

Escape Room

Input file: **standard input**
Output file: **standard output**
Time limit: 1 second
Memory limit: 256 megabytes

Busy Beaver is designing an escape room! His current design is a maze with N different sites, where each of the $\frac{N(N-1)}{2}$ pairs of sites is directly connected by a bidirectional tunnel.

To make the maze more interesting, each tunnel is locked with one of K ($1 \leq K \leq 10$) keys, numbered $1, 2, \dots, K$. One can only traverse a tunnel between sites i and j if they have its corresponding key a_{ij} .

Additionally, Busy Beaver wants to design the maze such that only certain sets of keys let you traverse the entire maze. In particular, there are $x_S \in \{0, 1\}$ for each subset $S \subseteq \{1, 2, \dots, K\}$ such that

- If $x_S = 1$, it is possible to move between any two sites in the maze using only the keys in S .
- If $x_S = 0$, there exists some pair of sites that cannot be accessed from each other using only the keys in S .

Decide whether or not the task is possible. Additionally, if the task is possible, provide any valid construction with at most 300 sites.

Input

Each test contains multiple test cases. The first line contains the number of test cases T ($1 \leq T \leq 300$). The description of the test cases follows.

The first line of each test case contains the integer K ($1 \leq K \leq 10$) — the number of keys.

The second line of each test case contains a string x ($|x| = 2^K$, $x_i \in \{0, 1\}$) such that for each S , if $i = \sum_{t \in S} 2^{t-1}$ then $x_S := x_i$. **Note that the string x is zero-indexed, that is, $0 \leq i < 2^K$.**

It is guaranteed that the sum of 2^K across all test cases is no more than 2^{10} .

Output

For each test case, if it is possible to satisfy the given constraints, the first line of output should contain an integer N ($1 \leq N \leq 300$) — the number of sites. The i -th of the next N lines of output should then contain N integers a_{ij} ($a_{ii} = 0$, $a_{ij} = a_{ji}$, $1 \leq a_{ij} \leq K$ for $i \neq j$), where for $i \neq j$, the tunnel between sites i and j uses key a_{ij} .

If there are multiple solutions, print any of them. Otherwise, if there is no solution, print a single integer -1 instead.

Due to judging constraints, the sum of N^2 over your outputs should not exceed $2 \cdot 10^5$. It can be shown that this is enough to solve the problem.

Scoring

You will receive 20% of the points for each subtask if you correctly decide if a solution exists, but your constructions are incorrect. Specifically, in order to receive these points, when a solution does not exist, you must output -1 . When a solution exists, you must output some N ($1 \leq N \leq 300$) and a matrix a that meets the specifications of ($a_{ii} = 0$, $a_{ij} = a_{ji}$, $1 \leq a_{ij} \leq K$ for $i \neq j$).

There are three subtasks for this problem.

- (10 points): The sum of 2^K across all test cases does not exceed 2^4 .
- (30 points): The sum of 2^K across all test cases does not exceed 2^6 .
- (60 points): No additional constraints.

Example

standard input	standard output
5	-1
1	2
00	0 1
2	1 0
0101	-1
2	4
0110	0 1 3 3
3	1 0 2 3
00011111	3 2 0 1
4	3 3 1 0
1111111111111111	1
	0

Note

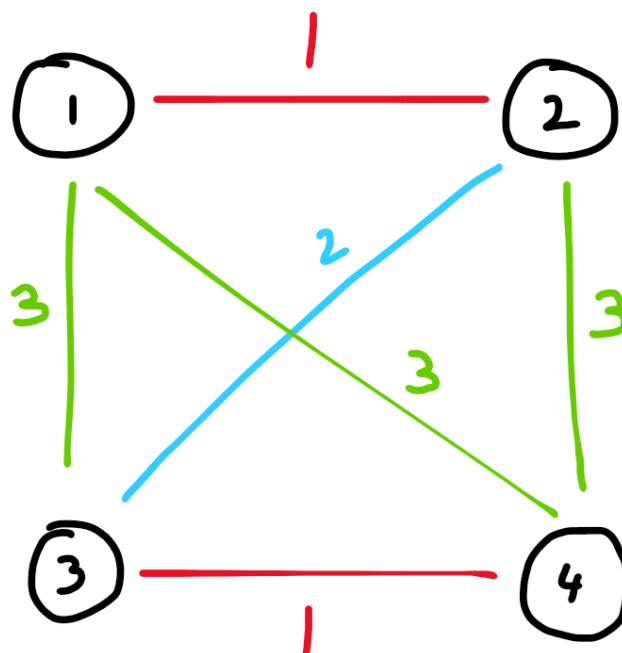
In the first test case, it can be shown that it is impossible to construct the desired maze.

In the second test case, a possible construction is a maze with 2 sites connected by a tunnel using key 1.

- With keys $S = \emptyset$ corresponding to $x_0 = 0$, it is impossible to traverse the entire maze.
- With keys $S = \{1\}$ corresponding to $x_1 = 1$, it is possible to traverse the entire maze.
- With keys $S = \{2\}$ corresponding to $x_2 = 0$, it is impossible to traverse the entire maze.
- With keys $S = \{1, 2\}$ corresponding to $x_3 = 1$, it is possible to traverse the entire maze.

In the third test case, it can be shown that it is impossible to construct the desired maze.

In the fourth test case, a possible construction is the following maze with 4 sites:



In the fifth test case, a possible construction is a maze with only 1 site. With any set of keys, it is possible to traverse the entire maze.