**King Fahd University of Petroleum & Minerals**

**College of Computer Science and Engineering**

**Information and Computer Science Department**

**ICS 202 – Data Structures**

# Linked Lists-Part I

**Objectives**

The objective of this lab is to design, implement and use Linked Lists

**Outcomes**

After completing this Lab, students are expected to:

* Understand the structure of a singly linked list class
* Add methods and enhance the functionality of a linked list class
* Use linked lists class in an application

**Notes**

For the purpose of this lab, you may download the attached programs.

**Lab Exercises**

1. Download the files related to Linked Lists associated with this lab. Compile and run the programs.

2. Warm-up Exercise: Write a method **public int length()** in the class SLL<T>.java that returns the length of the linked list. (Additional Exercise: Can you make a recursive length method?)

3. Add the following methods to the class **SLL<T>.java**:

(a) **public void insertBefore(T newElem, T existingElem)** that inserts an element **newElem** before the element **existingElem**. If no **existingElem** exists, then the method prints **existingElem does not exist** and returns. If more than one instance of **exisingElem** exists, then the methods inserts before the first instance of **existingElem**.

For example, suppose your linked list (of integers) is: [ 3 5 4 2 9 ],

Then a call to **insertBefore(new Integer(5), new Integer(9))** would result in the following linked list: [ 3 5 4 2 5 9 ]

A call to **insertBefore(new Integer(7), new Integer(5))** would result in [ 3 7 5 4 2 5 9 ]

A call to **insertBefore(new Integer(8), new Integer(10))** would result in

WARNING: Element 10 does not exist in the linked list. Insertion failed.

(b) Add the following methods with the same methodology as **insertBefore:**

 (i) **public void insertAfter(T newElem, T existingElem)**

 (ii) **public void deleteBefore(T elem)**

 (iii) **public void deleteAfter(T elem)**

 Make sure you test for cases where the list has only one element.

 (c) Write a **test class** to test these methods.

 The test data is as follows:

Make a new linked list, called **fruitList** of strings with the following information:

[“Apple”, “Mango”, “Banana”, “Peach”, “Watermelon”]

Now

(a) insert before “Apple” the word “Fruits”.

(b) insert before “Banana” the word “Orange”

and print the list.

Likewise, do the same for all four methods. Note that deleteBefore and deleteAfter take only one parameter.

4. [Advanced] Write a class **SortedSLL<T extends Comparable<T>>** that creates a sorted list. A sorted list has a **public void** **insert(T e)** method that inserts each element of type **T** in its correct position (ascending order). Make sure you provide a delete method also that deletes a given element. Assume the list contains unique elements.