# CSC 232: Data Structures and Algorithms

**Assignment 4: Singly Linked List**

**Due: Tuesday, October 13, 2015 @**11:15 PM

*Submit all programs through BB by midnight on the due date. Email your programs to me* as a last resort *if you experience problems with BB.*

The purpose of this assignment is to:

* Implement a formal data structure using a C++ class and a friend class.
* Practice use of class templates.
* Learn the use of pointers.
* Use good memory management techniques.

**Customer Requirements**

You are a motivated software developer and budding entrepreneur advertising for part-time work on the Internet. A small business called Widgets-R-Us has decided to give you an opportunity, but you will have to prove yourself first so they are only giving you the initial part of their overall project. Their hope is that you will use some Computer Science techniques to help them simplify their product.

Widgets-R-Us manufactures a small PCB (printed circuit board), called the WRU-1 that they program with one of three options:

* a simple computer game, Tic-Tac-Toe
* a four-function calculator, 4Calc
* a fun/whimsical program, 8-Ball Oracle

Widgets-R-Us sells the WRU-1 to other companies that put them into cheap plastic enclosures that can be used in a variety of ways, like keychain decorations, “the prize” in cereal boxes, party favors, or on the tips of pencils. Recently, they started having trouble getting new customers because of the limited number of programs that run on the WRU-1.

The rudimentary operating system they have been using allocates memory sequentially and is based on the array. In order to expand into the types of programs that their customers are requesting, they need a more flexible allocation scheme. If they can increase the number of programs that run on their PCB, they can increase their potential market.

The engineers have come up with a prototype, the WRU-2a. They modified the old firmware to return a random memory address rather than a sequential address. What they need from you is a data structure that can take advantage of this random memory function. In the prototype, the data stored at each memory location is a game instruction encoded as a floating point number. This is likely to change in the future.

**Assignment Requirements**

* Implement a singly linked list (SLL) abstract data type using an implementation the book with two classes. Call the first class **Node** and the second class **SLinkedList**. Both classes will be templated using the typename **E** which stands for element.
* Include the comment template at the top of your program.
* Instantiate a list of type **float**.
* Generate 10 random numbers between 0.01 and 9.99. Use them for the element field and call **addFront()** to add 10 new nodes to your list. These random numbers must not have more than two digits beyond the decimal or there will be a buffer overflow in the WRU-2a.
* Overload the **<<** operator to print the list like this: {4.31, 6.22, 9.15}. Do not include a trailing **std::endl** in this method.
* Add a method to sort the list using the insertion sort algorithm in DSA 3.1.2 Follow the algorithm as closely as possible. The tendency for this assignment is to overcomplicate things so here’s a hint: *it is not necessary to change the structure of the list to sort it.*
* Use good coding style as documented in the Coding Style Cheat Sheet (in the Resources folder in BB).
* You may use only language features discussed in class or presented in the book up to the date the assignment is due. Your submission must be your own work. You may not utilize any code outside of that provided in class or in the book, and you may not post any provided code on publicly accessible websites. Submit only what is requested.