A - Flip Row or Col 2

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 800 points

Problem Statement

You are given an $N \times N$ matrix $A = (A_{i,j})$ $(1 \le i, j \le N)$ and integer sequences of length N: $R = (R_1, R_2, \dots, R_N)$, $C = (C_1, C_2, \dots, C_N)$. Each element of A is 0 or 1, and each element of R, C is at least 0 and less than $\frac{N}{4}$.

You can freely choose a pair of strings X, Y of length N consisting of `0` and `1`. Based on the chosen strings X, Y, perform the following operations:

- First, for each $i = 1, 2, \dots, N$, do the following. Let X_i be the i-th character of X:
  - If X_i is `0`, do nothing.
  - If X_i is `1`, flip all elements in the i-th row of A. That is, for each $j = 1, 2, \dots, N$, replace $A_{i,j}$ with $1 - A_{i,j}$.
- Next, for each $j = 1, 2, \dots, N$, do the following. Let Y_j be the j-th character of Y:
  - If Y_j is `0`, do nothing.
  - If Y_j is `1`, flip all elements in the j-th column of A. That is, for each $i = 1, 2, \dots, N$, replace $A_{i,j}$ with $1 - A_{i,j}$.

Determine whether it is possible to choose X, Y cleverly so that the matrix A after the operations satisfies the following conditions, and if possible, output one such pair.

- For each $i = 1, 2, \dots, N$, the sum of elements in the i-th row of A, $\sum_{j=1}^{N} A_{i,j}$, is R_i.
- For each $j = 1, 2, \dots, N$, the sum of elements in the j-th column of A, $\sum_{i=1}^{N} A_{i,j}$, is C_j.

You are given T test cases, so answer each of them.

Constraints

- $1 \le T \le 10^5$
- $1 \le N \le 1000$
- $A_{i,j} \in \{0, 1\}$
- $0 \le R_i, C_j < \frac{N}{4}$
- T, N, R_i, C_j are integers.
- The sum of N^2 over all test cases in one input file is at most 10^6.

Input

The input is given from Standard Input in the following format:

$$\begin{array}{l} T \\ \text{case}_1 \\ \text{case}_2 \\ \vdots \\ \text{case}_T \end{array}$$

Each test case is given in the following format:

$$\begin{array}{l} N \\ A_{1,1}A_{1,2} \ldots A_{1,N} \\ A_{2,1}A_{2,2} \ldots A_{2,N} \\ \vdots \\ A_{N,1}A_{N,2} \ldots A_{N,N} \\ R_1 \quad R_2 \quad \ldots \quad R_N \\ C_1 \quad C_2 \quad \ldots \quad C_N \end{array}$$

Output

Output your solutions for $\text{case}_1, \text{case}_2, \ldots, \text{case}_T$ in order in the following format:

If there is no pair X, Y that satisfies the conditions, output `No`.

If there exists such a pair, output:

$$\begin{array}{l} \texttt{Yes} \\ X \\ Y \end{array}$$

If there are multiple solutions, any of them will be considered correct.

Sample Input 1

```
3
2
10
01
0 0
0 0
5
10101
11110
01111
10011
00110
1 1 1 1 1
1 1 1 1 1
10
0001011010
0101101000
0000101111
0010011100
0111000001
0011100110
1110001110
1100110000
0110111011
1101101101
1 1 0 2 0 0 2 2 2 2
2 2 0 1 0 2 1 2 1 1
```

Sample Output 1

```
Yes
01
10
Yes
01101
10001
No
```

For the first test case, $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$. Consider the case where X, Y are `01` and `10`, respectively. The operations are performed as follows:

- X_1 is `0`, so do nothing.
- X_2 is `1`, so flip the elements in the 2nd row of A, resulting in $A = \begin{pmatrix} 1 & 0 \\ 1 & 0 \end{pmatrix}$.
- Y_1 is `1`, so flip the elements in the 1st column of A, resulting in $A = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$.
- Y_2 is `0`, so do nothing.

Therefore, the matrix A after the operations is $A = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$. The sum of elements in the 1st row, the sum of elements in the 2nd row, the sum of elements in the 1st column, and the sum of elements in the 2nd column are all 0, so the conditions are satisfied.

It would also be correct to output:

```
Yes
10
01
```

B - Adjacent Replace

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 800 points

Problem Statement

You are given a sequence of non-negative integers of length N: $A = (A_1, A_2, \ldots, A_N)$ and a non-negative integer K.

Determine whether it is possible to make $A_1 = K$ by performing the following operation at most 10^4 times:

- Choose an integer i $(1 \leq i \leq N-1)$. Let $x = A_i \bigoplus A_{i+1}$, then replace both A_i, A_{i+1} with x.

Here, $\bigoplus$ denotes the bitwise XOR operation.

If possible, output one such sequence of operations.

You are given T test cases, so solve each of them.

▶ What is bitwise XOR operation?

