

Problem A. Snooker

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

Snooker is a cue sport that is played on a large ($12\text{ft} \times 6\text{ft}$, $3.6\text{m} \times 1.8\text{m}$) baize-covered table with pockets in each of the four corners and in the middle of each of the long side cushions. It is played using a cue, one white ball (the cue ball), 15 red balls (worth 1 point each) and 6 balls of different colours (worth 2-7 points each). [Wikipedia, the free encyclopedia]

Snooker is played by two players or two teams. The main rule in snooker is to alternate potting **reds** and **colours** — that's how yellow, green, brown, blue, pink and black balls are called. They cost from 2 to 7 points each in this particular order. Alternating means that after potting a **red** ball, the player has to pot any **colour** ball and vice versa. If the player has potted any **colour** ball and there are still some **reds** or he has potted last **red** by the previous shot, this potted **colour** ball is put back on the table. If there are no **reds** and a **colour** was out back for the last time, the player has to pot all **colours** in the increasing order of their cost. If there is at least one red ball at the table, the player can start his break (a sequence of continuously potted balls) only with the **red** ball. These rules will be enough for this problem.

For example, let's consider two **reds** on the table. The player may pot them in order like “red - black - red - pink - yellow - green - brown - blue - pink - black” which is correct break, but “red - red” or “red - black - pink” is not correct.

Professional players always estimate “**score on the table**” — maximal score one can achieve by correctly potting all the balls on the table. Obviously, this can be done by alternating reds with black, because black is the most expensive **colour** ball. Your task is to find this maximal score.

Input

The first line of the input file contains 7 numbers, representing the number of the balls of each color in a particular order: red, yellow, green, brown, blue, pink and black. The number of all balls except red will be from 0 to 1, the number of red balls will be from 0 to 15. The second line contains one word: “**RED**” if the last potted ball was red, “**COLOUR**” if the last potted ball was **colour**, and “**NONE**” if the next shot will be the first in the player's break. You may assume that if there is at least one red ball, there are all **colours**. Also you may assume that if there are no **reds**, **colours** have been potted in the correct order.

Output

Write to the output file the desired maximum score.

Examples

stdin	stdout
2 1 1 1 1 1 1 COLOUR	43
2 1 1 1 1 1 1 RED	50
0 0 0 1 1 1 1 NONE	22
0 1 1 1 1 1 1 RED	34

“Red - black - red - black - yellow - green - brown - blue - pink - black” costs $1+7+1+7+2+3+4+5+6+7 = 43$ points.

“Black - red - black - red - black - yellow - green - brown - blue - pink - black” costs $7+1+7+1+7+2+3+4+5+6+7 = 50$ points.

According to the rules, player has to pot brown ball next, so “brown - blue - pink - black” costs $4+5+6+7 = 22$ points.

“Black - yellow - green - brown - blue - pink - black” costs $7+2+3+4+5+6+7 = 34$ points.

Problem B. Join the Strings

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

His Royal Highness King of Berland Berl XV was a very wise man and had a very accomplished wife, who was aware of the fact, that prominent and outstanding personalities once having written down their names on the pages of glorious History, remain there forever. His Royal Highness King Berl XV experienced an intrinsic, lost nowadays, deep and sincere sense of respect and trust for his beloved spouse. So he decided to acquire a chronicler of his own. Due to the ambiguous nature of misunderstanding and the crying injustice of history to ambiguity, he decided to leave all his royal responsibilities aside and made up his royal mind to find the chronicler, who will make him famous, depicting all his heroic deeds truthfully and gloriously enough.

The King assembled the greatest minds of his kingdom at the Academic Chroniclers Meeting (ACM), as he named it, and decided to test their might. The task was to build the Smallest Lexicographical Concatenation (SLC) out of the given N strings. SLC of N strings $s_1, \dots, s_N$ is the lexicographically smallest their concatenation $s_{i_1} + \dots + s_{i_N}$, where $i_1, \dots, i_N$ is a permutation of integers from 1 through N . It's a great privilege to be a chronicler, so don't miss your chance and don't screw it up! Make the king choose you!

