Problem H. Delivery Route

Input file: standard input
Output file: standard output

Pony is the boss of a courier company. The company needs to deliver packages to n offices numbered from 1 to n. Especially, the s-th office is the transfer station of the courier company.

There are x ordinary two-way roads and y one-way roads between these offices. The delivery vans will consume c_i power if they pass through the i-th road. In general, the power consumption on one road must be non-negative. However, thanks to the experimental charging rail, the consumption may be negative on some one-way roads.

Besides, Pony got the following public information. The relevant department promised that if there is a one-way street from a_i to b_i, it is impossible to return from b_i to a_i.

To avoid the delivery vans anchoring on the road, Xiaodao wants to find these lowest power consumptions from the transfer station to these offices.

Input

The first line contains four integers n $(1 \le n \le 25000), x, y$ $(1 \le x, y \le 50000)$, and s $(1 \le s \le n)$. This is followed by $x + y$ lines, each line of which contains three integer a_i, b_i $(1 \le a_i, b_i \le n, a_i \ne b_i)$ and c_i $(-10000 \le c_i \le 10000)$ describing the roads. The first x given roads are ordinary two-way roads, and the last y given roads are one-way roads.

Output

The output should contain n lines, the i-th line represents the minimum energy consumption from s-th to the i-th office if possible, or output "`NO PATH`" if it is impossible to reach the i-th office.

Example

standard input	standard output
6 3 3 4 1 2 5 3 4 5 5 6 10 3 5 -100 4 6 -100 1 3 -10	NO PATH NO PATH 5 0 -95 -100