A. Music

The music business is changing rapidly, and this is reflected by the single charts. Initially, the Kama Single Top 100 was based purely on sale numbers of CD singles. In the course of time, however, these numbers dropped dramatically, in favour of legal and illegal downloads of music from the internet. Therefore, since 2006, downloads of singles from specific legal downloads sites are incorporated into the chart. Nowadays, even streams from certain streaming platforms contribute to the Single Top 100.

Between 2006 and 2013, when the Single Top 100 was based on both CD singles and downloads, there was also a chart called the Download Top 100, based purely on the downloads. Assuming that both charts used the same numbers of weekly downloads, one could tell from a comparison between the two charts, which singles were selling well physically. And in fact, since some singles did not even appear as CD singles any more, one could tell which singles were certainly available as CD single: the ones that were doing better (as compared to some other singles) in the Single Top 100 than in the Download Top 100. Now, you are asked to write a program to determine these singles. To be prepared for other communities, which may also have single charts of other sizes, your program should not be limited to charts containing exactly one hundred singles.

Input

The input starts with a line containing an integer T, the number of test cases.

Then for each test case:

• One line containing an integer N, satisfying 1 ≤ N ≤ 100,000, the size of both single charts.

• N lines, each containing a single integer, which together form a permutation of the numbers 1, . . . , N. The i-th integer Pi is the position in the Download Top N of the single that is ranked i in the Single Top N. As the above specification implies, the Download Top N and the Single Top N contain exactly the same N singles, possibly in different orders.

Output

For each test case, output:

• One line containing the number of singles M that are certainly available as CD single.

• M lines, each containing a single integer, the positions of the singles in the Download Top N that are certainly available as CD single, in ascending order.

Sample input and output

Input	Output
2 3 1 2 3 4 4 3 1 2	0 2 3 4

B. King's walk

Chess is a game in which two sides control pieces in an attempt to capture each other's king. The pieces vary in mobility. At the beginning of a game the kings are rather vulnerable. They are less mobile than most other pieces and they tend to hide behind their pawns. Like in real life, as soon as both queens have left the game it is time for the kings to come into action. Because there is little threat left for the king, he can now move safely around the board. Indeed his mobility seems to be quite strong at this stage making him one of the more dangerous pieces. Your task is to measure the mobility of the king in the endgame. Consider a chess board of N × N squares. The king is the only piece on the board. He starts at a given position and wants to go to another given position in the minimum number of moves. The king can move to any adjacent square in any orthogonal or diagonal direction.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

• One line with a single integer N, the size of the board, where 2 ≤ N ≤ 5,000.

• One line with four space-separated integers X1, Y1, X2, Y2, such that 1 ≤ X1, Y1, X2, Y2 ≤ N, where (X1, Y1) is the square on which the king starts and (X2, Y2) is the square the king wants to go to (different from his starting position).

Output

For each test case, output one line with a single integer: the number of ways by which the king can reach the destination square in the minimum number of moves. As this number can be very large, you must reduce your answer modulo 5,318,008.

Sample input and output

Input	Output
2 3 1 2 3 2 8 2 2 7 7	3 1

C. Six degrees

For years and years, the ICT Senior Service Desk (ISSD) of the university has been confronted with a slow wired network that gives unexpected time-outs and seemingly random slow connection speeds. A new manager has been hired to solve these problems once and for all. The manager does not have any computer science or IT knowledge, but he does happen to have a strong background in sociology. He quickly finds that the network problems only affect devices of old professors with an office in some distant corner of the building.

Obsessed by the idea of six degrees of separation, the new manager proposes a rule to counter the network problems. This rule says that any two devices in the network should be connected via at most 5 intermediary devices. So, given the current lay-out of the university's wired computer network, he decides to prepare a list of all devices of peripheral professors that are currently not able to connect to all other devices within 6 steps. The manager's solution to the network problems is then to disconnect all devices on this list from the wired network at once. He explicitly ignores the fact that, possibly, then disconnecting these devices in a particular order may lead to a network structure such that some devices on the list actually no longer have to be disconnected, or that afterwards additional devices may have to be disconnected or connected to reach the actual desired result.

The board of the university, not having a background in computer science, IT or sociology is also not bothered by whether or not the proposed solution is correct, but will instead only base its decision on whether or not the prepared list of devices to be disconnected is not too long, so that not too many professors would be affected. The board will therefore only approve the plan if no more than 5% of the wired network devices is on the list.