Input

The first line of the input file contains a single integer N ($1 \leq N \leq 100$) indicating the number of strings. The following N lines contain N strings, one string per line. The length of each string is no more than 100 characters. Each string consists only of lowercase Latin letters. There are no any leading or trailing spaces.

Output

Print the SLC of the given N strings to the output file as a single line.

Example

stdin	stdout
6 it looks like an easy problem	aneasyitlikelooksproblem

Problem C. Twisting the Number

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

Professor Dull invented a direction in number theory. This is the theory of “twisting generators”. Consider a positive integer number p . Let it contain b bits (the highest bit should be 1). Consider all possible b cycle shifts of the binary notation of the number p . Let’s make a set from all this shifts and call it $W(p)$. Note, some of the shifts can start with zero. Let’s say that the number p twistingly generates the set $W(p)$. For example, $W(11) = \{7, 11, 13, 14\}$.

The number p is called a twisting generator of the number n , if the union of all sets $W(1), W(2), \dots, W(p)$ contains $\{1, 2, \dots, n\}$ as a subset. Your task is to find the minimum generator of the given number n .

Input

The first line of the input contains the integer number n ($1 \leq n \leq 10^{18}$).

Output

Write to the output the minimum twisting generator of the number n .

Example

stdin	stdout
6	5

Problem D. Wolves and Sheep

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

The herds of Berland are in danger! Wolves have attacked a pasture of sheep. The shepherd has decided to exterminate wolves in the neighborhood without causing any damage to the sheep. Thus he took a trophy gun, left to him by his grandfather and headed for the ambush. The gun is cast steel and fires with the armour-piercing shells, and the bullets go right through and can hurt a sheep if a wolf is being shot. The wolves and the sheep are represented by segments. The shepherd is in point $(0, 0)$. The flying path of a bullet is a ray coming from point $(0, 0)$. If the path and the segment, characterizing an animal, intersect — the animal dies. Please find the minimum of shots, that is necessary, to kill all the wolves. We rely upon your prudence, for every sheep should remain safe and sound.

Input

The first line describes two integers N and M ($0 \leq N \leq 10^5$; $0 \leq M \leq 10^5$) — is the amount of the wolves and the sheep accordingly. It is followed by $N + M$ lines. Every line contains four integer numbers X_1, Y_1, X_2, Y_2 ($-1000 \leq X_1, X_2 \leq 1000$; $1 \leq Y_1, Y_2 \leq 1000$), describing the segments. The first N lines describe the disposition of the wolves, the following M lines reveal the situation with the sheep. Segments can degenerate to points.

Output

Print the minimum amount of shots required to kill all the wolves. If you find this request quite impossible to fulfill without killing a single sheep, enter “No solution” (no quotation marks).

Examples

stdin	stdout
1 1 5 5 6 7 3 5 8 5	No solution
2 1 1 1 2 3 -5 4 2 2 999 1000 1000 999	1

Problem E. XOR-omania

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

Professor Vasechkin had a notebook with an outstanding set of non-negative integers $A_1, A_2, \dots, A_n$. Somehow the most remarkable fact that made this set so outstanding appeared to be the impossibility to find such a subset of two or more elements, that XOR of elements in the subset would equal to zero. One day the professor managed to create a new set of integers $B_1, B_2, \dots, B_{n(n-1)/2}$ through applying the XOR operations to all pairs of elements of A set. The set B was not written in any particular order. Unfortunately due to his natural absent-mindedness professor lost the A set and now he is very confused but still obliged to ask you of a considerable favor. Please restore the set in accordance with the remaining B set.

