Lab 9: Linked Lists, Stacks, and Queues

You must make a LinkedList object that implements both the Stack interface and the Queue interface. (You should download these interfaces and compile them right away.) Your LinkedList class must use generics. In addition to the methods required by the interfaces, your it must contain the following public methods:

- void addToHead(E value), which adds a new object to the head.
- void addToTail(E value), which adds a new object to the tail.
- boolean contains(E value) which returns true if the passed value is to be found anywhere in the list. Note that this should return true if it encounters any object with the same value (i.e. it uses the object’s equals() function).
- E getHead(), which returns the head value, without actually removing it.
- int getSize(), which returns the size of the LinkedList.
- E removeHead(), which removes and returns whatever object was at the head, and updates the head (and possibly the tail). Return null if the list was empty.
- String toString(), which returns a String representing this LinkedList, with each object in parentheses separated by “arrows” (->). (The LinkedList in the figure would return the String "(19) -> (512) -> (42)".)
- static void main(String[] args), which is a main() function for unit testing (see below).

All of these functions must work in constant time, except contains() and toString(). These will work in O(n) time. (This means that you will need to keep track of the list’s tail, as well as the head.)

In addition, you will probably want to make an internal Node object, that holds both the internal object as well as a pointer to the next node in the list. This object might contain a constructor and its own toString() method.

Since the LinkedList must implement both the Stack interface and the Queue interface, you will need to create other methods not shown above. However, each of these methods will be one-liners, that just call one of your methods.

The main() function should declare a Stack variable, a Queue variable, and a plain LinkedList variable. All three should use different types for E. All will be allocated as LinkedLists. Use the Stack to test all the Stack methods, the Queue to test the Queue methods, and the LinkedList to test the remaining methods.