Given the lay-out of the network, in the form of a list of pairs of IP addresses or hostnames representing directly connected devices, determine whether or not the university board will allow the new manager to execute his plan.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line containing an integer $1 \leq M \leq 30{,}000$ denoting the number of (directly) connected pairs of devices (with at most 3,000 unique devices).
- M lines, each line containing two IP addresses or hostnames of (directly) connected devices, represented by two strings of ASCII characters (of length ≤ 64) without whitespace.

Each pair of connected devices is included once in the input file. All connections are bidirectional. You may assume that all devices in the university network are in the same connected component of devices.

Output

For each test case, output one line containing either YES if the plan is allowed to be executed or NO if the plan is not allowed to be executed.

Sample input and output

Input	Output
2 5 132.229.123.1 132.229.123.2 132.229.123.2 132.229.123.3 132.229.123.3 132.229.123.4 132.229.123.4 132.229.123.5 132.229.123.5 132.229.123.6 7 a b b c c d d e e f f g g h	YES NO

D. Whiteboard

You enter an empty classroom to do some homework, and you find out that someone did not clean the whiteboard properly. Apparently, the previous instruction in that room has been about the Extended Euclidean algorithm, because you see lots of intermediate results of this algorithm on the whiteboard. However, some parts of it have been wiped out, so you don't see everything they did. In particular, you're not sure what numbers they used as the inputs for the algorithm. As you didn't really feel like doing your homework in the first place, you decide to see if you can figure out the numbers they started with.

Looking at the algorithm as executed on the whiteboard, you can determine one thing for certain from their intermediate results: given that their inputs were A and B (A, B ≥ 1, both integers), you see three integers R, S and Q (with R ≥ 2, S ≤ −2 and Q ≥ 1), for which you know that A · R + B · S = Q. Now, given these three numbers, you want to figure out the A and B they started out with. Unfortunately, you quickly realize that there may not be a single A and B pair that fit this, so you decide to go looking for the pair with smallest positive A and B. Finally, you decide to not actually bother trying to find an A and B such that R, S and Q are intermediate results of the Extended Euclidean algorithm applied on A and B: you decide you're happy if they just satisfy A · R + B · S = Q.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line with three space-separated integers R, S and Q. These satisfy 2 ≤ R ≤ 108 , −108 ≤ S ≤ −2 and 1 ≤ Q ≤ 108 . You are given that Q is a multiple of the greatest common divisor of R and S.

Output

For each test case, output one line with two space-separated integers A ≥ 1 and B ≥ 1, the smallest such pair of numbers so that A · R + B · S = Q. By the smallest pair, we mean the pair such that A is minimal and if there are multiple such pairs the one of these for which B is minimal.

Sample input and output

Input	Output
4 3 -5 15 110 -29 1 6 -5 12 6 -5 11	10 3 24 91 7 6 6 5

E. Zanzibar

Turtles live long (and prosper). Turtles on the island Zanzibar are even immortal. Furthermore, they are asexual, and every year they give birth to at most one child. Apart from that, they do nothing. They never leave their tropical paradise.

Zanzi Bar, the first turtle on Zanzibar, has one further activity: it keeps track of the number of turtles on the island. Every New Year's Day it counts the turtles, and writes the total number in a small booklet. After many years this booklet contains a non-decreasing sequence of integers, starting with one or more ones. (After emerging from its egg on Zanzibar's beautiful beach, it took Zanzi some time to start a family on its own.)

One day Zanzi realizes that it could also be the case that turtles from abroad come to Zanzibar, by boat or plane. Now it wonders how many of the inhabitants were not born on Zanzibar. Unfortunately, it can only derive a lower bound from the sequence in the booklet. Indeed, if the number of turtles in a year is more than twice as big as the year before, the difference must be fully explained by import.

As soon as Zanzibar has 1,000,000 turtles, the island is totally covered with turtles, and both reproduction and import come to a halt. Please help Zanzi! Write a program that computes the lower bound of import turtles, given a sequence, as described above.

Input

The input starts with a line containing an integer T, the number of test cases. Then for each test case:

- One line containing a sequence of space-separated, positive integers (≤ 1,000,000), non-decreasing, starting with one or more ones. For convenience, a single space and a 0 are appended to the end of the sequence.

Output

For each test case, output a line containing a single integer: the lower bound for the number of turtles not born on Zanzibar.

Sample input and output

Input	Output
3 1 100 0 1 1 1 2 2 4 8 8 9 0 1 28 72 0	98 0 42