Constraints

- $1 \leq T \leq 50$
- $3 \leq N \leq 60$
- $0 \leq A_i, K < 2^{60}$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

$$T$$
$$\text{case}_1$$
$$\text{case}_2$$
$$\vdots$$
$$\text{case}_T$$

Each test case is given in the following format:

$$N \quad K$$
$$A_1 \quad A_2 \quad \ldots \quad A_N$$

Output

Output your solutions for $\text{case}_1, \text{case}_2, \ldots, \text{case}_T$ in order in the following format:

If it is impossible to make $A_1 = K$ by performing the operation at most 10^4 times, output `No`.

If possible, output the sequence of operations in the following format:

```
Yes
```
$$M$$
$$i_1 \quad i_2 \quad \ldots \quad i_M$$

Here, M is the number of operations, and $i_j \ (1 \leq j \leq M)$ represents the integer i chosen in the j-th operation. You need to satisfy $0 \leq M \leq 10^4, 1 \leq i_j \leq N - 1$.

If there are multiple sequences of operations that satisfy the conditions, any of them will be considered correct.

Sample Input 1

```
5
3 5
2 3 4
3 0
2 3 4
3 8
2 3 4
3 2
2 3 4
4 10
2 3 4 8
```

Sample Output 1

```
Yes
2
2 1
Yes
3
1 1 1
No
Yes
0

Yes
4
2 3 2 1
```

For the first test case, you can make $A_1 = 5$ by performing the operations as follows:

1. Choose $i = 2$. A becomes $(2, 7, 7)$.
2. Choose $i = 1$. A becomes $(5, 5, 7)$.

For the second test case, you can make $A_1 = 0$ by performing the operations as follows:

1. Choose $i = 1$. A becomes $(1, 1, 4)$.
2. Choose $i = 1$. A becomes $(0, 0, 4)$.
3. Choose $i = 1$. A becomes $(0, 0, 4)$.

For the third test case, it is impossible to make $A_1 = 8$ with at most 10^4 operations.

C - Circular Tree Embedding

Time Limit: 2 sec / Memory Limit: 1024 MiB

D - Limestone

Time Limit: 2 sec / Memory Limit: 1024 MiB

Score : 1000 points

Problem Statement

You are given positive integers H, W.

There is an $H \times W$ matrix $A = (A_{i,j})$ $(1 \leq i \leq H, 1 \leq j \leq W)$, where initially all elements are 0.

You can perform the following two types of operations on this matrix in any order and any number of times:

- Choose integers r, c $(1 \leq r \leq H, 1 \leq c \leq W)$. Set all of $A_{r,1}, A_{r,2}, \ldots, A_{r,c}$ to 1.
- Choose integers r, c $(1 \leq r \leq H, 1 \leq c \leq W)$. Set all of $A_{1,c}, A_{2,c}, \ldots, A_{r,c}$ to 1.

Find the sum of $\sum_{i=1}^{H} \sum_{j=1}^{W} A_{i,j}$ over all matrices that can be obtained by repeating the above operations, modulo 998244353.

Constraints

- $1 \leq H, W$
- $HW \leq 2 \times 10^5$
- All input values are integers.

Input

The input is given from Standard Input in the following format:

```
H W
```

Output

Output the sum of $\sum_{i=1}^{H} \sum_{j=1}^{W} A_{i,j}$ over all matrices that can be obtained by repeating the operations, modulo 998244353.

Sample Input 1

```
2 2
```

Sample Output 1

```
29
```

There are 14 matrices that can be obtained by repeating the operations:

$\begin{pmatrix}0 & 0\\0 & 0\end{pmatrix}\begin{pmatrix}1 & 0\\0 & 0\end{pmatrix}\begin{pmatrix}0 & 1\\0 & 0\end{pmatrix}\begin{pmatrix}1 & 1\\0 & 0\end{pmatrix}\begin{pmatrix}0 & 0\\1 & 0\end{pmatrix}\begin{pmatrix}1 & 0\\1 & 0\end{pmatrix}\begin{pmatrix}0 & 1\\1 & 0\end{pmatrix}\begin{pmatrix}1 & 1\\1 & 0\end{pmatrix}\begin{pmatrix}0 & 1\\0 & 1\end{pmatrix}\begin{pmatrix}1 & 1\\0 & 1\end{pmatrix}\begin{pmatrix}0 & 0\\1 & 1\end{pmatrix}\begin{pmatrix}1 & 0\\1 & 1\end{pmatrix}\begin{pmatrix}0 & 1\\1 & 1\end{pmatrix}\begin{pmatrix}1 & 1\\1 & 1\end{pmatrix}$

The answer is $0+1+1+2+1+2+2+3+2+3+2+3+3+4=29$.

$\begin{pmatrix}0 & 0\\0 & 1\end{pmatrix}$ and $\begin{pmatrix}1 & 0\\0 & 1\end{pmatrix}$ cannot be obtained by any sequence of operations.

Sample Input 2

```
1 10
```

Sample Output 2

```
5120
```

Sample Input 3

```
123 456
```

Sample Output 3

```
428623282
```