

There is a forest of colorful rooted trees containing n nodes. You are given m operations. Execute them one by one, and output the results.

1 $x y c$	Change x 's father to y . If $x = y$ or x is an ancestor of y , simply ignore it. The edge between x and its old father is removed, and the new edge should be painted with color c .
2 $x y c$	Paint all the edges along the path x - y with color c . If there is no path between x and y , simply ignore it.
3 $x y$	Count the number of edges along the path x - y , and the total number of colors among these edges.

Input

The input contains several test cases. The first line of each test case contains two integers n and m ($1 \leq n \leq 50,000$, $1 \leq m \leq 200,000$). Nodes are numbered from 1 to n . The second line contains n integers $F[i]$ ($0 \leq F[i] \leq n$), the father of each node ($F[i] = 0$ means the node is the root of a tree). The next line contains n integers $C[i]$ ($1 \leq C[i] \leq 30$), the colors of the edges between each node and its father (for root nodes, the corresponding color should be ignored). Each of the next m lines contains an operation. For all operations, $1 \leq x, y \leq n$, for each type-2 operation, $1 \leq c \leq 30$. The input is terminated by end-of-file (EOF).

Output

For each type-3 operation, output two integers: the number of edges and the number of colors among these edges.

Sample Input

```
6 6
0 1 1 3 3 0
1 2 1 1 1 1
3 2 3
1 3 2 3
3 2 3
3 5 6
1 6 1 1
3 4 6
```

Sample Output

```
2 2
1 1
0 0
4 3
```