Problem Name: Vacation

Problem Code: ZCO22001

Chefland can be represented as a N by M grid. The rows of the grid are numbered from 1 to N, and the columns of the grid are numbered from 1 to M. The square in row X and column Y of the grid can be uniquely identified as square (X, Y). Each grid square has a cost of either 0 or 1.
Chef is going on a vacation to Chefland for the next Q days. On the i^{th} of these days, Chef would like to travel from square (A_i, B_i) to square (C_i, D_i). Here, it is guaranteed that both $A_i \leq C_i$ and $B_i \leq D_i$. Due to restrictions on movement in Chefland, it is only possible to travel downwards or to the right. In other words, if Chef is in a square (X, Y), he is only able to move to square $(X, Y+1)$ or $(X+1, Y)$ in one move. The cost of Chef's trip is defined as the product of the costs of the grid squares he passes through on his journey from the starting square to the ending square. Note that this product also includes the costs of the starting square and the ending square.
For each of the Q days, find the minimum cost Chef would need to pay to travel between the starting and the ending squares.

Input Format

The first line of input contains two space-separated integers, N and M. N represents the number of rows in Chefland, while M represents the number of columns.
The following N lines each contain M space-separated integers, each of which is 0 or 1. On the i^{th} line, the j^{th} integer represents the cost of the grid square numbered (i, j) in the grid.
The following line contains Q, the number of days Chef will travel.
The i^{th} of the following Q lines each contains four space-separated integers, A_i, B_i, C_i and D_i, in order.

Output Format

For each of the Q trips, output the minimum possible cost of the trip on a new line.

Constraints

The input is divided into multiple subtasks. You will get the points allocated for a subtask if and only if you solve every testcase in the subtask correctly, within the time limit.
Please remember that when you make a submission to a problem, we will automatically consider your submission for every single subtask, and also the full problem. After the contest, your scores will be 'stitched'. This means that if you solve a subtask in any of your submissions, you will get the points for the subtask in your final score. There is no need to combine your solutions for different subtasks into the same submission.
For all subtasks:

- $1 \leq N \times M \leq 2 \times 10^5$
- $1 \leq Q \leq 2 \times 10^5$
- And for all $1 \leq i \leq Q$,
  - $1 \leq A_i \leq C_i \leq N$
  - $1 \leq B_i \leq D_i \leq M$

Subtasks

These are the subtasks for the problem:

- Subtask 1 [5 points]: All the cells in the grid have a cost of 1.
- Subtask 2 [6 points]: For all trips, $A_i = C_i$ and $B_i = D_i$.
- Subtask 3 [23 points]: $N \leq 8$, $M \leq 8$ and $Q \leq 5$.
- Subtask 4 [20 points]: $Q \leq 5$
- Subtask 5 [19 points]: At most 10 cells in the grid have a cost of 0.
- Subtask 6 [10 points]: $N = 1$
- Subtask 7 [8 points]: $N \leq 5$
- Subtask 8 [9 points]: No additional constraints.

Sample Input 1:

```
5 4
1 0 1 1
1 1 1 1
0 1 1 1
1 1 1 1
1 1 1 0
10
2 2 5 3
1 4 5 4
1 1 5 4
1 1 5 1
2 2 4 4
3 1 5 3
4 1 4 4
```

```
3 1 5 4
4 1 5 3
1 3 4 4
```

Sample Output 1:

```
1
0
0
0
1
0
1
0
1
1
```

Explanation:

For the first trip, it can be shown that the minimum possible cost is 1. One way to achieve this minimum cost is to travel via $(2,2) \Rightarrow (2,3) \Rightarrow (3,3) \Rightarrow (4,3) \Rightarrow (5,3)$. Then, the cost will be $1 \times 1 \times 1 \times 1 \times 1 = 1$.
For the second trip, it can be shown that the minimum possible cost is 0. One way to achieve this minimum cost is to travel via $(1,4) \Rightarrow (2,4) \Rightarrow (3,4) \Rightarrow (4,4) \Rightarrow (5,4)$. Then, the cost will be $1 \times 1 \times 1 \times 1 \times 0 = 0$.

Problem Name: Messages
Problem Code: ZCO22002

Please note that all arrays in this problem are 0-indexed.
Chef, who is now an elite spy, is in trouble! He needs to quickly send a message to you, who is in his Headquarters. Chef's message is a sequence of N non-negative integers.
To avoid the risk of the message being intercepted by the enemy, you and Chef have decided on an elaborate plan. First, Chef will construct his message, which can be represented as the array A_0: $A_{0,0}, A_{0,1}, A_{0,2}, \ldots, A_{0,N-1}$. Then, he will construct $2^N - 1$ fake messages, each of which is also a sequence of N non-negative integers. The fake messages are numbered from 1 to $2^N - 1$, with the i-th fake message represented by the array A_i. The i-th fake message is constructed via the following process:

- Let the binary representation of i be denoted as B_i.
- If the j^{th} bit of B_i is '0', $A_{i,j} = A_{0,j}$.
- Otherwise, $A_{i,j}$ can be any non-negative integer except $A_{0,j}$.
- In other words, if $B_{i,j} = 0$, then $A_{i,j} = A_{0,j}$, and if $B_{i,j} = 1$, then $A_{i,j} \neq A_{0,j}$.

