Faculty of Engineering, University of Jaffna

Department of Computer Engineering

EC4070: Data Structures and Algorithms

Lab – 01

Design and Analysis of Non-Recursive Algorithms

Date: 6th November 2020 **Duration: 3 hour**

Note: You can reuse relevant **PreLab - 01** code to implement Java programs for both questions.

1. Local minimum of a matrix. **[60 Marks]**

Given an N-by-N array a[ ][ ] of N^2 distinct integers, design a non-recursive algorithm to find all local minimums with pair of indices i and j such that

a[i][j] < a[i+1][j],

a[i][j] < a[i][j+1],

a[i][j] < a[i-1][j], and

a[i][j] < a[i][j-1].

1.1. Write down the algorithm step by step.

1.2. Analyze the runtime of the above algorithm.

1.3. Implement your algorithm using Java which takes the two dimensional integer array as user input and displays the correct output

Test case:

Input:

[[26 27 58 38]
[33 53 70 42]
[5 33 2 66]
[65 55 70 44]]

Output:

26, 38, 44, 5, 2 (Can be printed in any order)

2. Closest Pair (in one dimension) **[40 Marks]**

The Closest Pair program, given an array a[ ] of N double values, finds closest pair(s): two values whose difference is not greater than the difference of any other pair (in absolute value).

2.1. Write a non-recursive algorithm for the Closest Pair program.

2.2. Analyze the runtime of the above algorithm.

2.3. Implement your algorithm using Java which takes one dimensional double array as user input and displays the correct output.

Test case:

Input: [-5, 9, -3, -2, 0, 1, 10]

Output: (-3, -2), (0, 1) and (9, 10)

Instructions:

- Write down your answers for question 1.1, 1.2, 2.1 and 2.2 clearly in a document named 201x_E_xxx_L1_Report (It should be a pdf file). Algorithm will be evaluated based on efficiency, correctness and readability. Submit your answers at the end of the lab session.
- Implement Java programs for question 1.3 and 2.3 using best coding practices.
- Create a zip file named 201x_E_xxx_L1 which contains 201x_E_xxx_L1_Report and Java programs for question 1.3 and 2.3.
- Upload the zip file on/before given deadline via team.