Problem A. Azrael

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Gargamel is planning to clone his cat Azrael but for that he needs just one more ingredient: smurfberry juice. Gargamel has a number of containers, each of which can hold one litre of juice. Additionally there are some forests in which smurfberries grow (each forest has enough smurfberries to fill **exactly** one container with juice). Gargamel has already captured Smurfs living in each of the forests, now he wants to use them to gather smurfberries for him. Some forests are directly connected to some containers with pipes, which can be used to transport smurfberry juice. Unfortunately, controlling Smurfs takes energy. Smurfs in some forests are easier to control than in others. The more smurfberries Smurfs collect from one forest the harder they are to control. After extensive research Gargamel concluded that in order for Smurfs in forest i to gather x_i litres of smurfberry juice, he needs to use $c_i \cdot x_i^2$ energy. Gargamel, being both very greedy and very lazy wizard, wants to collect as much smurfberry juice as he can and **then** minimize total amount of energy he uses. All those constraints made him so confused that he needs your help now.

Input

First line of input contains two integers k and p ($1 \leq k, p \leq 100$) denoting the number of forests and the number of juice containers respectively. Second line contains k integers $c_1, c_2, \ldots, c_k$ ($0 \leq c_i \leq 100$) – the energy consumption coefficients for controlling the Smurfs in each of the forests. The next k lines describe the pipes connecting forests and juice containers, each containing exactly p integers. The j-th integer in the i-th line is 1 if the forest i is connected to the container j, or 0 if there is no such connection.

Output

Output the minimum amount of energy Gargamel must use to collect as much smurfberry juice as possible. Your answer will be accepted if relative or absolute error is less than 10^{-5}.

Examples

standard input	standard output
2 1 1 1 1 1	0.500000
2 1 4 4 1 1	2.000000
3 2 5 3 5 1 0 1 1 0 1	5.454545
4 2 1 1 1 1 1 0 1 0 1 0 0 1	1.333333

Problem B. Brainy

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Brainy Smurf invented a new $(n \times n)$ SmurfBoard which looks just like a normal chessboard except that the left edge is glued to the right edge and the top edge is glued to the bottom edge (don't ask how it's possible, it's patented by Brainy in Smurf Patent Office). As usual, the other Smurfs were not interested in his invention so he went to Papa Smurf:

- "Papa Smurf! No one cares about my SmurfBoard!"
- "What does it do?"
- "Well... nothing... yet."
- "Is it at least colorful? Smurfs love colorful things."
- "No... not yet."
- "Then you should color it, but it can't be any ordinary coloring. You should color it in such a way that each possible coloring of a 2×2 square appears exactly once."

The SmurfBoard is so fragile that it cannot be rotated or flipped. Brainy being so smart immediately concluded that for k colors there are k^4 combinations so he'll need $n = k^2$. But finding desired coloring for any k larger than two is beyond even Brainy's skills. Maybe you can help him?

Input

First and only input line contains k ($k \leq 40$ and k **is prime**) – the number of colors to be used. The dimensions of desired SmurfBoard are $n \times n$ where $n = k^2$.

Output

Output n lines with n integers each specifying any correct coloring (colors are numbered from 1 to k). If it is not possible to color the SmurfBoard then on a single line output the word "NO"(without quotes).

Examples

standard input	standard output
2	1 2 1 1 1 2 2 2 2 2 2 1 1 1 2 1

Problem C. Calendar

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Handy Smurf created his newest invention: nanobot calendar. It obviously consists of nanobots showing current date. Every day in order to switch current date they have to perform a cyclic rotation by k places (so that nanobot that was initially at position i is now at position $(i + k) \bmod n$, nanobots are indexed from 0). However, nanobots can only understand one command: `reverse` lr which reverses positions of all nanobots at positions between l and r (so that nanobot that was initially at position l is now at r, the one that was at $l + 1$ is now at $r - 1$ and so on). Help Handy write an algorithm for updating the date with minimum number of commands issued.

