Problem J. Colorful Tree

Your task is to maintain a colorful tree and process queries.

At the beginning, there is only one vertex numbered 1 with color C on the tree. Then there are q operations of two types coming in order:

- 0 x c d: Add a new vertex indexed $(n+1)$ with color c to the tree, where n is the current number of existing vertices. An edge connecting vertex x and $(n+1)$ with length d will also be added to the tree.
- 1 x c: Change the color of vertex x to c.

After each operation, you should find a pair of vertices u and v $(1 \leq u, v \leq n)$ with **different** colors in the current tree so that the distance between u and v is as large as possible.

The distance between two vertices u and v is the length of the shortest path from u to v on the tree.

Input

There are multiple test cases. The first line of the input contains an integer T indicating the number of test cases. For each test case:

The first line of the input contains two integers q and C $(1 \leq q \leq 5 \times 10^5,\ 1 \leq C \leq q)$ indicating the number of operations and the initial color of vertex 1.

For the following q lines, each line describes an operation taking place in order with 3 or 4 integers.

- If the i-th line contains 4 integers 0, x_i, c_i and d_i $(1 \leq x_i \leq n,\ 1 \leq c_i \leq q,\ 1 \leq d \leq 10^9)$, the i-th operation will add a new vertex $(n+1)$ with color c_i to the tree and connect it to vertex x_i with an edge of length d_i.
- If the i-th line contains 3 integers 1, x_i and c_i $(1 \leq x_i \leq n,\ 1 \leq c_i \leq q)$, the i-th operation will change the color of vertex x_i to c_i.

It's guaranteed that the sum of q of all test cases will not exceed 5×10^5.

Output

For each operation output the maximum distance between two vertices with different colors. If no valid pair exists output 0 instead.

Example

standard input	standard output
2 1 1 0 1 1 1 5 1 0 1 1 1 0 1 2 1 0 3 3 1 1 4 1 1 3 1	0 0 2 3 2 0