Problem B. Rectangle Tree

Input file:	*standard input*
Output file:	*standard output*
Time limit:	6 seconds
Memory limit:	512 mebibytes

Mr. Peanutbutter has recently discovered a nice $n \times n$ field covered with various crops. Diane told Mr. Peanutbutter that for generations this particular field is planted with crops using tree-like rectangle method. While Mr. Peanutbutter got distracted by a bird, Diane continued.

A *combinatorial rectangle* in the field is a subset of squares of the field of the form $A \times B$ where A and B are subsets of the set $\{0, \ldots, n-1\}$.

A *rectangle tree* is a rooted binary tree with k vertices with the following properties. Each vertex v of the tree is labeled with a combinatorial rectangle $r(v) \subseteq \{0, \ldots, n-1\} \times \{0, \ldots, n-1\}$. If s is an inner node of the tree, and c_1 and c_2 are its direct descendants, then their combinatorial rectangles form a partition of $r(s)$: formally, $r(s) = r(c_1) \cup r(c_2)$ and $r(c_1) \cap r(c_2) = \varnothing$. A node cannot have only one direct descendant.

Let $\mathrm{Crop}(x, y)$ be the crop that grows on the square $(x, y) \in \{0, \ldots, n-1\} \times \{0, \ldots, n-1\}$ of the field. A rectangle tree T with the root Root *computes* the crop types of the field if $r(\mathrm{Root}) = \{0, \ldots, n-1\} \times \{0, \ldots, n-1\}$ and for each leaf ℓ, the combinatorial rectangle $r(\ell)$ has exactly one type of crop growing on it: that is, for any two $(x, y), (x', y') \in r(\ell)$, we have $\mathrm{Crop}(x, y) = \mathrm{Crop}(x', y')$.

The *depth* of tree T is the largest distance between the root of T and a leaf of T. Here, distance stands for the number of edges in the shortest path between the vertices.

The *size* of tree T is the number of vertices in it.

You are given a rectangle tree T computing crop types Crop. Let the size of T be S. Construct another rectangle tree T' computing Crop such that its depth is at most $3 \log_2 S$ and its size is at most $5S$.

Input

The first line contains a single integer n, the size of the field ($1 \le n \le 1000$). Each of the next n lines contain n integers describing the types of the crops. The j-th integer in the i-th row is the type of crop in the square (i, j). All types are positive integers not exceeding 10^7.

The next line contains a single integer S, the size of the rectangle tree ($1 \le S \le 10\,000$, $S \cdot n \le 10^6$). The i-th of the next S lines contains the description of the i-th vertex of the tree. It contains several space-separated integers: p, m_1, m_2, a_1, $\ldots$, a_{m_1}, b_1, $\ldots$, b_{m_2}. Here, $p \in \{0, 1, \ldots, S-1\}$ is the number of the parent of vertex i (if i is the root, then $p = i$), and the combinatorial rectangle corresponding to this vertex is $r(i) = \{a_1, \ldots, a_{m_1}\} \times \{b_1, \ldots, b_{m_2}\}$.

It is guaranteed that, if ℓ is a leaf of the tree, then all types of crops in $r(\ell)$ are the same. Additionally, for each inner vertex v with direct descendants c_1 and c_2, the rectangles $r(c_1)$ and $r(c_2)$ form a partition of $r(v)$: $r(v) = r(c_1) \cup r(c_2)$ and $r(c_1) \cap r(c_2) = \varnothing$. Finally, if i is the root, then $r(i) = \{0, \ldots, n-1\} \times \{0, \ldots, n-1\}$.

Output

Print a tree of depth at most $3 \log_2 S$ and of size at most $5S$ such that it is also a rectangle tree that computes the given crops. The tree should be printed in the same format as the one given in the input.

Example

standard input	standard output
3 1 1 2 1 1 2 2 2 2 5 0 3 3 0 1 2 0 1 2 0 3 2 0 1 2 0 1 0 3 1 0 1 2 2 1 2 2 0 1 0 1 1 1 2 2 0 1	7 0 3 3 0 1 2 0 1 2 0 1 3 2 0 1 2 1 1 2 2 0 1 1 1 1 2 2 0 2 3 0 1 0 1 2 4 2 1 0 1 2 4 2 2 0 1 0 1