CSC220 Lab08
Linked Lists

The goal of this week's assignment is:

1. Work with linked structure
2. Learn about the importance of debugging

Things you must do:

1. There are many details in this lab. Make sure you read the whole thing carefully before writing any code and closely follow this instruction.
2. You must complete your lab **individually**.
3. Always remember Java is case sensitive.
4. Your file names, class names, package name, and method signatures must match exactly as they are specified here.

Things you must not do:

1. You must not change the file names, class names, package names.
2. You must not change the signature of any of these methods (name, parameters, …).

Part 0

- Create a new Java project and call it **Lab08.**
- Create a package inside your project and call it **lab08**.
- Download the Lab08-Assignment08 ZIP folder from Blackboard (Google drive link). Copy the following files into your new lab08 package:
    - **ListNode.java.** This class provides the definition of a node for your linked list.
    - **LinkedIntList.java.** You will be working on developing methods for this class.
    - **LinkedIntListTester.java**. You will use this class to test your code.

Part 1 – The problem description

For this lab, you are going to work on implementing various methods for a linked list that holds integer values. The main functionality of the class has been implemented for you. You are responsible for implementing the remaining methods based on the instruction below. You MUST follow the instructions exactly and you are not allowed to change the method signatures.

Your first task is to familiarize yourself with the current methods provided to you. Make sure to go through each and every method that is implemented in **ListNode.java** and **LinkedIntList.java** and make sure you know what it does, and how you can use them.

Part 2 – Implementation

In this lab you are required to write two functions:

- **public int lastIndexOf(int value)**
  - This method accepts an integer value as a parameter and returns the index in the list of the last occurrence of that value, or -1 if the value is not found in the list.
  - For example, if a variable list stores the values **[1, 18, 2, 7, 18, 39, 18, 40],** then the call of list.lastIndexof(18) should return 6. If the call has instead been list.lastIndexOf(3), the method should return -1.
- **public void removeAll(int value)**
  - This method should remove all occurrences of a particular value. For example, if a variable list stores the values **[3, 9, 4, 2, 3, 8, 17, 4, 3, 18]**, the call of list.removeAll(3); would change the list to store **[9, 4, 2, 8, 17, 4, 18]**. You should not use any auxiliary data structure to solve this problem. You MUST solve this problem by rearranging the links of the list.

Again, you need to accomplish both tasks by changing the references. Do not create copies of the linked list. In this lab you should be very careful and mindful of infinite loops, (see the next section).

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Part 2 – Implementation

For this assignment, you are required to write two functions:

- public void stutter()
    - This method will double the size of the list by replacing every integer in the list with two of that integer. If the list is empty, simply return.
    - For example, suppose a variable list stores the values [1, 8, 19, 4, 17], after a call of list.stutter(), it should store [1, 1, 8, 8, 19, 19, 4, 4, 17, 17].

- public void shift()
    - This method will rearrange the elements of a list of integers by moving to the end of the list all values that are in odd-numbered positions and otherwise preserve the list order. Remember, it does not matter whether the value itself is odd or even; what matters is whether the value appears in an odd index (index 1, 3, 5, etc).

Also, the original order of the elements of the list should otherwise be preserved. You may not construct any new nodes nor use any auxiliary data structures to solve this problem. You also may not change any data fields of the nodes; you MUST solve this problem by rearranging the links of the list.

- For example, suppose that a variable list stores the values [10, 31, 42, 23, 44, 75, 86]. The call of list.shift(), should rearrange the list to store [10, 42, 44, 86, 31, 23, 75].

Again, you need to accomplish both tasks by changing the references. Do not create copies of the linked list. In this assignment, you should be very careful and mindful of infinite loops, (see the next section).

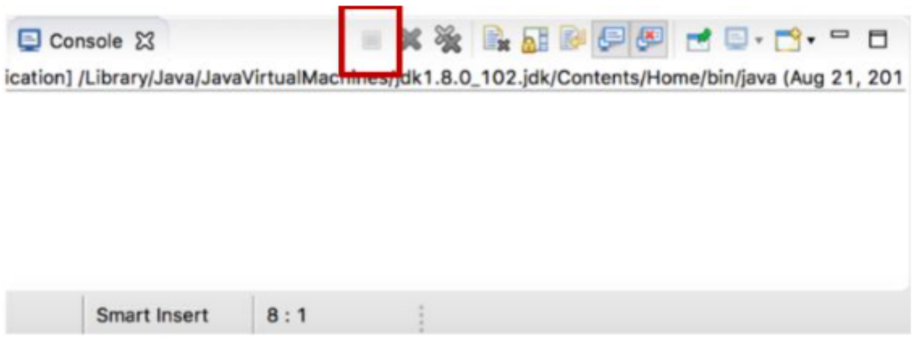
Part 3 – Test your code

As usual you need to test the functionality of the methods you have implemented. A set of comprehensive test has been provided for you as part of **LinkedIntListTester.java**. Uncomment the assignment portion of the tests and run the main function. If you see any red text that says “TEST FAILED”, you need to debug your code.

How to debug your code?

1. A toString method has been provided for you, use it to inspect the structure of your linked list.
2. Use the Eclipse debugger you learned about during the first lab
3. If you see JavaStackOverflow, that means that you have an infinite recursive call and your recursive call is filling up the “call stack” (we talked about this concept in class). Go back and debug the method that is causing the problem.

4. Infinite loops! How would you know you have an infinite loop? As you should know from CSC120, if you have an infinite loop in your code, your code will not stop running. An easy way to inspect that in Eclipse is to look at your console window, if your code is done running the console should look like the following


Console
ication] /Library/Java/JavaVirtualMachines/jdk1.8.0_102.jdk/Contents/Home/bin/java (Aug 21, 201
Smart Insert
8 : 1

If the little square marked above is red and continues to stay red, that means your code has an infinite loop!