CS 2401 Assignment #5

Due Date: Tuesday, March 7, 11:59PM

(See the syllabus for late policy)

Objective: The goal of this assignment is to practice recursion.

Assignment: The assignment requires writing recursive methods for some linked list operations. **The use of loops is strictly prohibited in this assignment.** That is, you cannot use for, while, and do-while in the recursive methods you will write. The only time you can use a loop is when you initiate values for a linked list in the main method.

Consider that you are given he following linked list node.

```
public class MyListOfInts {
  public int firstInt;
  public MyListOfInts restOfTheInts;

  public MyListOfInts(int f){
    firstInt=f;
  }

  public MyListOfInts(int f, MyListOfInts r){
    firstInt=f;
    restOfTheInts=r;
  }

}
```

Clearly, this class can be used to create a linked list. Write a class named `ListOperations` that will contain the following methods.

1. Write a recursive method named `printMyList(MyListOfInts m)` to print all the integers in the linked list `M`. Notice that `M` is the head of the linked list.
2. Write a recursive method named `sumOfMyList(MyListOfInts m)` that will sum up all the integers in the linked list `M` and return the summation value.
3. Write a recursive method named `maxOfMyList(MyListOfInts m)` that will return the largest number in a linked list.
4. Write a recursive method named `lengthOfMyList(MyListOfInts m)` that will compute and return the length of a given linked list `M`.
5. Write a recursive method named `reverseMyList (MyListOfInts m)` to reverse a linked list. Return the head of the reversed linked list.

A template for the `ListOperations` program is given below. You need to write your codes inside the body of the methods. Modify the main method for testing purpose, as necessary.

```
public class ListOperations {

  public static void main(String[] args){
    MyListOfInts t=null;
    for (int i=0; i<5;i++){
      //int ran = (int) (100.0* Math.random());
      int ran = i+2;
      t=new MyListOfInts(ran, t);
    }
    System.out.println("All numbers in the list:");
    printMyList(t);
    System.out.println();

    System.out.println("Sum="+sumOfMyList(t));
    System.out.println("Max="+maxOfMyList(t));
    System.out.println("Length="+lengthOfMyList(t));

    t=reverseMyList(t);
    System.out.println("All numbers in the reversed list:");
    printMyList(t);
    System.out.println();
  }

  /* Write a recursive method to print all the numbers separated by spaces.
  This method cannot contain any loop (that is, uses of for, while, do
  while are prohibited).
  */
  public static void printMyList(MyListOfInts m){

       /* Write your code here */

  }

  /* Write a recursive method to retrieve the sum of all the numbers in a list.
  This method cannot contain any loop (that is, uses of for, while, do while
  are prohibited).
  */
  public static int sumOfMyList (MyListOfInts m){

       /* Write your code here */

  }

  /* Write a recursive method to retrieve the largest number from the list.
  Assume that there is at least one number in the given list when the method
  is called from the main function. This method cannot contain any loop (that
  is, uses of for, while, do while are prohibited).
  */
  public static int maxOfMyList (MyListOfInts m){

       /* Write your code here */
  }

  /* Write a recursive method to compute the length of a list.
  This method cannot contain any loop (that is, uses of for, while, do while
  are prohibited).
  */
  public static int lengthOfMyList (MyListOfInts m){

       /* Write your code here */
  }
```

```
  /* Write a recursive method named reverseMyList that will reverse a given
  linked list m. Return the head of the reversed linked list. It is fine
  if you need to modify the given linked list to obtain the reversed one.
  The method reverseMyList may not contain any loop.
  */
  public static MyListOfInts reverseMyList (MyListOfInts m){

       /* Write your code here */

  }

}
```

Output of the program above is as follows.

```
All numbers in the list:
6 5 4 3 2
Sum=20
Max=6
Length=5
All numbers in the reversed list:
2 3 4 5 6
```

Deliverables: You are expected to submit two Java files (`MyListOfInts.java` and `ListOperations.java`) via Blackboard. You have to demo your programs within one week after the due date. Your demo will be based on your last submission in the Blackboard. Your TA will instruct you with further details.