Board Game

There is a board game for K players. The board of this game consists of N cells numbered from 1 to N, and M paths numbered from 1 to M, where path j ($1 \le j \le M$) connects cells U_j and V_j bidirectionally.

There are two types of cells on the board: **re-activate cells** and **stop cells**.

This information is given by a string S of length N consisting of `0`' and 1', where the i-th character of S ($1 \le i \le N$) is '`0`' if cell i is a re-activate cell, and '`1`' if cell i is a stop cell.

This board game is played by K players numbered from 1 to K. Each player has their own piece, and the game starts with each player placing their piece on a specified cell. At the beginning, player p ($1 \le p \le K$) places their piece on cell X_p. Note that multiple players' pieces can be placed on the same cell.

The game progresses with each player taking turns starting from player 1 and proceeding in numerical order. After player p finishes their turn, the turn moves to player $p + 1$ (if $p = K$, then the turn goes to player 1). Each player takes the following actions on their turn:

1. Choose one cell connected to the cell where their piece is placed via a path, and move their piece to the chosen cell.
2. If the destination cell is a re-activate cell, repeat step 1 and continue their turn. If the destination cell is a stop cell, end their turn.

The team consisting of K members, including JOI-Kun, who represent Japan in this board game, are researching cooperative strategies to quickly conquer the game. They are currently studying the following problem:

> What is the minimum total number of moves required by the K players in order to place player 1's piece on cell T? Even if it's in the middle of a turn, if player 1's piece is placed on cell T, the condition is considered satisfied.

Given the information about the board of the game and the initial placement of each player's piece, create a program to calculate the answer to this problem for each $T = 1, 2, \ldots, N$.

Inputs

Read the following data from the standard input.

N M K
U_1 V_1
U_2 V_2
$\vdots$
U_M V_M
S
X_1 X_2 $\cdots$ X_K

Outputs

Output N lines to the standard output. On the T-th line ($1 \leq T \leq N$), output the minimum total number of moves required by the K players to place player 1's piece on cell T.

Constraints

- $2 \leq N \leq 50\,000$.
- $1 \leq M \leq 50\,000$.
- $2 \leq K \leq 50\,000$.
- $1 \leq U_j < V_j \leq N$ ($1 \leq j \leq M$).
- $(U_j, V_j) \neq (U_k, V_k)$ ($1 \leq j < k \leq M$).
- It is possible to reach any cell from any other cell by traversing several paths.
- S is a string of length N consisting of '`0`' and '`1`'.
- $1 \leq X_p \leq N$ ($1 \leq p \leq K$).
- N, M and K are integers.
- U_j and V_j are integers ($1 \leq j \leq M$).
- X_p is an integer ($1 \leq p \leq K$).

Subtasks

1. (3 points) There are no stop cells.
2. (7 points) There is exactly one stop cell.
3. (7 points) There are exactly two stop cells.
4. (19 points) $N \leq 3\,000$, $M \leq 3\,000$, $K \leq 3\,000$.
5. (23 points) $K = 2$.
6. (9 points) $K \leq 100$.
7. (23 points) $N \leq 30\,000$, $M \leq 30\,000$, $K \leq 30\,000$.
8. (9 points) There are no additional constraints.

Sample Input and Output

Sample Input 1	Sample Output 1
5 5 2	0
1 2	1
2 3	2
2 4	2
3 5	3
4 5	
00000	
1 5	

Since player 1's piece starts on cell 1, the answer for $T = 1$ is 0.

For $T = 2$, in the first move, player 1 can move his piece from cell 1 to cell 2. Therefore, the answer for $T = 2$ is 1.

For $T = 3$, they can place player 1's piece on cell 3 with the following 2 moves:

- In the first move, player 1 moves his piece from cell 1 to cell 2. Since cell 2 is a re-activate cell, player 1's turn continues.
- In the second move, player 1 moves his piece from cell 2 to cell 3.

Since they cannot place player 1's piece on cell 3 in 1 or fewer moves, the answer for $T = 3$ is 2.

Similarly, it can be verified that the answer for $T = 4$ is 2 and for $T = 5$ is 3.

This sample input satisfies the constraints of subtasks 1, 4, 5, 6, 7, and 8.

Sample Input 2	Sample Output 2
5 5 2 1 2 2 3 2 4 3 5 4 5 01000 1 5	0 1 4 4 5

For $T = 3$, they can place player 1's piece on cell 3 with the following 4 moves:

- In the first move, player 1 moves his piece from cell 1 to cell 2. Since cell 2 is a stop cell, it's player 2's turn next.
- In the second move, player 2 moves his piece from cell 5 to cell 3. Since cell 3 is a re-activate cell, player 2's turn continues.
- In the third move, player 2 moves his piece from cell 3 to cell 2. Since cell 2 is a stop cell, it's player 1's turn next.
- In the fourth move, player 1 moves his piece from cell 2 to cell 3.

Since they cannot place player 1's piece on cell 3 in 3 or fewer moves, the answer for $T = 3$ is 4.
This sample input satisfies the constraints of subtasks 2, 4, 5, 6, 7, and 8.

Sample Input 3	Sample Output 3
5 5 2 1 2 2 3 2 4 3 5 4 5 01100 1 5	0 1 3 3 4

This sample input satisfies the constraints of subtasks 3, 4, 5, 6, 7, and 8.

Sample Input 4	Sample Output 4
8 7 5 1 3 5 7 4 6 2 6 2 3 7 8 1 5 10011010 4 6 4 7 1	4 2 3 0 10 1 17 24

This sample input satisfies the constraints of subtasks 4, 6, 7, and 8.

Sample Input 5	Sample Output 5
12 13 3 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 1 10 2 9 7 12 11 12 110000011101 1 9 11	0 1 4 5 6 7 8 8 4 1 13 9

This sample input satisfies the constraints of subtasks 4, 6, 7, and 8.