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Grammatikformalismen für die Computerlinguistik

Aufgabenblatt 2

Exercise 1. [3 points] We presuppose the signature presented on pages 28/29 (Section 2.1.2) of the electronic textbook *Grammar Formalisms and Parsing*. Which ones of the following expressions are syntactically well-formed, and which ones are not? For those which are ill-formed, indicate what is wrong with them (keywords suffice).

1. `nelist,head:(cat;three).`
2. `elist;(nelist,tail):elist.`
3. `~yellow;brown.`
4. `(~color):black.`
5. `woodpecker;legs.`
6. `(list,head:bird:legs:number,color:number);elist.`
7. `nelist,head:(pet:cat);dog.`
8. `head:(parrot,legs:two,color:(yellow;green,~brown)).`
9. `head:bird;pet *> color:color,legs:number.`
10. `color:red;legs:three <*> ~(bird),green,two.`
11. `head,tail *> nelist.`
12. `(head:green,color:one);(head:cat,color:cat).`
13. `animal:pet:(cat;dog).`
14. `~elist <*> nelist:(first,rest).`
15. `nelist,head:legs:(two;four),color:(green;red;yellow;brown),`
    `tail:nelist,head:canary,legs:two,color:yellow,tail:elist.`

Note that in MoMo notation, each description ends with a full stop.
We suggest that you first solve this exercise with paper and pencil, and then check with MoMo whether your answers are correct. For this purpose, we have prepared an mmp file,[1] which you may download.
The file already contains the signature and description cards with all descriptions of the exercise. However, be warned that the syntax checker of MoMo will only tell you about the first syntax error it finds in any given expression. When you

[1] milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section212/syntax-exercise.mmp

analyze ill-formed descriptions, please consider *all* mistakes that you can detect in them.

Exercise 2. [**4 points**] The signature of Pollard and Sag's grammar of English is fairly big. In this exercise, we want to translate a small part of it into the notation for signatures that is introduced in Section 2.1.2.
Assume that there is a sort *object* which subsumes all other sorts of the signature that we want to design. Then take Pollard and Sag's sort *head* as immediate subsort of *object* and complete the sort hierarchy under *head* as it is given by Pollard and Sag. Add all appropriate attributes to the sorts under *head* as well as the sorts that are in turn appropriate for them.
Hint: Attributes will introduce attribute values that may not be in the sort hierarchy of your signature yet, since they may not be subsorts of *head*. Introduce them in your sort hierarchy as additional immediate subsorts of *object*. However, you do not have to complete the sort hierarchy under those additional sorts.
To illustrate this exercise, we have prepared an mmp file, available from `milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section212/nominalobjects.mmp`, in which we have done the task we are asking you to do for the sort *head* for the sort *nom-obj*.
Use MoMo to verify that you have created a well-formed signature. You can check that by typing your signature into the signature window and then pressing the *Check Syntax* button above that window. Don't forget to precede the type hierarchy by the line *type_hierarchy* and to finish it with a full stop in the last line.

Sketch of the solution:

```
type_hierarchy
object
   head
      subsort-of-head1 attribute1:new-sort1
         moresorts1 ...
      subsort-of-head2 attribute2:new-sort2
         moresorts2 ...
   new-sort1
   new-sort2
.
```

Exercise 3. [**2 points**] In Section 2.2.1, we showed how a MoMo signature can be rewritten in a standard set notation of mathematics: We saw the MoMo signature with lists and animals of Section 2.1.2, *Signatures: Partitions and Feature Declarations*, in a notation that follows Definition 2 of initial signatures. In the previous exercise we asked you to reconstruct a small part of Pollard and Sag's signature of English in MoMo notation. The relevant part of the signature was the sort hierarchy under *head* plus that part of the overall appropriateness function that concerns *head* and its subsorts. Take the signature that you constructed in MoMo (where you had to use MoMo's notation for signatures) and write it down in the notation of our definition of initial signatures (as given at the beginning of Section 2.2.1).

Exercise 4. [3 points] We said that we did not want to introduce a potentially complicated definition of a syntax of AVM descriptions as Pollard and Sag use in their HPSG book. Nevertheless, we will often appeal to a correspondence between the syntax of descriptions that we use in MoMo and the AVM notation that is standard in linguistics. With a bit of practice, you will in fact find that this correspondence is fairly obvious. This exercise is meant to help you get some of the necessary practice.
In the file at the URL `milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section221/momo-avms.mmp` you find MoMo descriptions that correspond to the first three AVM descriptions below. Complete this file with corresponding MoMo descriptions for the last three AVMs .

a. $\begin{bmatrix} \textit{cat} \\ \textsc{color} \;\; \textit{yellow} \vee \textit{brown} \end{bmatrix}$

b. $\begin{bmatrix} \textit{dog} \\ \textsc{legs} \;\; \neg \; \textit{three} \end{bmatrix}$

c. $\begin{bmatrix} \textit{list} & & \\ \textsc{head} & \begin{bmatrix} \textit{canary} \\ \textsc{color} \;\; \textit{yellow} \end{bmatrix} & \\ \textsc{tail} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{woodpecker} \\ \textsc{color} \;\; \textit{brown} \end{bmatrix} \\ \textsc{tail} & \textit{elist} \end{bmatrix} & \end{bmatrix}$

d. $\begin{bmatrix} \textit{parrot} \\ \textsc{color} \;\; \textit{green} \vee \textit{red} \vee \textit{yellow} \vee \textit{brown} \end{bmatrix}$

e. $\begin{bmatrix} \textit{canary} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{color} \;\; \textit{yellow} \end{bmatrix}$

f. $\begin{bmatrix} \textit{nelist} \\ \textsc{tail} \; \textsc{tail} \;\; \textit{elist} \end{bmatrix} \leftrightarrow \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{canary} \\ \textsc{color} \;\; \textit{yellow} \end{bmatrix} & \\ \textsc{tail} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{parrot} \\ \textsc{color} \;\; \textit{green} \end{bmatrix} \\ \textsc{tail} & \textit{elist} \end{bmatrix} & \end{bmatrix}$