CS 1410 Introduction to Computer Science – CS2
Section 1: MWF 9:30 a.m. – 10:20 a.m.
Instructor: Xiaojun Qi
Programming Assignment #11

Given: Sunday, April 7, 2013
Due: 11:59 p.m. Tuesday, April 16, 2013
Total Points: 50 points

In this assignment, you will implement set operations using a linked list. For detailed discussion on sets, see http://www.wiu.edu/users/mfmk/Math101/Sets/SOper.html. You will implement a Set class using the linked list class that was given in lecture. Each Set class instance will hold a set of **unique** integer values ranging from 1 to 99. You are to overload the following selected operators in the Set class.

- [4 points] < : proper subset – returns true if S1 is a proper subset of S2 (S1 and S2 cannot be the same sets).
- [4 points] ^ : intersection – returns a new set that is the intersection of S1 and S2. The intersection of two sets includes the elements from both sets without duplicates. For example, if S1={4, 8, 9} and S2={2, 3, 4, 7, 8, 9}, then S1^S2={4, 8, 9}. [Note: The contents in S1 and S2 remain unchanged after this operation!]
- [4 points] + : union – returns a new set that is the union of S1 and S2. Remember, there are no duplicates in the unioned set. For example, for the same S1 and S2 in the previous example, S1 + S2 = {2, 3, 4, 7, 8, 9}. [Note: The contents in S1 and S2 remain unchanged after this operation!]
- [4 points] − : set difference – all elements that are elements of S1 but not of S2. For example, if S1={1, 4, 5, 8, 9} and S2={2, 3, 4, 7, 8, 9}, S1 – S2 = {1, 5}. [Note: The contents in S1 and S2 remain unchanged after this operation!]
- [2 points] << : output all the elements of the set.
- [2 points] >> : input a qualified element into a set. A qualified element is the integer ranging from 1 to 99. This integer should be different from the other existing elements in the Set. In other words, >> will insert a unique, non-duplicated element into the Set.

In addition, your Set class should provide the following methods and features:

- [4 points] Insert: Add a qualified integer in the list in the ascending order. The Insert operation does not allow duplicates. If a duplicate integer is attempted for insertion, throw an exception class named: `DuplicateException.`
- [2 points] Delete: Delete an integer from the list.
- [2 points] Find: Return true if the integer is found in the list and print "the item is found". Return false if the integer is not found in the list and print "not found".
- [2 points] Print: Print all the elements in the linked list.
- [2 points] Size: Return a count of the number of elements in the list
- [4 points] Overloaded = operator: Make a copy of the list to another list
- [2 points] Overloaded [] operator: Return the element at the position specified. For example, Set[0] will return the first integer in the set.

- [4 points] Copy constructor.
- [2 points] Destructor.
- [4 points] Reverse: Reverse the items in the list. That is, the head of the original linked list will be the tail of the reversed list and vice versa. Of course, after this operation, the linked list stores the elements in the descending order.

[2 points] After the Set class is implemented, you must write a driver program to test all the operations and demonstrate you have correctly implemented the requirements. The grader will create his own driver code to test all the functionalities.