Problem Set 3

Assigned: Sept. 25
Due: Oct. 2

Problem 1

For the singly linked list structure in MyList1.java, write a static method `append(L, M)`. If L and M are lists then the call to `append(L, M)` should return a new list W that consists of the elements of L followed by the elements of M. For example if L = [2, 3, 5] and M = [6, 1, 8, 9] then the value returned would be the list [2, 3, 5, 6, 1, 8, 9]. The method should make a copy of each of the nodes in L, and then link the last node in the copy to the first node of M after the header. In that way, L and M are unchanged as a result of the method.

A. Write the method `append(L, M)`.

B. How does the running time of `append` depend on the length of L? How does it depend on the length of M?
Exercise 2

In this exercise, you will write a method for duplicating one element in a list. For example, if \( l \) is the list \([2,3,5,7]\) and you duplicate the element 5, \( l \) becomes the list \([2,3,5,5,7]\).

A. For the class \texttt{MyList1} in the class notes, write a method \texttt{l.duplicate(n)} that duplicates node \( n \) in list \( l \). Note: You may assume, without checking, that \( n \) actually is a node in list \( l \) and is not the header node.

B. Write the same method for the class \texttt{MyList2}. Note: You must be sure that the first and last fields of \( l \) remain correct. You do not have to worry about what happens to any other list that shares the same structures.

Exercise 3

A. For the class \texttt{OrderedArray}, write a method \texttt{public int numBetween(int bottom, int top)} such that \( l\).numBetween(bottom, top) returns the number of elements of list \( l \) that are greater than \( \text{bottom} \), and less than \( \text{top} \). For instance, if \( l \) is the list of ints \([2,3,5,7,11,13]\), then \( l\).numBetween(5,12) returns 2, corresponding to elements 7 and 11. You should use the method \texttt{search} or \texttt{search1} as subroutines, so that \texttt{numBetween} runs efficiently. If \( \text{top} \) is less than \( \text{bottom} \), then return 0.

B. For the class \texttt{GOrderedList}, write a generic method

\[
\text{public int numBetween(T bottom, T top)}
\]

that works in the same way. For instance if \( l \) is the list of Strings \["a", "baboon", "doesnt", "eat", "moldy", "potatoes"]\(, then \( l\).numBetween("doesnt", "north") should return 2, corresponding to the two words "eat" and "moldy".