Input

First and only line of input contains two integers n and k ($1 \le n \le 10^9$, $0 \le k < n$), specifying the number of nanobots and number of places to rotate.

Output

First line of output should contain integer m – the number of `reverse` commands used. On each of the next m lines output two integers a and b ($0 \le a \le b < n$) which means that the next command is `reverse` ab.

Examples

standard input	standard output
2 1	1 0 1

Problem D. Denominations

Input file:	*standard input*
Output file:	*standard output*
Time limit:	0.5 seconds
Memory limit:	512 mebibytes

Greedy Smurf is opening a new shop in Smurf Village. Smurfs use coins with four denominations: 1, 5, 10 and 25 SmurfCoins. Write a program that will compute for Greedy the number of ways that he can give change of n SmurfCoins.

Output the number of different ways of giving change modulo $10^9 + 7$. Two ways of giving change are considered different if they differ in the amount of used coins of some denomination.

Input

First and only input line contains n ($1 \leq n \leq 10^{18}$) – the amount of change.

Output

Output the number of different ways of giving change modulo $10^9 + 7$. Two ways of giving change are considered different if they differ in the amount of used coins of some denomination.

Examples

standard input	standard output
14	4

Problem E. Euclid

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Smurfs love to play computer game called SmurfCraft. In this game there are a number of power sources to be harvested. Lazy Smurf must build his new base. He already found the location of three unoccupied power sources, and now wants to build his base in a position that minimizes the total distance to all three of those power sources. This problem wouldn't be difficult (even for Lazy Smurf) if not for the fact that the game is played in 3D. Because Lazy Smurf skipped his geometry classes he doesn't know how to solve this problem. Help him.

Input

There are three input lines, each contains three integers x, y, z ($-10^9 \le x, y, z \le 10^9$) – the coordinates of a power source.

Output

Output the minimum possible total distance to all three of the power sources. Your answer will be accepted if relative or absolute error is less than 10^{-4}.

Examples

standard input	standard output
0 0 0 20 0 0 10 20 0	37.320508

Problem F. Flowers

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Painter Smurf has almost finished his newest painting. The painting depicts a large tree consisting of many branches connected together so that there is exactly one path between any two points in the tree. At every point where two branches meet and also at every free end of a branch (including the root of the tree) there is a flower. To make this painting smurftastic Painter wants to color all the flowers with three colors so that each color is used the same number of times (assume the number of flowers is divisible by 3) and no two flowers that are directly connected with a branch have the same color.

Input

First line of input contains an integer n ($1 \leq n \leq 5 \cdot 10^5$, n divisible by 3) – the number of flowers on the tree. The next $n-1$ lines describe branches. ith input line ($i \in \{2, \ldots, n\}$) contains an integer p_i ($1 \leq p_i < i$) which means that there is a branch connecting flowers i and p_i. **Each flower is directly connected with at most 4 different flowers**.

Output

On a single line output a sequence of n letters from the set $\{\texttt{N}, \texttt{K}, \texttt{P}\}$, without spaces. The letters represent colors that Painter wants to paint with, but only Smurf would know the names of those colors. If it is not possible to color the tree satisfying all criteria then on a single line output "NO"(without quotes).

Examples

standard input	standard output
6 1 1 1 2 2	NPKPKN

Problem G. Garden

Input file:	*standard input*
Output file:	*standard output*
Time limit:	2 seconds
Memory limit:	512 mebibytes

Farmer Smurf is competing in a contest for most smurfiest garden. He already bought some plants which he put in a row. Each flower has some height measured in centimeters. Farmer wants to choose some subsequence of plants that he can put into **evenly** spaced holes (without changing order) so that all plants are visible from the front (each next plant is strictly higher than previous one). Since this year is the year of parabolas the contest judges require that the flowers form a convex function (after putting plants into evenly spaced holes each segment connecting the highest points of two plants is strictly above all the plants between them). Help farmer choose plants that fulfill these criteria.

