Problem J. Traveling in Jade City

Input file:	`standard input`
Output file:	`standard output`
Time limit:	3 seconds
Memory limit:	1024 megabytes

Jade City has a circular railroad system, which has N stations labeled by $1, 2, \ldots, N$ in the clockwise direction. Due to the city's rapid development in recent years, an extra line that connects Station 1 and Station K ($1 < K \leq N$) is now in use, and apart from these two terminal stations, there are M other stations on the line. These M stations are labeled by $N+1, N+2, \ldots, N+M$, from the direction of Station 1 to Station K. See Figure 14 for an illustration.

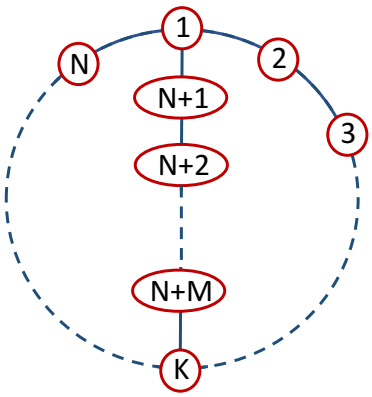


Figure 14: An illustration of Jade City's railroad system

The rails connecting adjacent stations have different lengths, so that traveling along them requires different amount of time. For simplicity, we label these rails as follows:

- c_i: For $1 \leq i \leq N-1$, the rail between Station i and Station $i+1$;
- c_N: For the rail between Station N and Station 1;
- x_0: For the rail between Station 1 and Station $N+1$;
- x_j: For $1 \leq j \leq M-1$, the rail between Station $N+j$ and Station $N+j+1$;
- x_M: For the rail between Station $N+M$ and Station K.

Given the traveling time for each of these rails, we want to compute the fastest way to travel from some station u to some station v using this railroad system. However, from time to time, some of the rails may become unavailable due to maintenance, so that the train cannot pass through them. (Initially, all the rails are available.)

Input

The first line contains three integers N, K, and M, as specified in the problem description, followed by an integer Q, representing the total number of query or update operations. The second line contains N non-negative integers, which denote the traveling times t for the rail $c_1, c_2, \ldots, c_N$, respectively. The third line contains $M+1$ non-negative integers, which denote the traveling times t for the rail $x_0, x_1, \ldots, x_M$, respectively. Then, Q lines follow, where each line specifies an operation by the following format:

- If the line begins with the letter "q" and is followed by two integers u and v ($1 \leq u, v \leq N+M$): It requests us to output the fastest time to travel from station u to station v, if there is a way. Else, output the word "impossible".

- If the line begins with the letter "c", followed by an integer i ($1 \leq i \leq N$): It means the state of edge labeled by c_i is toggled. Precisely, if c_i is originally available, then after this operation, c_i becomes unavailable. In contrast, if c_i is originally unavailable, then after this operation, c_i becomes available.
- If the line begins with the letter "x", followed by an integer j ($0 \leq j \leq M$): It means the state of edge labeled by x_j is toggled. Precisely, if x_j is originally available, then after this operation, x_j becomes unavailable. In contrast, if x_j is originally unavailable, then after this operation, x_j becomes available.

Constraints

- $1 \leq N, K, M, Q \leq 10^6$;
- The traveling time of any rail is a non-negative integer at most 200.

Output

For each query, output on a separate line the corresponding answer.

Examples

standard input	standard output
4 3 1 9 2 3 8 4 1 1 q 3 4 x 0 q 3 4 c 3 q 3 4 c 1 q 3 4 x 0 q 3 4	6 8 9 impossible 6