result is as you expect.