

Problem C
Largest All-One Submatrix
Input file: pc.txt

Notation and Definitions

For any set S of integers, let $|S|$ denote the number of elements in S . For example, if $S=\{1,3,5\}$, then $|S|=3$. Let A be an $m \times n$ matrix. For any indices i and j with $i \in \{1, 2, \dots, m\}$ and $j \in \{1, 2, \dots, n\}$, let $A(i, j)$ denote the element of A in row i and column j . For any index sets I and J with $I \subseteq \{1, 2, \dots, m\}$ and $J \subseteq \{1, 2, \dots, n\}$, let $A(I, J)$ denote the submatrix of A consisting of $A(i, j)$ for each pair i and j of indices with $i \in I$ and $j \in J$. We say that $A(I, J)$ is an all-one submatrix of A if $A(i, j) = 1$ holds for each pair i and j of indices with $i \in I$ and $j \in J$.

Problem Statement

Suppose A is an input $m \times n$ binary matrix. That is, for each $i \in \{1, 2, \dots, m\}$ and $j \in \{1, 2, \dots, n\}$, we have $A(i, j) \in \{0, 1\}$. You are asked to output an all-one submatrix of A with maximum size.

Example

$A = \begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 0 & 1 \end{bmatrix}$ is a 5×7 binary matrix. Clearly, $A(\{1,2,3\}, \{5,6,7\})$ is

not an all-one submatrix of A , since $A(2,5) = A(1,6) = 0$. It is also clear that $A(\{2,4\}, \{3,6\})$ is an all-one submatrix of A of size $2 \times 2 = 4$; $A(\{5\}, \{1,2,4,5,7\})$ is an all-one submatrix of A of size $1 \times 5 = 5$; and $A(\{1,3,5\}, \{2,5,7\})$ is an all-one submatrix of A with size $3 \times 3 = 9$. It is not difficult to verify that $A(\{1,3,5\}, \{2,5,7\})$ is the only all-one submatrix of A with size at least 9.

Constraints

To simplify the problem, you may assume that $1 \leq m, n \leq 80$ and that the number of non-zero entries in each row of A is at most 15.

Input format

The first line of input file consists of a single number denoting the number of test cases in the file. There is a single line containing a ‘/’ character separating two consecutive test cases. The end of the file is marked with a line containing a ‘.’

character. For each test case, the first line has an integer specify number of rows m in this test case. For the next m lines, each line contains no more than 15 integers, each separated by a blank space character. Each number j in the i -th row specifies that $A(i, j) = 1$. You may also assume that the numbers in each line are monotonically increasing.

Output Format

Please output two sets I and J of indices such that $A(I, J)$ is an all-one submatrix of A with maximum size. Your program should output a single line of numbers, separated by space characters in the following order: (a) the numbers in I in increasing order, (b) a zero, and (c) the numbers in J in increasing order. If there is more than one all-one submatrix of A with maximum size, then output the solution with the least alphabetical order.

Sample Input

```
1
5
2 5 7
3 6 7
2 5 6 7
2 3 6
1 2 4 5 7
.
```

Sample Output

```
1 3 5 0 2 5 7
```