Input

First line of input contains two integers n and k ($1 \le k \le n \le 20\,000$, $1 \le k \le 100$). n is the number of plants, k is the number of plants that Farmer wants to choose. Second line of input contains n integers h_i ($1 \le h_i \le 7 \cdot 10^8$). h_i is the height of ith plant bought by Farmer.

Output

On a single line output k integers a_i ($1 \le a_i \le n$) specifying the numbers of plants that Farmer should choose. Don't forget that the plants must be in original order ($a_i < a_{i+1}$). If it is not possible to choose k plants satisfying all criteria then on a single line output "NO"(without quotes).

Examples

standard input	standard output
6 3 4 6 5 1 2 4	4 5 6

Problem H. Hamilton

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Tracker Smurf is planning his trip for next holidays. He wants to spend **exactly** one night in each of the villages in SmurfLand. His trip can start and end in any village. Villages in SmurfLand are connected by roads in such a way that there's exactly one path between any two villages. The distance between any two directly connected villages is exactly one kilometer. Tracker is so fast that he can travel up to three kilometers each day, but he is still not sure if that's enough to be able to spend a night in each village exactly once. Help him find the answer.

Input

First line of input contains an integer n ($1 \leq n \leq 10^5$) – the number of villages in SmurfLand. The next $n-1$ lines describe the roads. ith input line ($i \in \{2, \ldots, n\}$) contains an integer p_i ($1 \leq p_i < i$) which means that there is a road connecting villages i and p_i.

Output

On a single line output n integers $q_1, q_2, \ldots, q_n$ ($1 \leq q_i \leq n$) specifying the sequence of villages for Tracker to spend the nights in (Tracker starts in village q_1 then goes to village q_2 and so on, finishing in village q_n). If it is not possible to plan Tracker's trip then on a single line output the word "NO"(without quotes).

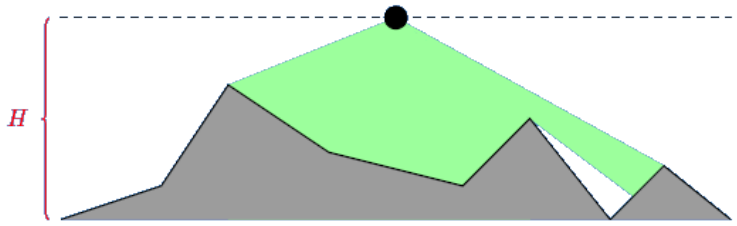
Examples

standard input	standard output
8 1 2 3 4 4 4 7	1 3 5 6 7 8 4 2

Problem I. Invigilation

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

The Smurfs have built the Great Smurfy Wall. The wall consists of a sequence of points connected by straight wall segments. Smurfs have also built towers on some of those points. Now Gargamel needs to observe all those towers, but he can't do this himself because wall segments can obscure his vision (although it is possible to see all towers along the wall). He wants to place some cameras along a highway that passes nearby the wall. However the cameras are very expensive so Gargamel asked you to tell him the minimal number of cameras he needs.



Input

First line of input contains integers n and H ($1 \le n \le 10^5$, $1 \le H \le 10^6$). n is the number of points of the wall, and H specifies that highways is the line with $y = H$. The next n lines describe the Great Smurfy Wall. Each of those lines contains three integers x_i, y_i, z_i ($0 \le x_i \le 10^6$, $0 \le y_i < H$, $z_i \in \{0, 1\}$), (x_i, y_i) are the coordinates of a point, and $z_i = 1$ iff there's a tower at that point. y_1 and y_n are always 0, and the points are given in the order of strictly increasing x_i.

Output

Output the minimal number of cameras Gargamel needs to use.