After the real message and the $2^N - 1$ fake messages (for a total of $M = 2^N$) are constructed, they are all put together and randomly shuffled, so that it is unknown which was the real message.
Let us illustrate this process with an example. Say that $N = 2$. We may randomly construct the real message to be $A_0 = [0, 2]$. Now:

- $B_1 = [0, 1]$. It is possible to create $A_1 = [0, 1]$. Since $B_{1,0} = 0$, $A_{1,0} = A_{0,0}$. Since $B_{1,1} = 1$, $A_{1,1} \neq A_{0,1}$.
- $B_2 = [1, 0]$. It is possible to create $A_2 = [2, 2]$. Since $B_{2,0} = 1$, $A_{2,0} \neq A_{0,0}$. Since $B_{2,1} = 0$, $A_{2,1} = A_{0,1}$.
- $B_3 = [1, 1]$. It is possible to create $A_3 = [1, 1]$. Since $B_{3,0} = 1$, $A_{3,0} \neq A_{0,0}$. Since $B_{3,1} = 1$, $A_{3,1} \neq A_{0,1}$.

In the end, we have 4 messages: $A_0 = [0, 2]$, $A_1 = [0, 1]$, $A_2 = [2, 2]$, $A_3 = [1, 1]$. Now, we can randomly shuffle them, and get the following: $A_0 = [1, 1]$, $A_1 = [0, 1]$, $A_2 = [0, 2]$, $A_3 = [2, 2]$. As we can see, the original real message is now the message A_2.
Your task is this: given the final randomly shuffled sequence of messages, determine which message(s) could have been the real message. In particular, in some cases, it may be possible that **more than one** of the messages could have been the real message. (For example, in the preceding example, apart from message 2, message 1 also could have been the real message.) It is also possible that Chef made a mistake when generating the messages and so **none** of the messages could have been the real message. In this case, report this.

Input Format

- First line will contain T, number of testcases. Then the testcases follow.
- The first line of each testcase contains two integers: N and M. N is the length of each message, and M is the number of messages (so $M = 2^N$).
- Then, M lines follow. Each line consists of N space-separated non-negative integers and represents one of the messages. In other words, the j-th integer on the i-th of these lines is $A_{i-1,j-1}$.

Output Format

- For each testcase, print 2 lines of output.
- The first line consists of a single integer, K. K is the number of messages which could have been the real message. Please note that it is possible that $K = 0$ if none of the messages could have been the real message.
- The second line consists of K space-separated integers - the indices of the messages which could have been the real message, **in ascending order**.
- If $K = 0$, the second line of output for the testcase should still be there, but it should be empty.

Constraints

The input is divided into multiple subtasks. You will get the points allocated for a subtask if and only if you solve every testcase in the subtask correctly, within the time limit.
Please remember that when you make a submission to a problem, we will automatically consider your submission for every single subtask, and also the full problem. After the contest, your scores will be 'stitched'. This means that if you solve a subtask in any of your submissions, you will get the points for the subtask in your final score. There is no need to combine your solutions for different subtasks into the same submission.
For all subtasks:

- $1 \leq N \leq 17$
- $2 \leq M \leq 131072$
- $M = 2^N$.
- $0 \leq A_{i,j} \leq N$ for all (i, j).
- The sum of M across all testcases is ≤ 131072.

Subtasks

Please note that when K is mentioned, it refers to the K in the output. For example, say that $K = 1$ is guaranteed for a subtask. It means that for each testcase, exactly one message could have been the real message.
These are the subtasks for the problem:

- Subtask 1 [11 points]: $N = 1$, $M = 2$
- Subtask 2 [16 points]: $N \leq 7$, $M \leq 128$, $\sum M \leq 128$

- Subtask 3 [15 points]: $N \le 11$, $M \le 2048$, $\sum M \le 2048$
- Subtask 4 [10 points]: $0 \le A_{i,j} \le 1$ for all (i, j), $K \ge 1$
- Subtask 5 [14 points]: $0 \le A_{i,j} \le 1$ for all (i, j)
- Subtask 6 [12 points]: $K = 1$
- Subtask 7 [14 points]: $0 \le K \le 1$
- Subtask 8 [8 points]: No additional constraints.

Sample Input 1:

```
4
2 4
1 1
0 1
0 2
2 2
1 2
0
0
2 4
1 0
1 0
0 1
0 1
3 8
0 0 0
0 0 1
0 1 0
0 1 1
1 0 0
1 0 1
1 1 0
1 1 1
```

Sample Output 1:

```
2
1 2
0

0

8
0 1 2 3 4 5 6 7
```

Explanation:

The first testcase is the same as the example in the problem statement. As discussed, both messages 1 and 2 could have been the real message.
In the second testcase, Chef made a mistake, and none of the messages could have been the real message. Note that there were still two lines of output, but the second line was empty.
In the third testcase, none of the messages could have been the real message.
In the final testcase, all of the messages could have been the real message.