American University of Armenia
CS 121 Data Structures A

Homework Assignment 2

1. (2 points) Modify the recursive binary search algorithm so that it returns the index of the target in the sequence or -1 (if the target is not found). Test your Java/C++ algorithm implementation on a few examples and show the results.

2. (2 points) Implement a fast recursive algorithm for reversing a singly linked list L, so that the ordering of the nodes becomes opposite of what it was before. You can use the linked list implementations from the textbooks. What is the running time of your algorithm?

3. (2 points) Suppose you are given an array A, containing n distinct integers that are listed in increasing order. Describe and implement a recursive algorithm that prints all the pairs of opposite integers in A. What is the running time of your algorithm? Is it optimal?

4. (3 points) Suppose you are given an array A, containing n distinct integers that are listed in increasing order. Describe and implement a *nonrecursive* algorithm, running in $O(n)$, that prints all the pairs of opposite integers in A. Is it optimal?

5. (2 points) Write a Java/C++ method that, given a two-dimensional array of integers, produces a new array with the maximal elements from every column in the original array. What is the running time of your algorithm? Test your method on a few examples and show the results.

6. (3 points) Write a Java/C++ method that, given a singly linked list of integers, performs insertion sort on it. You can rely on the linked list implementations from the textbooks and can use a second list in your implementation. What is the running time of your algorithm? Test your method on a few examples and show the results.

7. (3 points) Write a Java/C++ method that, given a singly linked list of singly linked lists of integers, increments the values of all the integers stored. You can rely on the linked list implementations from the textbooks. What is the running time of your algorithm? Test your method on a few examples and show the results.

Challenge. Problem 1603 from Timus Online Judge, http://acm.timus.ru/ can be solved with multiple recursion. Will you be able to find a solution? If you have written a program and want to test it, you need to register on this webpage and submit your solution for automatic testing.