Input

The first line describes M — the amount of numbers in B set ($1 \leq M \leq 100$, $M = N \times (N - 1)/2$ for some number N). The second line describes M numbers — $B_1, B_2, \dots, B_M$ ($0 \leq B_i \leq 2^{31} - 1$).

Output

Print the A set in one line through a blank. All elements of A should be from 0 to $2^{31} - 1$ inclusively. If there are several solutions of the problem, you can choose any of them. It is guaranteed that there exists at least one A set that satisfies the condition.

Example

stdin	stdout
6 30 19 66 13 92 81	94 64 77 28

Problem F. A Mission for a Scout

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

The scout Sidorov is facing a delicate situation: he has to get from A to B . The embarrassment of the situation apparently lies in the news that the scout received lately. It appears that a bomb has been detonated at the neighborhood recently, and the explosion caused a circle crater. Fortunately, Sidorov has an antigravitator to fly over the craters, but the fuel in the tank is hardly enough for the distance D . Sidorov wrote out all the necessary data he had and sent it to you by secret post. He is looking forward to hearing from you, for nobody else can calculate the length of the shortest route from A to B , taking into consideration the craters and the fuel left. He also would like to get the route itself. Clearly, the route will consist only of segments and arcs of the circle formed by the crater.

Input

The first line describes four numbers X_A, Y_A, X_B, Y_B — coordinates of A and B accordingly. The second line describes three numbers X_C, Y_C, R_C — coordinates of the center and the radius of the crater. The third line describes D — the distance the antigravitator can fly over the crater. All coordinates in the input file are integers from 0 to 10 000. R_C and D are integer numbers from 1 to 10 000. A doesn't coincide with B and both points are outside the crater.

Output

Write the number of the parts T of the desired route to the first line of the output file. After that write the description of route parts one per line. For each part of the route print character “S” (for segment) or “A” (for arc) followed by the coordinates of their endpoints. Coordinates should be written with 8 digits after decimal point. T should not exceed 100. The first point in the route should be point A , the last point — B , and the second endpoint of each part should coincide with the first endpoint of the next part in the route.

Examples

stdin				
1	1	101	1	
50	1	40		
80				
stdout				
1				
S	1.0000000000	1.0000000000	101.0000000000	1.0000000000

stdin				
1	1	101	1	
50	1	40		
1				
stdout				
4				
S	1.0000000000	1.0000000000	17.34693878	24.10362726
S	17.34693878	24.10362726	17.93468841	24.91267013
A	17.93468841	24.91267013	81.37254902	25.81457572
S	81.37254902	25.81457572	101.0000000000	1.0000000000

Problem G. Beerland Attacks

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

In this task Beerland again needs your help. Beerland consists of N cities. Some pairs of the cities are connected by bidirectional roads. Each road is characterized by its length. The cities are numbered from 1 to N , the capital has number 1. From time to time the President of Beerland takes a tour around the country visiting all the cities. The tour is a sequence of trips. The goal of each trip is to visit one of the cities and return to the capital. During the trip the President chooses one of the shortest ways from the capital to the desired city.

Long time ago, when Dijkstra algorithm seemed to be difficult, the royal security service created a secret set of roads T . Security officers created the T set in such a manner that it is possible to get by the shortest way from the capital to any city using only roads from the set T . Moreover, there is only one way from the capital to each city along the roads from the T set. The smartest citizens called this set “tree of the shortest paths”.

The President uses only roads from the T set during his trips. With years passing the set lost much of its secrecy. Moreover, recently Beerland extremists have come into possession of the secret set.

Now the royal security service has the new task. For each city except the capital it is required to find out v_i ($2 \leq i \leq N$), where v_i is the length of the shortest path to the i -th city if the last road on the way to this city is attacked and the President can't use it any more.

