American University of Armenia, CSE
CS 121 Data Structures A, B, C
Fall 2019

Homework Assignment 3

Due Date: Thursday, October 3 by 23:55 electronically on moodle

Please solve the programming tasks either in Java or C++, following good coding practices (details posted in moodle).

You should submit full tested programs for all questions.

1. **(30 points)** Implement **bubble sort** for a doubly linked list of integers. Your bubble sort method/function should receive only the header node of the list. Write a program that (i) constructs a doubly linked list of integers, (ii) calls your method to bubble sort the list, and (iii) prints the sorted sequence. **Your method should not access or use any of the data/methods of the** `DoublyLinkedList` **class. Thus, the nested** `Node` **class must be declared** `public` **for use outside of the** `DoublyLinkedList` **class.**

2. **(20 points)** Extend the `CircularlyLinkedList` class with a method/function that implements the `removeLast` operation for a **circularly linked list**. What is the running time of your method/function? Can you improve the running time? If so, how?

3. **(22 points)** Implement the **Deque ADT** using a **circular array**. Note that all operations should have $O(1)$ running time. Your `ArrayDeque` class should implement the `Deque` interface given in the textbook. Write a program to test all the methods of your class.

4. (a) **(25 points)** Suppose you have two nonempty stacks S and T and a doubly linked list D. Write an **efficient** method/function that uses D to modify S to store all the original elements of both S and T, and to make T empty. In the resulting S, the original elements of S should go above all of the original elements of T. Note that both sets of elements should still be in their original order.

   (b) **(3 points)** Explain the time complexity of your method in part (a).