Grammar Development in Constraint-Based Grammar Formalisms

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Exercise Sheet 5+

Please define the following relations using ConTroll syntax:

1. `last`: a two place relation which takes a list and returns the last element (if there is one),
   i.e., `last(`*`List`*`)` → *`Last-List-element`*

   Example queries:

   - `query(last([a,b,c,d]))` → `d`
   - `query(last([a,b,c]))` → `c`
   - `query(last([])) fails`

2. `firstLastSwap`: a two place relation which takes a list and returns the same list with one difference: the first list element and the last list element are exchanged,
   i.e., `firstLastSwap(`*`List`*`)` → *`List-With-First-Last-Swapped`*

   Example queries:

   - `query(firstLastSwap([a,b,c,d]))` → `[d,b,c,a]`
   - `query(firstLastSwap([a,b,c]))` → `[c,b,a]`
   - `query(firstLastSwap([])) fails`

3. `deleteA`: a two place relation which takes a list and deletes the first occurrence of `a` (if there is one),
   i.e., `deleteA(`*`List`*`)` → *`List-with-one-a-less`*

   Example queries:

   - `query(deleteA([a,b,a,d]))` → `[b,a,d]`
   - `query(deleteA([b,a,c,a,g,h]))` → `[b,c,a,g,h]`
   - `query(deleteA([b,g,a]))` → `[b,g]`
   - `query(deleteA([b,g,a,a]))` → `[b,g,a]`
   - `query(deleteA([b,c])) fails`

4. `containsList`: a three place relation which takes two lists and returns `bot` if the second list is part of the first,
   i.e., `containsList(`*List*`,`*Sublist*`)` → `bot/fail`

   Example queries:

   - `query(containsList([a,b,c,d],[b,c])) bot`
   - `query(containsList([a,b,b,c,d],[b,c])) bot`
   - `query(containsList([a,b,c,d],[a,b])) bot`
   - `query(containsList([a,b,c,d],[a,b,c])) bot`
   - `query(containsList([a,b,c,d],[a])) bot`
   - `query(containsList([a,b,c,d],[])) fails`
   - `query(containsList([a,b,c,d],[a,c])) fails`
   - `query(containsList([a,b,c,d],[b,d])) fails`