American University of Armenia, CSE
CS121 Data Structures A, C
Fall 2021

Homework Assignment 4

Due Date: Tuesday, October 26 by 23:59 electronically on Moodle

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

1. **(10 points)** Consider a sequence of non-negative integers of maximum six digits. Implement the radix sort algorithm for such a sequence. You should use array lists to represent the sequence to be sorted and for the intermediate steps of the algorithm, i.e. the buckets should also be array lists. Illustrate the use of your implementation in a program. What is the execution time of this implementation?

2. **(15 points)** Write a efficient method that, given an array list of integers sorted in non-decreasing order, removes duplicate elements from it. Similarly, write a method that does the same thing for a linked positional list. Illustrate the work of both methods in a program. Specify and compare the execution times of the two methods.

3. **(20 points)** Implement the List ADT using a doubly linked list as the underlying data structure. Name the class `DLLList`. Test it in a sample program. Specify and discuss the execution times of each of the List ADT methods/functions in this implementation.

4. **(15 points)** Extend your answer in question 3 with an iterator (using the `Iterator` and `Iterable` interfaces) that enumerates only the elements at odd indices of a `DLLList`.

5. **(20 points)** Write a class `StringArrayPositionalList` that represents a positional list of integers using a dynamic array as the underlying data structure. Note that your class should implement the `PositionalList<String>` interface.

6. **(20 points)** Extend your answer in question 5 with an iterator (using the `Iterator` and `Iterable` interfaces) that enumerates the contents of a `StringArrayPositionalList` in non-decreasing order of length. What is the running time of your iterator class constructor and its public methods? What is the space complexity of your iterator class implementation? Briefly justify your answers.