CSCI2100B Assignment 4

Due: 23:59, April 20, 2022

1 Submission

Please submit your code on https://vjudge.net/contest/487464, as well as a simple report on Blackboard. Make sure to include your SID in your report names.
The grading scheme of this assignment is as follows. $[0, 5]$ is the score of your report. Note that partial marks for unsolved problems will only be given if you solve 0 problems.

#Solved Problems	Score
0	[0,30]+[0,5]
1	40+[0,5]
2	60+[0,5]
3	90+[0,5]
4	95+[0,5]

2 Problem 1

2.1 Statement

A graph of n vertices and $n-1$ **directed** edges is given. The i-th edge is from vertex i to vertex $i+a_i$. You need to determine whether it is possbile to arrive at vertex t starting from vertex 1.

2.2 Input

Two numbers n $(3 \leq n \leq 3 \times 10^4)$ and t $(2 \leq t \leq n)$ in the first line.
$n-1$ numbers $a_1, ..., a_{n-1} (1 \leq a_i \leq n-i)$ in the second line.

2.3 Output

"YES" or "NO".

2.4 Example

Input:
8 4
1 2 1 2 1 2 1
Output:
YES

Input:
8 5
1 2 1 2 1 1 1
Output:
NO

3 Problem 2

3.1 Statement

You are asked to build the **minimum** number of roads between n cities so that you can travel from every city to any other city by **at most two** roads. There are also m roads that are not allowed to build. It is guaranteed that a solution exists under the given constraints.

3.2 Input

n ($1 \leq n \leq 10^3$) and m ($0 \leq m < n/2$) in the first line.
m pairs of integers a_i, b_i ($1 \leq a_i, b_i \leq n, a_i \neq b_i$) in the following m lines. Roads cannot be built between city a_i and city b_i.

3.3 Output

One integer s in the first line denoting the number of roads.
Each of the following s lines describes a road by two city numbers.
If there are multiple solutions, you can print any of them.

3.4 Example

Input:
4 1
1 3
Output:
3
1 2
4 2
2 3

4 Problem 3

4.1 Statement

Can you find a path of minimum cost from vertex 1 to vertex n in a weighted undirected graph of n vertices and m edges?

4.2 Input

Two numbers in the first line: n and m ($2 \leq 10^5, 0 \leq m \leq 10^5$).
Each of the following m lines contains three integers u_i, v_i, w_i ($1 \leq u_i, v_i \leq n, 1 \leq w_i \leq 10^6$), which describes an edge between vertex u_i and vertex v_i with a cost of w_i.

4.3 Output

Output "-1" if such path does not exist. Otherwise, please output any path of minimum cost.

4.4 Example

Input:
5 6
1 2 2
2 5 5
2 3 4
1 4 1
4 3 3
3 5 1
Output:
1 4 3 5

5 Problem 4

5.1 Statement

You are given a graph of $n + 1$ vertices and $2n - 1$ **directed** edges.

- $n - 1$ edges are from vertex i to vertex $i + 1$ for $i = 1, ..., n - 1$.
- n numbers a_i describe the remaining n edges. The i-th edge is going from vertex i to vertex $n+1$ if $a_i = 0$, or from vertex $n+1$ to vertex i if $a_i = 1$.

Can you find a path visiting each vertex exactly once? You can start and end at any vertices.

5.2 Input

A number t ($1 \leq t \leq 20$) denoting the number of testcases.
In each testcase, the first line has one integer n ($1 \leq n \leq 10^4$). The second line contains n integers a_i ($a_i \in \{0, 1\}$).

5.3 Output

For each testcase, print a line of $n+1$ integers denoting a path you find, or "-1" if there are no such paths.
If there are multiple correct paths, you can print any of them.

5.4 Example

Input:
2
3
0 1 0
3
1 1 0
Output:
1 4 2 3
4 1 2 3