ODL127 Algorithms and Data Structures 6 February 2006

Exercise 4: Operations on Lisp Lists

1) Make sure you have read and understood the sections of notes numbered 8, 9 and 10 on "Lisp lists".

2) Download the files `LispList.class`, `LispList$Cell.class` and `UseLispLists2.java` from the course code directory (subdirectory `lispLists`). Check you can compile and run the code in `UseLispLists2.java`. The other two files are already compiled, you need them to use the type `LispList`, but you do not need the Java code which produced them. The file `UseLispLists2.java` contains a method called `parseIntLispList` which takes a string representing a Lisp list of integers and returns the equivalent object of type `LispList<Integer>`. You can use this to read Lisp lists of integers in the format for the questions below.

3) Write static methods which perform the following operations:

`length` takes a list and returns the number of integers in it. For example, with [7,3,8,12,9,14] it would return 6

`member` takes a list and an integer and returns a boolean saying whether the integer is in the list. For example, with [7,3,8,12,9,14] and 12 it would return `true`, with [7,3,8,12,9,14] and 6 it would return false.

`count` takes a list and an integer and returns the number of times the integer occurs in the list. For example, with [2,3,4,2,5,12,2,5] and 2 it would return 3.

If you can, give both iterative and recursive methods for these operations.

4) Write a static method for `delete` which takes a list and an integer and deletes the first occurrence of the integer from the list. For example, with [3,2,4,2,5,12,2,5] and 2 it would return [3,4,2,5,12,2,5].

Then write a static method for `deleteAll` which takes a list and an integer and deletes all occurrences of the integer from the list. For example, with [3,2,4,2,5,12,2,5] and 2 it would return [3,4,5,12,5].

5) Write a static method for `upto` which takes a list and an integer and returns the front portion of the list up to but not including the first occurrence of that integer. So if the list is [2,3,4,2,5,12,2,5] and the integer is 12, it will return [2,3,4,2,5].

6) Write a static method for `positions` which takes a list and an integer, and returns a list consisting of all the positions of that integer in the list. For example, if the integer is 2 and the list is [2,3,4,2,5,12,2,5], it will return [0,3,6].

7) Write a static method for `removePos` which takes a list and an integer `n`, and deletes integer at position `n` in the list. For example, if the list is [7,3,8,12,9,14] and the integer is 2 it will return [7,3,12,9,14].

8) Write a static method for `sublist` which takes two lists and returns `true` if one is a sublist of the other, `false` otherwise. For example [4,8,2] is a sublist of [5,6,4,8,2,3,1].

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