Input

The first line of the input contains two integer numbers N and M ($2 \leq N \leq 4000$; $N - 1 \leq M \leq 100\,000$), where N is a number of the cities in the country and m is a number of the roads. The following M lines contain the description of the roads, one per line. Each road description is given as the four integer numbers a_j, b_j, l_j, t_j , where a_j, b_j are numbers of the cities connected by the road ($1 \leq a_j, b_j \leq n; a_j \neq b_j$), l_j — length of the road ($1 \leq l_j \leq 10^5$), t_j is equal to 1 if the road belongs to the shortest paths tree T and to 0 otherwise.

The given set T satisfies the requirements listed in the problem statement. There can be more than one road between a pair of cities. All roads are bidirectional.

Output

Write to the output $N - 1$ numbers separated by spaces. i -th number should be equal to the length of the shortest way from the capital to the city $i + 1$ or -1 if the way doesn't exist.

Example

stdin	stdout
5 9 3 1 3 1 1 4 2 1 2 1 6 0 2 3 4 0 5 2 3 0 3 2 2 1 5 3 1 1 3 5 2 0 4 5 4 0	6 7 8 5

Problem H. Billing

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

A girl named Kate has a contract with the Berland only cell phone operator BTS. Her tariff plan is called “Very Profitable” and all Kate can do is to make phone calls. All incoming calls are free. The outgoing calls are billed in the following way: at the very beginning of the call Kate’s account is charged p_1 cents for the first k_1 seconds of the call. Each of the next k_2 seconds costs p_2 cents. And all remaining time costs p_3 cents per second. The account is always billed instantly at the end of each second. If the account balance becomes non-positive, the call is automatically dropped.

Kate has put N cents to her account and she is going to talk with her very good friend. Kate would like to know what is the maximum number of seconds she can talk during a single call.

If $N < p_1$, Kate does not have enough money to establish the call.

Input

The input contains 6 integer numbers $N, k_1, k_2, p_1, p_2, p_3$, ($0 \leq N \leq 1\,000\,000$; $1 \leq k_1, k_2 \leq 1\,000\,000$; $1 \leq p_1, p_2, p_3 \leq 1\,000\,000$).

Output

Write to the output just one integer number — the maximum number of seconds Kate can talk.

Examples

stdin	stdout
20 3 3 3 4 2	9
3 15 3 5 2 3	0
1 1 1 1 3 1	1
2 1 1 1 3 1	2

Problem I. Just Matrix

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

This task is not about Berland or Beerland troubles, roads or flights. There will be no boring coins. This task is about simple square matrix.

Numbers from 1 to n^2 were written down in $n \times n$ square matrix A . Each number was written exactly once. After that for each number the pair $top_{i,j}$ and $left_{i,j}$ was written. $top_{i,j}$ is the number of elements in column j bigger than $A_{i,j}$ and positioned to the top from $A_{i,j}$. $left_{i,j}$ is the number of elements in the row i bigger than $A_{i,j}$ and positioned to the left from $A_{i,j}$.

You are given matrices top and $left$. Your task is to find any possible matrix A fulfilling the requirements of the problem.

Input

The first line of the input contains integer number n ($1 \leq n \leq 600$). Further matrices top and $left$ are written, each in the form of n lines of n non-negative integer numbers. The matrices are separated by the empty line. Numbers in both matrices are not bigger than n .

Output

Write to the output matrix A in the format similar to the input data. If there are several solutions, you can choose any of them. If there is no solution, write to the output just one number 0.

Example

stdin	stdout
3	1 2 6
0 0 0	5 3 7
0 0 0	9 8 4
0 0 2	
0 0 0	
0 1 0	
0 1 2	

Problem J. Numbers Painting

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

Dr. Vasechkin wants to paint all numbers from 1 to N in such a way that if number A is divisible by number B , numbers A and B have different colors.

Help Dr. Vasechkin to find such a painting, where the number of the colors used is minimal.

Input

The input contains integer number N ($1 \leq N \leq 10\,000$).

Output

Write the number of the colors M in the desired painting in the first line of the output. In the second line of the output write the desired painting of numbers from 1 to N . The used colors should be represented by numbers from 1 to M . If there are several solutions, choose any of them.

