SCS2101 - Data Structures and Algorithms III

Assignment 03 – Takehome Assignment

Question 01

A mathematician wants to find the zig-zag sequence of a given sequence of numbers. **Zig-zag sequence** is the differences between successive numbers strictly alternate between positive and negative.

For example, {1, 3, 2, 10, 1, 7} is a zig-zag sequence because the differences (2, -1, 8, -9, 6) are alternately positive and negative. Furthermore, {2, 5, 8, 3, 6} and {2, 8, 5, 6, 6} are not zig-zag sequences. Because in {2, 5, 8, 3, 6}, the first two differences are positive and in {2, 8, 5, 6, 6}, the last difference is zero.

Given a sequence of integers, return the length of the longest subsequence of the sequence that is a zig-zag sequence. A subsequence is obtained by deleting some number of elements (possibly zero) from the original sequence, leaving the remaining elements in their original order.

Rangana, a software engineer wishes to implement this program using Java.

The implementation should work for the following inputs:

1. {1, 7, 4, 9, 2, 5}
2. {1, 17, 5, 10, 13, 15, 10, 5, 16, 8}
3. {44}
4. {1, 2, 3, 4, 5, 6, 7, 8, 9}
5. {70, 55, 13, 2, 99, 2, 80, 80, 80, 80, 100, 19, 7, 5, 5, 5, 1000, 32, 32}
6. {374, 40, 854, 203, 203, 156, 362, 279, 812, 955, 600, 947, 978, 46, 100, 953, 670, 862, 568, 188, 67, 669, 810, 704, 52, 861, 49, 640, 370, 908, 477, 245, 413, 109, 659, 401, 483, 308, 609, 120, 249, 22, 176, 279, 23, 22, 617, 462, 459, 244}

You want to give the sequence as a keyboard input. Also, you want to return the count of output sequences and the elements of the output sequences.

Question 02

Anupa is a Tech Lead in Virtusa is going to organize a dinner dance. Everyone in Virtusa has got invitations and each invitation is containing a random number. All the invitees must participate for the dinner dance. When an invitee comes to the party he/she can sit down on a squared table with his/her friends.

Anupa starts the game after all the invitees sit on a squared table. He picks a random person from a certain table and tells that person to read his/her number in the invitation out loud. Anupa moves this process clockwise around the table and each person will read out loud their numbers in the invitation. The goal is to find that set of numbers which forms an increasing subsequence. All people owning these numbers will

be eligible for a lucky draw. Isuru is a software engineer in Virtusa. He wishes to implement this program using Java.

- If the obtained sequence is {1, 3, 2}, then the output increasing sequence is {1, 2}.
- If the obtained sequence is {1, 5, 2, 4, 8, 6}, then the output increasing sequence is {1, 2, 4, 6}.

Constraints:
- If N is the number of invitees and 1<=N<=1000.
- Each number of the invitation must be generated randomly.

Note: The random number may be repeated.

Instructions

1. This is a group assignment and each group has 3 or 4 members.
2. Implement the two questions in Java.
3. Write a report with all the inputs, outputs of two questions and individual contribution of each member.
4. Submit a zip file to the LMS by one student from each group as Group_<group_number>.zip.
5. The zip file must consist of
    a. The PDF version of the report.
    b. Two .java files.

Plagiarism

All work must be your own group members. All forms of plagiarism and cheating (for example downloading programs/content directly from the internet or copying from another group) are regarded seriously and could result in heavy penalties including failure in the assignment. Under certain circumstances some students may be called for a viva.