D1 - Sequence and Cartesian Trees

Time Limit: 1 sec.

Problem Description

In this problem, you are asked to

- Encode the set of all possible Cartesian trees with k vertices into non-negative integers (represented by a binary string) between 0 and 4^k.

- Map the input sequences to the particular Cartesian trees they correspond to.

Input Format

The first line consists of two integers k and m, where k is the size of the Cartesian tree and m is the number of input sequences. Then there are m lines, each containing a sequence of k integers.

You may assume that

- $1 \leq k \leq 2 \times 10^5$.

- $m \times k$ is at most 2×10^5.

Output Format

For each input sequence, compute the encoding of the Cartesian tree it corresponds to and print the binary representation of the encoding in a line. Make sure that the length of the binary string is equal to $2k$.

Note that, the encoding is not unique. You can use any valid way to encode the trees.

Sample Input

```
2 3
1 3
-1 -2
20 30
```

Sample Output

```
0001
0010
0001
```

Note.

This problem is a subroutine for the optimal RMQ algorithm to be used in Problem D2.