Example

stdin	stdout
12	4 1 2 2 3 2 3 2 4 3 3 2 4

Problem K. Extrasensory Perception

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

His Royal Highness the King of Berland Berl XV has just decapitated his magician for being politically incorrect. It is a truth universally acknowledged that every king in the possession of a good fortune is in a want of a decent sorcerer. Heralds all over the country have spread the news about the coming Berland-wide wizard competition that is to end up with the announcement of the winner's name. The winner is to join the royal retinue as His Royal Highness' Counselor.

Magician Resool graduated from Bexford University ten years ago and since that time he has been chased by misfortunes and disasters. His wife, an accomplished, still pretty looking lady, believes her husband can do much better than just grumbling about the unfair life. She suggests that he should try his magic powers at the competition and reminds him of his famous trick. The gist of the trick is to see through people's souls.

After two weeks of training Resool makes himself enter the Great Hall of Berland Palace and demonstrate his exceptional abilities. His Royal Highness the King of Berland Berl XV gives him an assignment: N men and N women are presented, and the fact is known that they form N married couples; Resool is to identify a wife for every husband. After the magician casts a spell, burns some magic herbs, and performs ritual dance he still fails to answer correctly. He only manages to guess K married couples out of N . But The King is full of sympathy for the magician and can't just let the magician go away jobless and sorrowful. So, he hires him as a yard-keeper. Now Resool has a lot of free time on his new job and wants to calculate the chances he had at the competition. He wants to know the probability of guessing correctly exactly K married couples when given N men, N women, and a fact that they form N married couples. This will definitely help him during the competition next time.

Input

Input file contains two integers K and N ($1 \leq N \leq 100$; $0 \leq K \leq N$) separated by a space.

Output

Print the required probability to the output file. If the answer is zero, simply print "0" (without quotes). Otherwise print the answer in a form of irreducible fraction " A/B " (without quotes), where A and B are positive integers without leading zeroes. See examples below for the format of output.

Example

stdin	stdout
2 5	1/6
9 10	0

Problem L. Remote Control

Input file: `stdin`
Output file: `stdout`
Time limit: 1 second
Memory limit: 64 megabytes

A couple of years ago Peter Berlandin bought a brand new Berlony TV set. The TV set supports 100 channels, numbered from 0 to 99. The remote control of the TV set has 13 buttons:

1 2 3 ↑
4 5 6 ↓
7 8 9
-- 0

When pressing the button “↑” the number of the current channel increases by 1 (if the current channel is the 99th, it switches to 0). If you press the button “↓” the number of the current channel decreases by 1 (if the number of the current channel is 0, it switches to the 99th). Switching to the channel from 0 to 9 can be done by pressing the button at the remote control with the corresponding number. Switching to the channel from 10 to 99 can be done by pressing the “--” button followed by two buttons in accordance with the number of the channel required. Casual handling and time don’t do good to any of us! Finally the remote control was damaged and went out of order. Now some of the buttons are not functioning. Your task is to switch from X channel to Y using the minimum number of clicks.

Input

The first 4 lines contain information about the productivity of every button at the remote control. 0 stands for the broken button and 1 stands for the one that is functioning. The first line describes “1”, “2”, “3” and “↑” buttons accordingly. The second line describes “4”, “5”, “6” and “↓” buttons accordingly. The third line describes “7”, “8” and “9” buttons accordingly. The fourth line describes “--” and “0” buttons accordingly. The fifth line describes X and Y.

Output

Print the answer to the problem — the minimum number of clicks to switch from X to Y — in the output file. Print -1 if it is impossible to switch from X to Y.

Examples

stdin	stdout
1 1 1 1 1 1 1 1 1 1 1 1 1 23 52	3
0 0 1 1 1 1 1 1 1 1 1 1 1 23 52	4