CS 0445 Spring 2022
Recitation Exercise 3

Introduction:

In Recitation Exercise 2 you added 3 methods to the BagInterface<T> and implemented this modified interface with the ResizableArrayBag<T> class. In this exercise you will implement the same modified interface, but this time by modifying the LinkedBag<T> class.

Before continuing with this exercise, **look again at Recitation Exercise 2.** In particular, be sure you fully understand the specifications of the union(), intersection() and difference() methods.

The required methods are repeated below. However, for more detailed descriptions of their functionalities, refer back to Recitation Exercise 2.

```
// Creates a new bag that combines the contents of this bag
// and anotherBag.
//    @param anotherBag  The bag that is to be added.
//    @return  A combined bag.
public BagInterface<T> union(BagInterface<T> anotherBag);

// Creates a new bag that contains those objects that occur
// in both this bag and anotherBag.
//    @param anotherBag  The bag that is to be compared.
//    @return  A combined bag.
public BagInterface<T> intersection(BagInterface<T> anotherBag);

// Creates a new bag of objects that would be left in this bag
// after removing those that also occur in anotherBag.
//    @param anotherBag  The bag that is to be removed.
//    @return  A combined bag.
public BagInterface<T> difference(BagInterface<T> anotherBag);
```

For this exercise your task is to implement the three new methods in the LinkedBag<T> class so that they work as described. The interface is available in file BagInterface.java. The LinkedBag<T> class (without the new methods) is available in file LinkedBag.java (and on the Canvas site). Test your implementation with the main program CS445Rec3.java (note: this file is the same as CS445Rec2.java except for the bag object types). The output contents should match that shown in Rec3Out.txt. Note however, that within any bag the order of the data does not matter – so if you bags show the contents in a different order that does not necessarily mean that they are incorrect.

Important Implementation Restriction: Since the primary point of this exercise is to give you experience programming with linked-lists, it is counter-productive to access the data in your bags via arrays. Thus, **you should not use the toArray() method anywhere in this exercise.**

You are, however, allowed to use any of the other BagInterface<T> methods that are previously implemented in the LinkedBag<T> class.

Hints:

You will need to iterate through the contents of one or perhaps both of your LinkedBag<T> objects to implement these methods. This can be done by accessing the underlying linked lists in a loop.

The argument bag for each of these methods will be passed in via a BagInterface<T> parameter. This parameter type will restrict access to the methods in BagInterface and will not allow direct access of the underlying linked list. To get this access (if you need it) you will need to cast the parameter to type (LinkedBag<T>) .