19I510 DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

LAB TEST - 1

SET - 2

1. Topological Sorting

An organization has n employees each having a unique ID in the range [0,n-1]. There is one direct manager for each employee. CEO is head of the company with ID as 0, and no direct manager. The CEO wishes to propagate a major announcement to all the employees of the organization. The information is passed through the manager. Given the time taken by the manager to communicate the information to the subordinates, find the total time taken for the news to reach every employee in the organization.

Note: It is guaranteed that all employees can be informed.

Input: The first line contains the value of n. The next line contains the id of the manager for every employee separated by space. The last line contains the time taken by the manager to propagate the news to all his/her subordinates. -1 for manager id indicates that the employee does not have a manager.

Output: Print the total time taken for the news to reach every employee in the organization.

Sample Input

6
-1 0 0 2 2 3
1 1 4 7 1 1

Sample Output

12

#HINT: use topological sorting to find the order in which the news will propagate and cost of propagation is added only when the manager has a subordinate.

Input	Output
5 -1 0 1 1 2 5 7 6 5 4	18
6 -1 4 5 2 5 0 3 5 10 7 11 3	27
7 -1 2 3 0 2 4 5 7 8 1 9 5 5 5	27
4 -1 2 0 1 5 7 8 9	20

2. Modified Merge Sort

Given a list of positive and negative numbers, use merge sort to reorder elements such that negative elements occur before positive elements. But the elements should maintain their relative ordering

Input: The first line contains the number of integers and the following line contains n integers separated by space

Output: Print the n ordered integers separated by space

Constraints 1 ≤ n≤ 50 000; array elements ai −108 ≤ ai ≤ 108

Sample
Input:
10
5 -4 6 7 2 -3 -1 6 -7 1

Sample Output:
-4 -3 -1 -7 5 6 7 2 6 1

Input	Output
2 1 -1	-1 1
3 2 -1 1	-1 2 1
11 8 7 -2 9 4 -4 3 9 6 1 2	-2 -4 8 7 9 4 3 9 6 1 2
8 1 2 3 4 -4 -3 -2 -1	-4 -3 -2 -1 1 2 3 4

3. Hashing

Collatz sequence is an iterative sequence defined for the set of positive integers:

If n is even, reduce it by half n → n/2

else triple the number and add 1 to it n → 3n + 1

This sequence eventually reaches 1 for all or most of the possible values

Starting with 13, we generate the following sequence:

13 40 → 20 → 10 → 5 → 16 → 8 → 4 → 2 → 1

It can be seen that this sequence (starting at 13 and finishing at 1) contains 10 terms.

Find the length of longest Collatz sequence from integers from 1 to n

Input: The first line contains the value of n

Output: Print the length of longest sequence and the starting number which produced the longest chain separated by a space

Constraints 1 ≤ n≤ 10000

Sample
Input:
8

Sample Output:
17 7

Input	Output
100	119 97
35	112 27
15	20 9
12	20

4. Given a string and the pattern, determine the index positions where the pattern is found in the string. Implement rabin-karp algorithm.

Input: The first line contains a string and the following line contains the pattern

Output: Print all the index positions where the pattern is found separated by a space. If the pattern is not found in the string, print -1.

Sample Input:
health is wealth
ealth

Sample Output:
1 11

Input	Output
Time and Tide Wait for None Time	0
ADADADDDDADAD ADAD	0 2 9
STUDIOUS STUDENT STUD	0 9
LOTOFMONEYINLOTTERY LOT	0 12