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Grammar Development in Constraint-Based Grammar Formalisms

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Exercise Sheet 5

1. Please define a ConTroll relation `reverse` which reverses the elements of a list. E.g. the `query(reverse([a,b,c]))` should result in the list `[c,b,a]`.

   (a) Please define and test this relation in Xtroll.

   (b) By using the ConTroll systems predicate `inspect`, which will activate the Xtroll debugger, please test the behavior of the `reverse` relation on the following input lists.

      i. `[_,_,_]`
      ii. `[a,b|_]`
      iii. `hd:a,tl:[b]`
      iv. `_`

   (c) In general, with which arguments does a call to `reverse` terminate in ConTroll?

   (d) Please write a `delay` statement that guarantees that the arguments that are critical for termination are properly instantiated.

2. Please define and test under Xtroll a ConTroll relation `permute` which returns for a given input list each list as ouput that consists of all and only the elements of the input list in any order of occurrence. E.g. for the input list `[a,b]`, `permute([a,b])` should have as solutions the lists `[a,b]` and `[b,a]`.

   Hint: in defining `permute` it is useful to define an auxiliary relation `insert` which inserts a single element into an input list at any arbitrary position of the list and returns this newly constructed list.

3. Please define

   `select(list,element) **> list`

   as a ConTroll-relation. `select` succeeds only if element occurs in list. Then the first occurrence of element is removed from the original list, whose elements stay in the same order, and the new list is returned.

   Please test your program

   (a) `select(c,[c,b])`
   (b) `select(c,[b,c])`
   (c) `select(c,[c,b,c])`

   Please note that you have to define a minimal signature in a separate signature file which includes `string` as the only subtype of `bot`. Also remember that in ConTroll relations are encoded in functional notation.

   Something to think about: what problems would arise if we wanted to define `select` in such a way that the original list is returned if the element in question does not occur in that list?

4. In preparation of this exercise, please create a subdirectory `sample-grammars/ex5.4` under one of your directories.

   Your task is to integrate the NP grammar that you developed for exercise 3 of sheet 3 into the overall sentence grammar developed so far. To this end, please copy the files for the sentence grammar from our directory `sample-grammars/ex4+append` to your new subdirectory and extend this grammar to include the NP grammar. Please note that the phonological string for the NP can be of arbitrary length. Hence the phonological string for the combined NP and sentence grammar should be assembled by the *append*-relation that has been discussed in class.