Examples

standard input	standard output
9 30 0 0 1 15 5 1 25 20 1 40 10 1 60 5 1 70 15 1 82 0 1 90 8 1 100 0 1	2

Problem J. Joke

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

Jokey Smurf loves to make fun of other Smurfs, now he wants to make fun of Poet Smurf. However, Poet Smurf is not so easily tricked (an exploding present didn't work) so Jokey needs to find another way. Smurfily for him, Poet has just finished his newest poem about Smurfette. Jokey now wants to erase some letters of this poem so that all occurrences of words praising Smurfette are damaged. However, some letters take more time to erase and Jokey doesn't want to raise suspicion of other Smurfs so he wants to minimize total time spent on his work.

Input

First line of input contains Poet's poem. On the next line there is a single integer k ($1 \leq k \leq 10$) – the number of words praising Smurfette. Each of the next k lines contains one of those words. Last line of input contains 26 integers $c_a, \ldots, c_z$ ($0 \leq c_\alpha \leq 1000$). c_α is the number of seconds it takes to erase single occurence of the letter α. Poem and all words praising Smurfette are nonempty sequences of small letters from latin alphabet. Erased letter is replaced by space, so resulting parts of Poem does not merge. The length of Poem and each of those words does not exceed $2 \cdot 10^5$.

Output

Output the minimal number of seconds Jokey needs to spend on his work.

Examples

standard input	standard output
chryzantematematyka 3 chryzantema matematyka tematem 3 1 1 1 1 1 1 1 1 1 1 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1	2

Problem K. Klothes

Input file:	*standard input*
Output file:	*standard output*
Time limit:	1 second
Memory limit:	512 mebibytes

What an unsmurfy day! Smurfette just found out that someone (probably Jokey Smurf) has stolen all of her clothes and she'll need to buy new ones. There are n sets of clothes in the shop each having different integer price from 1 to n smurfcoins. Since smurfiness of an article of clothing is proportional to its price Smurfette wants to spend all of her s smurfcoins. However her wardrobe will fit only k clothes so she needs to buy exactly k (having empty places in a wardrobe is bad for her image).

Input

First line of input file contains the number of testcases t ($t \leq 8000$). Each testcase consists of a single line containing three integers n, s, and k ($1 \leq k \leq n \leq 40\,000$, $0 \leq s \leq 10^9$). n is the number of clothes available in the shop, k is the number of clothes Smurfette wants to buy, and s is the amount of smurfcoins she wants to spend.

Output

For each testcase output on a single line the word "YES"(without quotes) if it is possible to buy k clothes so that their price is s, or "NO"otherwise. If the answer is "YES"then on the following line output a string of n digits a_i. a_i should be 1 if Smurfette should buy article of clothing with price i, otherwise a_i should be 0.

Examples

standard input	standard output
3 3 6 2 5 7 3 1 1 1	NO YES 11010 YES 1

Problem L. (Smurf)Land protection

Input file:	*standard input*
Output file:	*standard output*
Time limit:	4 seconds
Memory limit:	512 mebibytes

In SmurfLand there are n Smurf villages and m roads connecting them. Each road can be used to transport goods only in one direction. Some roads may lead from some village to itself and there might be more than one road connecting a pair of villages. The Smurfs have developed trade unions. Each trade union is a maximal subset of villages with the property that it is possible to transport goods from any village to any other village inside that trade union. Gargamel is planning to destroy one of the villages. It would be a disaster if after the village is destroyed the number of trade unions would have to increase. Help Smurfs decide which villages will need to be protected to ensure that the disaster doesn't happen.

Input

The first line of input contains two integers n and m ($1 \le n \le 2 \cdot 10^5$, $1 \le m \le 5 \cdot 10^5$) – the number of villages and roads. The next m lines describe the roads: each line contains two integers u, v ($1 \le u, v \le n$) specifying that there is a road directly connecting villages with numbers u and v.

Output

Ouput n lines: ith line should contain the word "YES"(without quotes) if Smurfs must protect ith village or the word "NO"otherwise.

Examples

standard input	standard output
7 9 1 2 3 1 2 3 1 3 3 5 3 4 4 1 5 6 6 5	YES NO YES NO NO NO NO